KONGU ENGINEERING COLLEGE

(Autonomous Institution Affiliated to Anna University, Chennai)

PERUNDURAI ERODE – 638 060 TAMILNADU INDIA



REGULATIONS, CURRICULUM & SYLLABI – 2022

(CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION)

(For the students admitted during 2022 - 2023 and onwards)

IN FOOD TECHNOLOGY

DEPARTMENT OF FOOD TECHNOLOGY



KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638060

(Autonomous)

REGULATIONS

2022

CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED

EDUCATION BACHELOR OF ENGINEERING (BE) / BACHELOR

OF TECHNOLOGY (BTech)

DEGREE PROGRAMMES

These regulations are applicable to all candidates admitted into BE/BTech Degree programmes from the academic year 2022 - 2023 onwards.

1. DEFINITIONS AND NOMENCLATURE

In these Regulations, unless otherwise specified:

- i. "University" means ANNA UNIVERSITY, Chennai.
- ii. "College" means KONGU ENGINEERING COLLEGE.
- iii. "Programme" means Bachelor of Engineering (BE) / Bachelor of Technology (BTech)

 Degreeprogramme
- iv. "Branch" means specialization or discipline of BE/BTech Degree programme, like CivilEngineering, Information Technology, etc.
- v. "Course" means a Theory / Theory cum Practical / Practical course that is normally studied in asemester like Mathematics, Physics etc.
- vi. "Credit" means a numerical value allocated to each course to describe the candidate's workloadrequired per week.
- vii. "Grade" means the letter grade assigned to each course based on the marks range specified.
- viii. "Grade point" means a numerical value (0 to 10) allocated based on the grade assigned

- ix. "Principal" means Chairman, Academic Council of the College.
- x. "Controller of Examinations (COE)" means authorized person who is responsible for all examination related activities of the College.
- xi. "Head of the Department (HOD)" means Head of the Department concerned.

2. PROGRAMMES AND BRANCHES OF STUDY

The following programmes and branches of study approved by Anna University, Chennai and All IndiaCouncil for Technical Education, New Delhi are offered by the College.

Programme	Branc h			
	Civil Engineering			
	Mechanical Engineering			
	Electronics and Communication Engineering			
	Computer Science and Engineering			
BE	Electrical and Electronics Engineering			
DL	Electronics and Instrumentation Engineering			
	Mechatronics Engineering			
	Automobile Engineering			
	Computer Science and Design			
	Chemical Engineering			
BTech	Information Technology			
	Food Technology			
	Artificial Intelligence and Data Science			
	Artificial Intelligence and Machine Learning			

3. ADMISSION REQUIREMENTS

First Semester Admission

The candidates seeking admission to the first semester of the eight semester BE / BTech Degree Programme:

Should have passed the Higher Secondary Examination (10 + 2) in the academic stream with Mathematics, Physics and Chemistry as three of the four subjects of study under Part-III subjects of the study conducted by the Government of Tamil Nadu or any examination of any other University or authority accepted by the Anna University, Chennai as equivalent thereto.

(OR)

Should have passed the Higher Secondary Examination of Vocational stream (Vocational groups in Engineering / Technology) as prescribed by the Government of Tamil Nadu.

They should also satisfy other eligibility conditions as prescribed by the Anna University, Chennai and Directorate of Technical Education, Chennai from time to time.

Lateral Entry Admission

The candidates who hold a Diploma in Engineering / Technology awarded by the State Board of Technical Education, Tamilnadu or its equivalent are eligible to apply for Lateral entry admission to the third semester of BE / BTech.

(OR)

The candidates who hold a BSc degree in Science(10+2+3 stream) with mathematics as one of

the subjects at the BSc level from a recognised University are eligible to apply for Lateral entry admission to the third semester of BE / BTech. Such candidates shall undergo two additional Engineering course(s) in the third and fourth semesters as prescribed by the College.

They should also satisfy other eligibility conditions prescribed by the Anna University, Chennai and Directorate of Technical Education, Chennai from time to time.

4. STRUCTURE OF PROGRAMMES

4.1 Categorisation of Courses

The BE / BTech programme shall have a curriculum with syllabi comprising of theory, theory cum practical, practical courses in each semester, professional skills training/industrial training, project work, internship, etc that have been approved by the respective Board of Studies and Academic Council of the College. All the programmes have well defined Programme Outcomes (PO), Programme Specific Outcomes (PSO) and Programme Educational Objectives (PEOs) as per Outcome Based Education (OBE). The content of each course is designed based on the Course Outcomes (CO). The courses shall be categorized as follows:

- i. Humanities and Social Sciences (HS) including Management Courses, English Communication Skills, Universal Human Values and Yoga & Values for Holistic Development.
- ii. Basic Science (BS) Courses
- iii. Engineering Science (ES) Courses
- iv. Professional Core (PC) Courses
- v. Professional Elective (PE) Courses
- vi. Open Elective (OE) Courses
- vii. Employability Enhancement Courses (EC) like Project work, Professional Skills/Industrial Training, Comprehensive Test & Viva, Entrepreneurships/Start ups and Internship / In- plant Training in Industry or elsewhere
- viii. Audit Courses (AC)
- ix. Mandatory Courses (MC) like Student Induction Program and Environmental Science.
- x. Honours Degree Courses (HC)

4.2 Credit Assignment and Honours Degree

Credit Assignment

Each course is assigned certain number of credits as follows:

Contact period per week	Credits
1 Lecture / Tutorial Period	1
2 Practical Periods	1
2 Project Work Periods	1
40 Training / Internship Periods	1

The minimum number of credits to complete the BE/BTech programme is 166.

4.2.2 Honours Degree

If a candidate earns 18 to 20 additional credits in an emerging area, then he/she can be awarded with Honours degree mentioning that emerging area as his/her specialization. The respective board of studies shall recommend the specializations for honours degree and

appropriate additional courses to be studied by the candidate which shall get approval from Academic Council of the institution. A candidate shall have not less than 8.0 CGPA and no history of arrears to opt for the honours degree and has to maintain the same during the entire programme.

Various specializations for various branches recommended by the respective boards of studies are given below:

Sno	Specializations for Honoursdegree in emerging areas	To be offered as Honours, Only for the following branches mentioned against the specializatio
1.	Construction Technology	BE – Civil Engineering
2.	Smart Cities	BE – Civil Engineering
3.	Smart Manufacturing *	BE – Mechanical Engineering
4.	Computational Product Design *	BE – Mechanical Engineering
5.	Intelligent Autonomous Systems *	BE – Mechatronics Engineering
6.	E-Mobility *	BE – Automobile Engineering
7.	Artificial Intelligence and MachineLearning	BE – Electronics and Communication Engineering
8.	System on Chip Design *	BE – Electronics and CommunicationEngineering
9.	Electric Vehicles	BE – Electrical and Electronics Engineering
10.	Microgrid Technologies	BE – Electrical and Electronics Engineering
11.	Intelligent Sensors Technology *	BE – Electronics and InstrumentationEngineering
12.	Smart Industrial Automation *	BE – Electronics and InstrumentationEngineering
13.	Data Science	BE – Computer Science and Engineering
14.	Cyber Security	BE – Computer Science and Engineering
15.	Data Science	BTech – Information Technology
16.	Cyber Security	BTech – Information Technology
17.	Petroleum and PetrochemicalEngineering *	BTech – Chemical Engineering
18.	Waste Technology *	BTech – Chemical Engineering
19.	Food Processing and Management *	BTech - Food Technology
20.	Virtual and Augumented Reality	BE- Computer Science and Design
21.	Data Science	BE- Computer Science and Design
22.	Internet of Things (IoT)	BTech – Artificial Intelligence and DataScience
23.	Blockchain	BTech – Artificial Intelligence and DataScience
24.	Internet of Things (IoT)	BTech – Artificial Intelligence and MachineLearning
25.	Blockchain	BTech – Artificial Intelligence and MachineLearning

^{*}Title by KEC

The courses specified under Honours degree in the emerging area may include theory, theory cum practical, practical, project work, etc. under the particular specialization. A candidate can choose and study these specified courses from fourth semester onwards and he/she shall successfully complete the courses within the stipulated time vide

clause 5. Total number

of credits earned in each semester may vary from candidate to candidate based on the courses chosen. The registration, assessment & evaluation pattern and classification of grades of these courses shall be the same as that of the courses in the regular curriculum of the programme of the candidate vide clause 6, clause 7 and clause 15 respectively. A candidate can earn Honours degree in only one specialization during the entire duration of the programme.

4.3 Employability Enhancement Courses

A candidate shall be offered with the employability enhancement courses like project work, internship, professional skills training/industrial training, comprehensive test & viva, and entrepreneurships/start ups during the programme to gain/exhibit the knowledge/skills.

4.3.1 Professional Skills Training/ Indsutrial Training/Entrepreneurships/Start Ups/ Inplant Training

A candidate may be offered with appropriate training courses imparting programming skills, communication skills, problem solving skills, aptitude skills etc. It is offered in two phases as phase I in fourth semester and phase II in fifth semester including vacation periods and each phase can carry two credits.

(OR

A candidate may be allowed to go for training at research organizations or industries for a required number of hours in fifth semester vacation period. Such candidate can earn two credits for this training course in place of Professional Skills Training course II in fifth semester. He/She shall attend Professional Skills Training Phase I in fourth semester and can earn two credits.

(OR

A candidate may be allowed to set up a start up and working part-time for the start ups by applying his/her innovations and can become a student entrepreneur during BE/BTech programme. Candidates can set up their start up from fifth semester onwards either inside or outside of the college. Such student entrepreneurs may earn 2 credits in place of Professional Skills Training II. The area in which the candidate wants to initiate a start upmay be interdisciplinary or multidisciplinary. The progress of the startup shall be evaluated by a panel of members constituted by the Principal through periodic reviews.

4.3.2 Comprehensive Test and Viva

The overall knowledge of the candidate in various courses he/she studied shall be evaluated by (i) conducting comprehensive tests with multiple choice questions generally with pattern similar to GATE and/or (ii) viva-voce examination conducted by a panel of experts assigned by the Head of the department. The members can examine the knowledge of the candidate by asking questions from various domains and the marks will be assigned based on their answers. This course shall carry two credits.

4.3.3 Full Time Project through Internships

The curriculum enables a candidate to go for full time project through internship during a part of seventh semester and/or entire final semester and can earn credits vide clause 7.6 and clause 7.11.

A candidate is permitted to go for full time projects through internship in seventh semester with the following condition: The candidate shall complete a part of theseventh semester courses with a total credit of about 50% of the total credits of seventh semester including Project Work-II Phase-I in the first two months from the commencement of the seventh semester under fast track mode. The balancecredits required to complete the seventh semester shall be earned by the candidate through either approved One/Two Credit Courses /Online courses / Self Study Courses or Add/Drop courses as per clause 4.4 and clause 4.5 respectively.

A candidate is permitted to go for full time projects through internship during eighth semester. Such candidate shall earn the minimum number of credits required to complete eighth semester other than project through either approved One / Two Credit Courses /Online courses / Self Study Courses or Add/Drop courses as per clause 4.4 and clause 4.5 respectively.

- Assessment procedure is to be followed as specified in the guidelines approved by the Academic Council.
- **4.3.4** A student shall go for in-plant training for duration of two weeks during the entireprogramme. It is mandatory for all the students.

4.4 One / Two Credit Courses / Online Courses / Self Study Courses

The candidates may optionally undergo One / Two Credit Courses / Online Courses / Self Study Courses as elective courses.

- **4.4.1** One / Two Credit Courses: One / Two credit courses shall be offered by the college with the prior approval from respective Board of Studies. A candidate can earn a maximum of six credits through one / two credit courses during the entire duration of the programme.
- **4.4.2 Online Courses:** Candidates may be permitted to earn credits for online courses, offered by NPTEL / SWAYAM / a University / Other Agencies, approved by respective Board of Studies.
- **4.4.3 Self Study Courses:** The Department may offer an elective course as a self study course. The syllabus of the course shall be approved by the respective Board of Studies. However, mode of assessment for a self study course will be the same as that used for other courses. The candidates shall study such courses on their own under the guidance of member of the faculty following dueapproval procedure. Self study course is limited to one per semester.
- **4.4.4** The elective courses in the final year may be exempted if a candidate earns the required credits vide clause 4.4.1, 4.4.2 and 4.4.3 by registering the required number of courses in advance.
- **4.4.5** A candidate can earn a maximum of 30 credits through all one / two credit courses, online courses and self study courses.

4.5 Flexibility to Add or Drop Courses

- **4.5.1** A candidate has to earn the total number of credits specified in the curriculum of the respective programme of study in order to be eligible to obtain the degree. However, if the candidate wishes, then the candidate is permitted to earn more than the total number of credits prescribed in the curriculum of the candidate's programme.
- **4.5.2** From the first to seventh semesters the candidates have the option of registering for additional elective/Honours courses or dropping of already registered additional elective/Honours courses within two weeks from the start of the semester. Add / Drop is only an option given to the candidates.
- **4.6** Maximum number of credits the candidate can enroll in a particular semester cannot exceed 30 credits.
- 4.7 The blend of different courses shall be so designed that the candidate at the end of the programme would have been trained not only in his / her relevant professional field but also would have developed to become a socially conscious human being.

4.8 The medium of instruction, examinations and project report shall be English.

5. DURATION OF THE PROGRAMME

- A candidate is normally expected to complete the BE / BTech Degree programme in 8 consecutive semesters/4 Years (6 semesters/3 Years for lateral entry candidate), butin any case not more than 14 semesters/7 Years (12 semesters/6 Years for lateral entry candidate).
- 5.2 Each semester shall consist of a minimum of 90 working days including continuous assessment test period. The Head of the Department shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus for the course being taught.
- 5.3 The total duration for completion of the programme reckoned from the commencement of the first semester to which the candidate was admitted shall not exceed the maximum duration specified in clause 5.1 irrespective of the period of break of study (vide clause 11) or prevention (vide clause 9) in order that the candidate may be eligible for the award of the degree (vide clause 16). Extension beyond the prescribed period shall not be permitted.

6. COURSE REGISTRATION FOR THE EXAMINATION

- **6.1** Registration for the end semester examination is mandatory for courses in the current semester as well as for the arrear courses failing which the candidate will not be permitted to move on to the higher semester. This will not be applicable for the courses which do not have an end semester examination.
- 6.2 The candidates who need to reappear for the courses which have only continuous assessment shall enroll for the same in the subsequent semester, when offered next, and repeat the course. In this case, the candidate shall attend the classes, satisfy the attendance requirements (vide clause 8) and earn continuous assessment marks. This will be considered as an attempt for the purpose of classification.
- 6.3 If a candidate is prevented from writing end semester examination of a course due to lack of attendance, the candidate has to attend the classes, when offered next, and fulfill the attendance requirements as per clause 8 and earn continuous assessment marks. If the course, in which the candidate has a lack of attendance, is an elective, the candidate may register for the same or any other elective course in the subsequent semesters and that will be considered as an attempt for the purpose of classification.
- A candidate shall register for the chosen courses as well as arrear courses (if any vide clause 6.2 and 6.3) from the list of courses specified under Honours degree.

7. ASSESSMENT AND EXAMINATION PROCEDURE FOR AWARDING MARKS

7.1 The BE/BTech programmes consist of Theory Courses, Theory cum Practical courses, Practical courses, Comprehensive Test and Viva, Project Work, Industrial Training /Professional Skills Training, Internship/In-plant Training and Entrepreneurships/ Start ups. Performance in each course of study shall be evaluated based on (i) Continuous Assessments (CA) throughout the semester and (ii) End Semester Examination (ESE)at the end of the semester except for the courses which are evaluated based on continuous assessment only. Each course shall be evaluated for a maximum of 100

marks as shown below:

Sl. No.	Category of Course	Continuous Assessment Marks	End Semester Examination Marks
1.	Theory	40	60
2.	Theory cum Practical (The distribution of marks shall bedecided based on the credit weightage assigned to theory and	50	50
3.	Practical	60	40
4.	Professional Skills Training / Comprehensive Test & Viva / Entrepreneurships / Start ups / Project Work I / Mandatory Course/Industrial Training/ Universal Human Values / Yoga and Values for Holistic Development	100	
5.	Project Work II Phase I / Project Work II Phase II / Internships	50	50
6.	One / Two credit Course	The distribution of marks shall be	
7.	All other Courses	decided based on the credit weightage assigned	

Examiners for setting end semester examination question papers for theory courses, theory cum practical courses and practical courses and evaluating end semester examination answer scripts, project works, internships and entrepreneurships/start ups shall be appointed by the Controller of Examinations after obtaining approval from the Principal.

Theory Courses

For all theory courses out of 100 marks, the continuous assessment shall be 40 marks and the end semester examination shall be for 60 marks. However, the end semester examinations shall be conducted for 100 marks and the marks obtained shall be reduced to 60. The continuous assessment tests shall be conducted as per the schedule laid down in the academic schedule. The total of the continuous assessment marks and the end semester examination marks shall be rounded off to the nearest integer.

The assessment pattern for awarding continuous assessment marks shall beas follows:

Sl. No.	Туре	Max. Mark s	Remarks
1.	Test - I	25	
1.	Test - II	25	Average of best 2 tests
	Test - III	25	(25 marks)
2.	Tutorial: (Tutorial/Problem Solving (or)Simulation (or) Simulation & Mini Project (or)Mini Project (or) Case Studies (or) Any other relevant to the course)	10	Type of assessment is to be chosen based on the nature of the course and to be approved by Principal
3.	Others: Assignment / Paper Presentation in Conference / Seminar / Comprehension / Activity based learning / Class notes	05	To be assessed by the Course Teacher based on any one type.
	Total	40	Rounded off to the one decimal place

However, the assessment pattern for awarding the continuous assessment marks may be changed based on the nature of the course and is to be approved by the Principal.

A reassessment test or tutorial covering the respective test or tutorial portions may be conducted for those candidates who were absent with valid reasons (Sports or any other reason approved by the Principal).

The end semester examination for theory courses shall be for a duration of three hours and shall be conducted between November and January during odd semesters and between April and June during even semesters of every year.

Theory cum Practical Courses

For courses involving theory and practical components, the evaluation pattern as per the clause 7.1 shall be followed. Depending on the nature of the course, the end semester examination shall be conducted for theory and the practical components. The apportionment of continuous assessment and end semester examination marks shall be decided based on the credit weightage assigned to theory and practical components approved by Principal.

Practical Courses

For all practical courses out of 100 marks, the continuous assessment shall be for 60 marks and the end semester examination shall be for 40 marks. Every exercise / experiment shall be evaluated based on the candidate's performance during the practical class and the candidates' records shall be maintained.

The assessment pattern for awarding continuous assessment marks for each course shall be decided by the course coordinator based on rubrics of that particular course, and shall be based on rubrics for each experiment.

The end semester examination shall be conducted for a maximum of 100 marks for duration of 3 hours and reduced to 40 marks. The appointment of examiners and the schedule shall be decided by chairman of Board of Study of the relevant board.

Project Work II Phase I / Project Work II Phase II

Project work shall be assigned to a single candidate or to a group of candidates not exceeding 4 candidates in a group. The project work is mandatory for all the candidates.

The Head of the Department shall constitute review committee for project work. There shall be two assessments by the review committee during the semester. The candidate shall make presentation on the progress made by him/her before the committee.

The continuous assessment and end semester examination marks for Project Work II Phase I /Project Work II Phase II and the Viva-Voce Examination shall be distributed as below.

Continuous Assessment (Max. 50 Marks)				Ex	d Seme camina x. 50 N	tion	ı		
	eroth view	Review I (Max 20 Marks)		Review II Max. 30 Marks)		Report Evaluat ion (Max. 20 Marks)	Viva - ax. 30)
Rv	Sup	Review	Sup	Review	Supe	Ext.	Sup	Exr.	Exr.
	er	Commi	erv	Commit	r	Exr.	er	1	2
Co	viso	ttee	isor	tee	visor		viso		
m	r	(exclud		(excludi			r		
		ing		ng					
		supervi		supervis					
		sor)		or)					
0	0	10	10	15	15	20	10	10	10

The Project Report prepared according to approved guidelines and duly signed by the Supervisor shall be submitted to Head of the Department. The candidate(s) must submit the project report within the specified date as per the academic schedule of the semester. If the project report is not submitted within the specified date then the candidate is deemed to have failed in the Project Work and redo it in the subsequent semester.

If a candidate fails to secure 50% of the continuous assessment marks in the project work, he / she shall not be permitted to submit the report for that particular semester and shall have to redo it in the subsequent semester and satisfy attendance requirements.

The end semester examination of the project work shall be evaluated based on the project report submitted by the candidate in the respective semester and viva-voce examination by a committee consisting of two examiners and supervisor of the project work.

If a candidate fails to secure 50 % of the end semester examination marks in the project work, he / she shall be required to resubmit the project report within 30 days from the date of declaration of the results and a fresh viva-voce examination shall be conducted as per clause 7.6.6.

A copy of the approved project report after the successful completion of vivavoce examination shall be kept in the department library.

Project Work I / Industrial Training

The evaluation method shall be same as that of the Project Work II as per clause 7.6 excluding 7.6.3, 7.6.5, 7.6.6 and 7.6.7. The marks distribution is given below.

Continuous Assessment (Max. 100 Marks)								
_	Zeroth Review I Review II (Max 20 Marks) Review II ax 30 Marks)		Review I		III(Max Marks) Report Evaluatio n(Max. 20 Marks)	Review k. 50 Viva - (Max. Marks	30	
Revie	Supe	Review	Supe	Review	Sup	Review	Super	Review
w	r	Committe	r	Commi	er	Committ	visor	Committee
Com	visor	e	visor	ttee	viso	ee		
mitte		(excludin		(exclud	r			
e		g		ing				
		supervisor		supervi				
)		sor)				
0	0	10	10	15	15	20	10	20

If a candidate fails to secure 50 % of the continuous assessment marks in this course,he / she shall be required to resubmit the project report within 30 days from the date of declaration of the results and a fresh viva-voce examination shall be conducted.

Professional Skills Training

Phase I training shall be conducted for minimum of 80 hours in 3rd semester vacation and during 4th semester. Phase II training shall be conducted for minimum of 80 hours in 4th semester vacation and during 5th semester. The evaluation procedure shall beapproved by the board of the offering department and Principal.

Comprehensive Test and Viva

A candidate can earn 2 credits by successfully completing this course. The evaluation procedures shall be approved by the Principal.

Entrepreneurships/Start ups

A start up/business model may be started by a candidate individually or by a group of maximum of three candidates during the programme vide clause 4.3.1. The head of the department concerned shall assign a faculty member as a mentor for each start up.

A review committee shall be formed by the Principal for reviewing the progress of the Start ups / Business models, innovativeness, etc. The review committee can recommend the appropriate grades for academic performance for the candidate(s) involved in the start ups. This course shall carry a maximum of two credits in fifth semester and shall be evaluated through continuous assessments for a maximum of 100 marks vide clause 7.1.A report about the start ups is to be submitted to the review committee for evaluation for

each start up and the marks will be given to Controller of Examinations after getting approval from Principal.

7.11 In-Plant Training

Each candidate shall go for In-Plant training for a duration of minimum of two weeks during the entire programme of study and submit a brief report about the training undergone and a certificate issued from the organization concerned.

7.12 One / Twe Credit Courses

For all one/ two credit courses out of 100 marks, the continuous assessment shall be 50 marks and the model examination shall be for 50 marks. Minimum of two continuous assessments tests shall be conducted during the one / two credit course duration by the offering department concerned. Model examination shall be conducted at the end of the course.

7.13 Online Course

The Board of Studies will provide methodology for the evaluation of the online courses. The Board can decide whether to evaluate the online courses through continuous assessment and end semester examination or through end semester examination only. In case of credits earned through online mode from NPTEL / SWAYAM / a University / Other Agencies approved by Chairman, Academic Council, the credits may be transferred and grades shall be assigned accordingly.

7.14 Self Study Course

The member of faculty approved by the Head of the Department shall be responsible for periodic monitoring and evaluation of the course. The course shall be evaluated through continuous assessment and end semester examination. The evaluation methodology shall be the same as that of a theory course.

7.15 Audit Course

A candidate may be permitted to register for specific course not listed in his/her programme curriculum and without undergoing the rigors of getting a 'good' grade, as an Audit course, subject to the following conditions.

The candidate can register only one Audit course in a semester starting from second semester subject to a maximum of two courses during the entire programme of study. Such courses shall be indicated as 'Audit' during the time of registration itself.

Only courses currently offered for credit to the candidates of other branches can be audited.

A course appearing in the curriculum of a candidate cannot be considered as an audit course. However, if a candidate has already met the Professional Elective and Open Elective credit requirements as stipulated in the curriculum, then, a Professional Elective or an Open Elective course listed in the curriculum and not taken by the candidate for credit can be considered as an audit course.

Candidates registering for an audit course shall meet all the assessment and examination requirements (vide clause 7.3) applicable for a credit candidate of that course. Only if the candidate obtains a performance grade, the course will be listed in the semester Grade Sheet and in the Consolidated Grade Sheet along with the grade SC (Successfully Completed). Performance grade will not be shown for the audit course.

Since an audit course has no grade points assigned, it will not be counted for the purpose of GPA and CGPA calculations.

7.16 Mandatory Courses

A candidate joined in first semester shall attend and complete a mandatory course namely Student Induction Program of duration three weeks at the beginning of first semester. The candidates studying in second year shall attend and complete another one mandatory course namely Environmental Science. No credits shall be given for mandatory courses and shall be evaluated through continuous assessment tests only vide clause 7.1 for a maximum of 100 marks each. Upon the successful completion, these courses will be listed in the semester grade sheet and in the consolidated grade sheet with the grade "SC" (Successfully Completed). Since no grade points are assigned, these courses will not be counted for the purpose of GPA and CGPA calculations.

7.17 Universal Human Values (UHV) and Yoga and Values for Holistic Development (YVHD)

Courses YVHD shall be offered to all first year candidates of all BE/ BTech programmes to impart knowledge on yoga and human values. Course UHV shall be offered to all the second year BE/ BTech students. These courses shall carry a maximum of 100 marks each and shall be evaluated through continuous assessment tests only vide clause 7.1. The candidate(s) can earn 2 credits for UHV and 1 credit for YVHD by successfully completing these courses. Two continuous assessment tests will be conducted and the average marks will be taken for the calculation of grades.

8. REQUIREMENTS FOR COMPLETION OF A SEMESTER

- **8.1** A candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester and permitted to appear for the examinations of that semester.
 - **8.1.1** Ideally, every candidate is expected to attend all classes and secure 100 % attendance. However, a candidate shall secure not less than 80 % (afterrounding off to the nearest integer) of the overall attendance taking into account the total number of working days in a semester.
 - 8.1.2 A candidate who could not satisfy the attendance requirements as per clause 8.1.1 due to medical reasons (hospitalization / accident / specific illness) but has secured not less than 70 % in the current semester may be permitted to appear for the current semester examinations with the approval of the Principal on payment of a condonation fee as may be fixed by the authorities from time to time. The medical certificate needs to be submitted along with the leave application. A candidate can avail this provision only twice during the entire duration of the degree programme.

A candidate who could not satisfy the attendance requirements as per clause 8.1.1 due to his/her entrepreneurships/ start ups activities, but has secured not less than 60 % in the current semester can be permitted to appear for the current semester examinations with the recommendation of review committee and approval from the Principal.

- **8.1.3** In addition to clause 8.1.1 or 8.1.2, a candidate shall secure not less than 60 % attendance in each course.
- **8.1.4** A candidate shall be deemed to have completed the requirements of study of any semester only if he/she has satisfied the attendance requirements (vide clause 8.1.1 to 8.1.3) and has registered for examination by paying the prescribed fee.
- **8.1.5** Candidate's progress is satisfactory.

- **8.1.6** Candidate's conduct is satisfactory and he/she was not involved in any undisciplined activities in the current semester.
- **8.2.** The candidates who do not complete the semester as per clauses from 8.1.1 to 8.1.6 except 8.1.3 shall not be permitted to appear for the examinations at the end of the semester and not be permitted to go to the next semester. They have to repeat the incomplete semester in next academic year.
- **8.3** The candidates who satisfy the clause 8.1.1 or 8.1.2 but do not complete the course as per clause 8.1.3 shall not be permitted to appear for the end semester examination of that course alone. They have to repeat the incomplete course in the subsequent semester when it is offered next.

9. REOUIREMENTS FOR APPEARING FOR END SEMESTER EXAMINATION

- **9.1** A candidate shall normally be permitted to appear for end semester examination of the current semester if he/she has satisfied the semester completion requirements as per clause 8, and has registered for examination in all courses of that semester. Registration is mandatory for current semester examinations as well as for arrear examinations failing which the candidate shall not be permitted to move on to the highersemester.
- 9.2 When a candidate is deputed for a National / International Sports event during End Semester examination period, supplementary examination shall be conducted for such a candidate on return after participating in the event within a reasonable period of time. Such appearance shall be considered as first appearance.
- **9.3** A candidate who has already appeared for a course in a semester and passed the examination is not entitled to reappear in the same course for improvement of letter grades / marks.

10. PROVISION FOR WITHDRAWAL FROM EXAMINATIONS

- 10.1 A candidate may, for valid reasons, be granted permission to withdraw from appearing for the examination in any regular course or all regular courses registered in a particular semester. Application for withdrawal is permitted only once during the entire duration of the degree programme.
- 10.2 The withdrawal application shall be valid only if the candidate is otherwise eligible to write the examination (vide clause 9) and has applied to the Principal for permission prior to the last examination of that semester after duly recommended by the Head of the Department.
- 10.3 The withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class with Distinction/First Class.
- 10.4 If a candidate withdraws a course or courses from writing end semester examinations, he/she shall register the same in the subsequent semester and write the end semester examinations. A final semester candidate who has withdrawn shall be permitted to appear for supplementary examination to be conducted within reasonable time as per clause 14.

10.5 The final semester candidate who has withdrawn from appearing for project viva-voce for genuine reasons shall be permitted to appear for supplementary viva-voce examination within reasonable time with proper application to Controller of Examinations and on payment of prescribed fee.

11. PROVISION FOR BREAK OF STUDY

- 11.1 A candidate is normally permitted to avail the authorised break of study under valid reasons (such as accident or hospitalization due to prolonged ill health or any other valid reasons) and to rejoin the programme in a later semester. He/She shall apply in advance to the Principal, through the Head of the Department, stating the reasons therefore, in any case, not later than the last date for registering for that semester examination. A candidate is permitted to avail the authorised break of study only once during the entire period of study for a maximum period of one year. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for the break of study.
- 11.2 The candidates permitted to rejoin the programme after break of study / prevention due to lack of attendance shall be governed by the rules and regulations in force at the time of rejoining.
- 11.3 The candidates rejoining in new Regulations shall apply to the Principal in the prescribed format through Head of the Department at the beginning of the readmitted semester itself for prescribing additional/equivalent courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.
- 11.4 The total period of completion of the programme reckoned from the commencement of the semester to which the candidate was admitted shall not exceed the maximumperiod specified in clause 5 irrespective of the period of break of study in order to qualify for the award of the degree.
- 11.5 If any candidate is prevented for want of required attendance, the period of prevention shall not be considered as authorized break of study.
- 11.6 If a candidate has not reported to the college for a period of two consecutive semesters without any intimation, the name of the candidate shall be deleted permanently from the college enrollment. Such candidates are not entitled to seek readmission under any circumstances.

12. PASSING REQUIREMENTS

- 12.1 A candidate who secures not less than 50 % of total marks (continuous assessment and end semester examination put together) prescribed for the course with a minimum of 45 % of the marks prescribed for the end semester examination in all category of courses vide clause 7.1 except for the courses which are evaluated based on continuous assessment only shall be declared to have successfully passed the course in the examination.
- 12.2 A candidate who secures not less than 50 % in continuous assessment marks

prescribed for the courses which are evaluated based on continuous assessment only shall be declared to have successfully passed the course. If a candidate secures less than 50% in the continuous assessment marks, he / she shall have to re-enroll for the same in the subsequent semester and satisfy the attendance requirements.

12.3 For a candidate who does not satisfy the clause 12.1, the continuous assessment marks secured by the candidate in the first attempt shall be retained and considered valid for subsequent attempts. However, from the fourth attempt onwards the marks scored in the end semester examinations alone shall be considered, in which case the candidate shall secure minimum 50 % marks in the end semester examinations to satisfy the passing requirements.

13. REVALUATION OF ANSWER SCRIPTS

A candidate shall apply for a photocopy of his / her semester examination answer script within a reasonable time from the declaration of results, on payment of a prescribed fee by submitting the proper application to the Controller of Examinations. The answer script shall be pursued and justified jointly by a faculty member who has handled the course and the course coordinator and recommended for revaluation. Based on the recommendation, the candidate can register for revaluation through proper application to the Controller of Examinations. The Controller of Examinations will arrange for revaluation and the results will be intimated to the candidate concerned. Revaluation is permitted only for Theory courses and Theory cum Practical courses where end semester examination is involved.

14. SUPPLEMENTARY EXAMINATION

If a candidate fails to clear all courses in the final semester after the announcement of final end semester examination results, he/she shall be allowed to take up supplementary examinations to be conducted within a reasonable time for the courses of final semester alone, so that he/she gets a chance to complete the programme.

15. AWARD OF LETTER GRADES:

For all the passed candidates, the relative grading principle is applied to assign the letter grades.

Marks / Examination Status	Letter Grade	Grade Point
	O (Outstanding)	10
	A+ (Excellent)	9
Based on the relative	A (Very Good)	8
grading	B+ (Good)	7
	B (Average)	6
	C (Satisfactory)	5
Less than 50	U (Reappearance)	0
Successfully Completed	SC	0
Withdrawal	W	-

Absent	AB	-

Shortage of Attendance in a	SA	-
course		

The Grade Point Average (GPA) is calculated using the formula:

	donse credits for all courses in the specific
GPA =	<u>semester</u>
0111	dousecredis for all courses in the specific semester
	plative Grade Point Average (CGPA) is calculated from first semester (third semesterfor ry candidates) to final semester using the formula
CCDA-	□□□coursecredits□□□grade points□□for allcourses in all the semesters so far
CGPA=	□ □ course credits □ for all courses in all the semesters so far

The GPA and CGPA are computed only for the candidates with a pass in all the courses.

The GPA and CGPA indicate the academic performance of a candidate at the end of a semester and at the end of successive semesters respectively.

A grade sheet for each semester shall be issued containing Grade obtained in each course, GPA and CGPA.

A duplicate copy, if required can be obtained on payment of a prescribed fee and satisfying other procedure requirements.

Withholding of Grades: The grades of a candidate may be withheld if he/she has not cleared his/her dues or if there is a disciplinary case pending against him/her or for any other reason.

16. ELIGIBILITY FOR THE AWARD OF DEGREE

A candidate shall be declared to be eligible for the award of the BE / BTech Degree provided the candidate has

- i. Successfully completed all the courses under the different categories, as specified in the regulations.
- ii. Successfully gained the required number of total credits as specified in the curriculum corresponding to the candidate's programme within the stipulated time (vide clause 5).
- iii. Successfully passed any additional courses prescribed by the respective Board of Studies whenever readmitted under regulations other than R-2022 (vide clause 11.3)
- iv. No disciplinary action pending against him / her.

17. CLASSIFICATION OF THE DEGREE AWARDED

17.1 First Class with Distinction:

- 17.1.1. A candidate who qualifies for the award of the degree (vide clause 16) and who satisfies the following conditions shall be declared to have passed the examination in First class with Distinction:
 - Should have passed the examination in all the courses of all the eight semesters (six semesters for lateral entry candidates) in the **First Appearance** within eight consecutive semesters (six consecutive semesters for lateral entry candidates) excluding the authorized break of study (vide clause 11) after the commencement of his / her study.
 - Withdrawal from examination (vide clause 10) shall not be considered as an appearance.
 - Should have secured a CGPA of not less than 8.50

(OR)

- A candidate who joins from other institutions on transfer or a candidate who gets readmitted and has to move from one regulations to another regulations and who qualifies for the award of the degree (vide clause 16) and satisfies the following conditions shall be declared to have passed the examination in First class with Distinction:
 - Should have passed the examination in all the courses of all the eight semesters (six semesters for lateral entry candidates) in the **First Appearance** within eight consecutive semesters (six consecutive semesters for lateral entry candidates) excluding the authorized break of study (vide clause 11) after the commencement of his / her study.
 - Submission of equivalent course list approved by the respective Boardof studies.
 - Withdrawal from examination (vide clause 10) shall not be considered as an appearance.
 - Should have secured a CGPA of not less than 9.00

17.2 First Class:

A candidate who qualifies for the award of the degree (vide clause 16) and who satisfies the following conditions shall be declared to have passed the examination in First class:

- Should have passed the examination in all the courses of all eight semesters (six semesters for lateral entry candidates) within ten consecutive semesters (eight consecutive semesters for lateral entry candidates) excluding authorized break of study (vide clause 11) after the commencement of his / her study.
- Withdrawal from the examination (vide clause 10) shall not be considered as an appearance.
- Should have secured a CGPA of not less than 6.50

17.3 Second Class:

All other candidates (not covered in clauses 17.1 and 17.2) who qualify for the award of the degree (vide clause 16) shall be declared to have passed the examination in Second Class.

A candidate who is absent for end semester examination in a course / project work after having registered for the same shall be considered to have appeared for that examination for the purpose of classification.

17.5 Honors Degree:

A candidate who qualifies for the award of the degree (vide clause 16) and who satisfies the following conditions shall be declared to have earned the BE/BTech degree with Honours (vide clause 16 and clause 4.2.2):

- Should have passed the examination in all the courses of all the eight semesters (six semesters for lateral entry candidates) in the **First Appearance** within eight consecutive semesters (six consecutive semesters for lateral entry candidates) excluding the authorized break of study (vide clause 11) after the commencement of his / her study.
- Withdrawal from examination (vide clause 10) shall not be considered as an appearance.
- Should have secured a CGPA of not less than 8.00

18. MALPRACTICES IN TESTS AND EXAMINATIONS

If a candidate indulges in malpractice in any of the tests or end semester examinations, he/she shall be liable for punitive action as per the examination rules prescribed by the college from time to time.

19. AMENDMENTS

Notwithstanding anything contained in this manual, the Kongu Engineering College through the Academic council of the College, reserves the right to modify/amend without notice, the Regulations, Curricula, Syllabi, Scheme of Examinations, procedures, requirements, and rules pertaining to its BE / BTech programme.

CURRICULUM BREAKDOWN STRUCTURE - R2022-2023 Summary of Credit Distribution Curriculum Total Content (% of total Semester number number of credits Category of credits of the program) ı Ш I۷ ٧ VI VII VIII Ш HS 4 3 4 3 1 15 8.93 BS 7 8 4 20 11.90 4 14.29 ES 8 8 3 24 PC 3 3 15 13 15 9 57 33.93 PΕ 3 3 9 3 18 10.71 OE 4 4 3 3 14 8.33 EC 2 2 11.90 6 6 4 20 MC 0 0 0 0 Semester 23 23 21 24 24 22 21 10 168 100.00 wise Total Category Abbreviation Lecture hours per week L Tutorial hours per week T Practical, Project work, Internship, Professional Skill Training, Industrial Training Р hours per week Credits С

		CUF	RRICU	LUM B	REAKI	DOWN	STRU	CTURE	E – R2023-20	24
				Sun	nmary	of Cre	dit Dis	tributio	on	
Category				Semo	ester				Total number of credits	Curriculum Content (% of total number of credits of the program)
	I	II	III	IV	V	VI	VII	VIII		
HS	4	5	2	1			3		15	8.93
BS	8	8		4					20	11.90
ES	7	10	3	4					24	14.29
PC	3		15	12	16	9	3		57	33.93
PE					3	3	6	3	18	10.71
OE					4	4	3	3	14	8.33
EC				2	2	7	7	4	20	11.90
MC	0					0			0	0
Semester wise Total	22	23	20	23	25	23	22	10	168	100.00
				Categ	jory					Abbreviation
Lecture hours										L
Tutorial hours	•			D (OL ::: =				
	ractical, Project work, Internship, Professional Skill Training, Industrial Training burs per week								P	
Credits	in.									С

		CATEGORISATION OF COURSI	ES								
HU	HUMANITIES AND SOCIAL SCIENCE INCLUDING MANAGEMENT (HS)										
S. No.	Course Code	Course Name	L	Т	Р	С	Sem				
1.	22EGT11	Communication Skills I	3	0	0	3	1				
2.	22VEC11	Yoga and Values for Holistic Education	1	0	1	1*	I				
3.	22EGT21	Communication Skills II	3	0	0	3	Ш				
4.	22EGL31	Communication Skills Development Laboratory*	0	0	2	1	IV				
5.	22GCT31	Universal Human Values	2	0	0	2	III				
6.	6. 22GCT71 Engineering Economics and Management 3 0 0 3 VII										
	Total Credits to be earned 13										

		BASIC SCIENCE (BS)					
S. No.	Course Code	Course Name	L	Т	Р	С	Sem
1.	22MAC11	Matrices and Ordinary differential equation	3	1	2	4	I
2.	22PHT23	Physics for Food Technology	3	0	0	3	Ш
3.	22PHL23	Physics laboratory for Food Technology	0	0	2	1	II
4.	22MAC21	Multivariable Calculus and Complex Analysis	3	1*	2*	4	П
5.	22CYT13	Chemistry for Food Technology	3	0	0	3	1
6.	22CYL12	Chemistry laboratory for Food Technology	0	0	2	1	I
7.	22MAT41	Numerical Methods for Engineers	3	1	0	4	IV
Tota	Credits to	be earned				20	

		ENGINEERING SCIENCE (ES)					
S. No.	Course Code	Course Name	L	Т	Р	С	Sem
1	22CSC11	Problem Solving and Programming in C	3	0	2	4	1
2	22MEC11	Engineering Drawing	2	0	2	3	I
3	22MEL11	Engineering Practices Laboratory	0	0	2	1	I
4	22ITC23	Python Programming	3	0	2	4	Ш
5	22MET22	Basics of Mechanical Engineering	3	0	0	3	Ш
6	22MEL21	Basics of Mechanical Engineering Laboratory	0	0	2	1	II
7	22ITC31	Java Programming	3	0	2	4	Ш
8	22FTT41	Heat Transfer Operations	3	1	0	4	IV
	To	tal Credits to be earned				24	

		PROFESSIONAL CORE	Ξ (P	C)				
S. No.	Course Code	Course Name	L	Т	Р	С	Sem	Domain/ Stream
1.	22FTT11	Fundamentals of Biochemistry	3	0	0	3	I	CA
2.	22FTT21	Engineering Properties of Food Materials	3	0	0	3	11/111	FE
3.	22FTT31	Process Fluid Mechanics	3	0	0	3	Ш	ES
4.	22FTT32	Food Chemistry	3	0	0	3	III	CA

	1							-
5.	22FTT33	Food Process Calculations	3	1	0	4	III	PE
6.	22FTT34	Refrigeration and Cold Chain Management	3	1	0	4	III	FE
7.	22FTL31	Fluid Flow Laboratory	0	0	2	1	III	PE
8.	22FTL32	Food Chemistry Laboratory	0	0	2	1	111	CA
9.	22FTT42	Food Microbiology	3	0	0	3	IV	FE
10.	22FTT43	Mass Transfer in Food Processing Operations	3	1	0	4	IV	PE
11.	22FTT44	Food Process Engineering I	3	1	0	4	IV/V	PE
12.	22FTT35	Food Packaging Technology	3	0	0	3	IV	PE
13.	22FTL41	Heat and Mass Transfer Laboratory	0	0	2	1	IV	PE
14.	22FTL42	Food Microbiology Laboratory	0	0	2	1	IV	FE
15.	22FTT51	Food Process Engineering II	3	1	0	4	V	FE
16.	22FTT52	Fruit and Vegetable Processing Technology	3	0	0	3	V	FE
17.	22FTT53	Baking and Confectionery Technology	3	0	0	3	V	FE
18.	22FTL51	Food Process Engineering Laboratory	0	0	2	1	V	FE
19.	22FTL52	Fruit and Vegetable Processing Laboratory	0	0	2	1	V	FE
20.	22FTL53	Baking and Confectionery Technology Laboratory	0	0	2	1	V	FE
21	22FTT54	Food Science and Nutrition	3	0	0	3	V/IV	CA
22.	22FTT61	Dairy Technology	3	0	0	3	VI	FE
23.	22FTT62	Food Quality and Safety	3	0	0	3	VI	CA
24.	22FTL61	Dairy Technology Laboratory	0	0	2	1	VI	FE
25.	22FTL62	Food Analysis Laboratory	0	0	2	1	VI	FE
26.	22FTL63	Food Process Equipment Design and Drawing Laboratory	0	0	2	1	VI	FE
Total C	Credits to be	e earned				57		
			_	_				

	PROFESSIONAL ELECTIVES (PEs)									
S. No.	Course Code	Course Name	L	Т	Р	С	Domain/ Stream			
		Semester - V								
		Elective - I								

1	22FTE01	Technology of Snack and Extruded	3	0	0	3	FE
2	22FTE02	Foods Nanotochnology in Food Processing			_		PE
3		Nanotechnology in Food Processing	3	0	0	3	
	22FTE03	Fermentation Technology	3	0	0	3	CA
4	22FTE04	Food Storage and Infestation Control	3	0	0	3	FE
5	22FTE05	Food Additives and Nutraceuticals	3	0	0	3	CA
		Semester - VI					
		Elective – II	ı				
6.	22FTE06	Food Allergens and Toxicology	3	0	0	3	CA
7.	22FTE07	Modern Separation Process	3	0	0	3	PE
8.	22FTE08	Bioprocess Engineering	3	0	0	3	PE
9.	22FTE09	Emerging Technologies in Food Processing	3	0	0	3	FE
10.	22FTE10	Plantation and Spices Products Technology	3	0	0	3	FE
		Semester - VII					
		Elective - III					
11.	22FTE11	Enzymes in Food Processing	3	0	0	3	FE
12.	22FTE12	Dairy Products Technology	3	0	0	3	FE
13.	22FTE13	Technology of Fats and Oils	3	0	0	3	CA
14.		Process Instrumentation and control	3	0	0	3	PE
15.	22FTE15	Fundamentals of Computation Fluid Dynamics	3	0	0	3	PE
		Elective – IV					
16.	22FTE16	Energy Management in Process Industries	3	0	0	3	PE
17.	22FTE17	Technology of Cereals, Pulses and Oil Seeds	3	0	0	3	FE
18.	22FTE18	Meat, Fish and Poultry Processing	3	0	0	3	FE
19.	22FTE19	Traditional Foods	3	0	0	3	FE
20.	22FTE20	Reaction Engineering	3	0	0	3	PE
		Elective - V	1				
21.	22FTE21	Modeling, Simulation and Soft tools for Food Technologists	3	0	0	3	FE
22.	22FTE22	Beverage Technology	3	0	0	3	FE
23.	22FTE23	Production of Field and Horticulture Crops	3	0	0	3	FE

24.	22FTE24	Cane Sugar Technology	3	0	0	3	FE
25	22GEE01	Fundamentals of Research	3	0	0	3	GE
		Semester - VIII					
		Elective - VI					
26.	22FTE25	Waste Management and By-Product Utilization in Food Industries	3	0	0	3	FE
27.	22FTE26	Food Process Plant Layout and Safety	3	0	0	3	PE
28.	22FTE27	Agri Business Management and Retail marketing	3	0	0	3	FE
29.	22FTE28	Industrial Waste Water Treatment	3	0	0	3	PE
30	22FTE29	Analytical Instruments in Food Industries	3	0	0	3	FE
Tota	l Credits to	be earned				18	

 $^{^{\}star}$ Domain/Stream Abbreviations:, PE - PROCESS ENGINEERING, CA - CHEMISTRY AND ANALYIS, FE-FOOD ENGINEERING, GE - GENERAL ENGINEERING

	EM	PLOYABILITY ENHANCEMENT COU	RSE	S (E	C)		
S. No.	Course Code	Course Name	L	Т	Р	С	Sem
1.	22GEL41	Professional Skills Training I				2	IV
2.	22GEL51	Professional Skills Training II				2	V
3.	22FTP61	Project Work I	0	0	4	2	VI
4.	22GEP61	Comprehensive Test and Viva			!	2	VI
5.	22FTP71	Project Work II Phase I	0	0	8	4	VII
6.	22GEI71	Industrial Training			!	1	VII
7.	20FTP81	Project Work II Phase II	0	0	14	7	VIII
Total	Credits to	be earned				20	

MAN	IDATORY C	COURSES (EC)					
S. No.	Course Code	Course Name	L	Т	Р	С	Sem
1.	22MNT11	Student Induction Program				0	I

2.	22MNT31	Environmental Science	2	0	0	0	VI
Total	Credits to I	pe earned				00	

OPEN ELECTIVE COURSES OFFERED TO OTHER DEPARTMENTS (OE)								
S. No.	Course Code	Course Name	L	Т	Р	С	Sem	
1.	22FTX01	Baking Technology	3	0	2	4	V	
2.	22FTO01	Food Processing Technology	3	1	0	4	V	
3.	22FTX02	Processing of milk and milk products	3	0	2	4	VI	
4.	22FTX03	Processing of Fruits and Vegetables	3	0	2	4	VI	
5.	22FTO02	Principles of Food safety	3	0	0	3	VII	
6.	22FTO03	Fundamentals of Food Packaging and Storage	3	0	0	3	VII	
7.	22FTO04	Food Ingredients	3	0	0	3	VIII	
8.	22FTO05	Food and Nutrition	3	0	0	3	VIII	

OPEN ELECTIVE COURSES OFFERED BY OTHER DEPARTMENTS (OE)								
S. No.	Course Code	Course Name	L	Т	Р	С	OFFERED BY	
		SEMESTER V						
1.	22CEX01	Remote Sensing and its Applications	3	0	2	4	CIVIL	
2.	22MEX01	Renewable Energy Sources	3	0	2	4	MECH	
3.	22MTO01	Design of Mechatronics Systems	3	1	0	4	MTS	
4.	22MTX01	Data Acquisition and Virtual Instrumentation	3	0	2	4	MTS	
5.	22MTX02	Factory Automation	3	0	2	4	MTS	
6.	22AUX01	Automotive Engineering	3	0	2	4	AUTO	
7.	22ECX01	Basics of Electronics in Automation Appliances	3	0	2	4	ECE	
8.	22ECX02	Image Processing	3	0	2	4	ECE	
9.	22EEO01	Solar and Wind Energy Systems	3	1	0	4	EEE	
10.	22EEO02	Electrical Wiring and Lighting	3	1	0	4	EEE	
11.	22EEO03	Programmable Logic Controller and	3	1	0	4	EEE	

		SCADA						
12.	22EEO04	Analog and Digital Electronics	3	1	0	4	EEE	
13.	22EEO05	Power Electronics and Drives	3	1	0	4	EEE	
14.	22EEO06	Sensors and Actuators	3	1	0	4	EEE	
15.	22EIO01	Measurements and Instrumentation	3	1	0	4	EIE	
16.	22EIO02	Biomedical Instrumentation and Applications	3	1	0	4	EIE	
17.	22EIO03	Industrial Automation	3	1	0	4	EIE	
18.	22CSX01	Fundamentals of Databases	3	0	2	4	CSE	
19.	22CSX02	Data science for Engineers	3	0	2	4	CSE	
20.	22CSX03	Enterprise Application Development Using Java	3	0	2	4	CSE	
21.	22CSO01	Computational science for Engineers	3	1	0	4	CSE	
22.	22CSO02	Formal Languages and Automata Theory	3	1	0	4	CSE	
23.	22ITO01	Artificial Intelligence	3	1	0	4	IT	
24.	22ITX01	Next Generation Databases	3	0	2	4	IT	
25.	22GEX02	NCC Studies (Air Wing) - 1	3	0	2	4	IT	
26.	22CDO01	Fundamentals of User Experience Design	3	1	0	4	CSD	
27.	22ADO01	Data Warehousing and Data Mining	3	1	0	4	AIDS	
28.	22ALO01	Business Intelligence	3	1	0	4	AIML	
29.	22CHO01	Industrial Enzymology	3	1	0	4	CHEM	
30.	22CHO02	Waste to Energy Conversion	3	1	0	4	CHEM	
31.	22CHO03	Applied Nanotechnology	3	1	0	4	СНЕМ	
32.	22FTX01	Baking Technology	3	0	2	4	FT	
33.	22FTO01	Food Processing Technology	3	1	0	4	FT	
34.	22MAO01	Mathematical Foundations for Machine Learning	3	1	0	4	MATHS	
35.	22MAO02	Numerical Computing	3	1	0	4	MATHS	
36.	22MAO03	Stochastic Processes and Queuing Theory	3	1	0	4	MATHS	
37.	22MAO04	Statistics for Engineers	3	1	0	4	MATHS	
38.	22PHO01	Thin Film Technology	3	1	0	4	PHYSICS	
39.	22PHO02	High Energy Storage Devices	3	1	0	4	PHYSICS	

40.	22PHO03	Structural and Optical Characterization of Materials	3	1	0	4	PHYSICS
41.	22CYO01	Instrumental Methods of Analysis	3	1	0	4	CHEMISTRY
42.	22CYO02	Chemistry Concepts for Competitive Examinations	3	1	0	4	CHEMISTRY
43.	22CYO03	Organic Chemistry for Industry	3	1	0	4	CHEMISTRY
		SEMESTER VI					
44.	22CEO01	Disaster Management	3	1	0	4	CIVIL
45.	22MEX02	Design of Experiments	3	0	2	4	MECH
46.	22MTO02	Robotics	3	1	0	4	MTS
47.	22MTO03	3D Printing and Design	3	1	0	4	MTS
48.	22AUO01	Automotive Electronics	3	1	0	4	ECE
49.	22ECX03	PCB Design and Fabrication	3	0	2	4	ECE
50.	22EEO07	Energy Conservation and Management	3	1	0	4	EEE
51.	22EEO08	Microprocessors and Microcontrollers Interfacing	3	1	0	4	EEE
52.	22EEO09	Electrical Safety	3	1	0	4	EEE
53.	22EEO10	VLSI System Design	3	1	0	4	EEE
54.	22EEO11	Automation for Industrial Applications	3	1	0	4	EEE
55.	22EIO04	PLC Programming with High Level Languages	3	1	0	4	EIE
56.	22EIO05	Virtual Instrumentation	3	1	0	4	EIE
57.	22CSX04	Foundations of Machine Learning	3	0	2	4	CSE
58.	22CSX05	Web Engineering	3	0	2	4	CSE
59.	22ITX02	Advanced Java Programming	3	0	2	4	IT
60.	22ITO02	Internet of Things	3	1	0	4	IT
61.	22ITO03	Fundamentals of Software Development	3	1	0	4	IT
62.	22ITO04	Mobile Application Development	3	1	0	4	IT
63.	22CDX01	Fundamentals of User Interactive Design	3	0	2	4	CSD
64.	22ADX01	Data Visualization	3	0	2	4	AIDS
65.	22ALX01	Data Exploration and Visualization Techniques	3	0	2	4	AIML
66.	22CHO04	Air Pollution Monitoring and Control	3	1	0	4	CHEM
67.	22CHO05	Paints and Coatings	3	1	0	4	CHEM

68.	22CHO06	Powder Technology	3	1	0	4	CHEM
69.	22FTX02	Processing of milk and milk products	3	0	2	4	FT
70.	22FTX03	Processing of Fruits and Vegetables	3	0	2	4	FT
71.	22MAO05	Graph Theory and its Applications	3	1	0	4	MATHS
72.	22MAX01	Data Analytics using R Programming	3	0	2	4	MATHS
73.	22MAO06	Operations Research	3	1	0	4	MATHS
74.	22MAO07	Number Theory and Cryptography	3	1	0	4	MATHS
75.	22PHO04	Synthesis, Characterization and Biological Applications of Nanomaterials	3	1	0	4	PHYSICS
76.	22PHO05	Techniques of Crystal Growth	3	1	0	4	PHYSICS
77.	22CYO04	Corrosion Science and Engineering	3	1	0	4	CHEMISTRY
78.	22CYO05	Chemistry of Cosmetics in Daily Life	3	1	0	4	CHEMISTRY
79.	22CYO06	Nanocomposite Materials	3	1	0	4	CHEMISTRY
		SEMESTER VII					
80.	22CEO02	Introduction to Smart Cities	3	0	0	3	CIVIL
81.	22CEO03	Environmental Health and Safety	3	0	0	3	CIVIL
82.	22MEO01	Fundamentals of Ergonomics	3	0	0	3	MECH
83.	22MEO02	Principles of Management and Industrial Psychology	3	0	0	3	MECH
84.	22MEO03	Waste Heat Recovery System and Storage	3	0	0	3	MECH
85.	22MTO04	Drone System Technology	3	0	0	3	MTS
86.	22AUO02	Vehicle Maintenance	3	0	0	3	AUTO
87.	22ECO01	Wearable Devices	3	0	0	3	ECE
88.	22ECX04	Electronic Hardware and Troubleshooting	2	0	2	3	ECE
89.	22EEO12	Electric Vehicle	3	0	0	3	EEE
90.	22EEO13	E-Waste Management	3	0	0	3	EEE
91.	22EEO14	Embedded System Design	3	0	0	3	EEE
92.	22EEO15	Energy Storage Systems and Controllers	3	0	0	3	EEE
93.	22EEO16	Al Techniques for Engineering Applications	3	0	0	3	EEE
94.	22EIO06	Introduction to Distributed Control Systems	3	0	0	3	EIE

	1	11 () () ()		1			
95.	22EIO07	Instrumentation in Aircraft Navigation and Control	3	0	0	3	EIE
96.	22EIO08	Industry 4.0 with Industrial IoT	3	0	0	3	EIE
97.	22EIO09	Industrial Data Communication	3	0	0	3	EIE
98.	22EIO10	Wireless Instrumentation	3	0	0	3	EIE
99.	22EIO11	Instrumentation Techniques in Agriculture	3	0	0	3	EIE
100.	22CSO03	Nature Inspired optimization techniques	3	0	0	3	CSE
101.	22ITO05	Fundamentals of Cloud Computing	3	0	0	3	IT
102.	22CDO02	Introduction to Mobile Game Design	3	0	0	3	CSD
103.	22CDO03	Introduction to Graphics Design	3	0	0	3	CSD
104.	22ADO02	Neural Networks and Deep Learning	3	0	0	3	AIDS
105.	22ALO02	Industrial Machine Learning	3	0	0	3	AIML
106.	22CHO07	Hydrogen Energy	3	0	0	3	СНЕМ
107.	22CHO08	Rubber Technology	3	0	0	3	СНЕМ
108.	22FTO02	Principles of Food safety	3	0	0	3	FT
109.	22FTO03	Fundamentals of Food Packaging and Storage	3	0	0	3	FT
110.	22MAO08	Non-Linear Optimization	3	0	0	3	MATHS
111.	22MAO09	Optimization for Engineers	3	0	0	3	MATHS
112.	22CYO07	Waste and Hazardous Waste Management	3	0	0	3	CHEMISTRY
113.	22CYO08	Chemistry in Everyday Life	3	0	0	3	CHEMISTRY
		SEMESTER VIII					
114.	22CEO04	Infrastructure Planning and Management	3	0	0	3	CIVIL
115.	22CEO05	Environmental Laws and Policy	3	0	0	3	CIVIL
116.	22MEO04	Safety Measures for Engineers	3	0	0	3	MECH
117.	22MEO05	Energy Conservation in Thermal Equipments	3	0	0	3	MECH
118.	22MEO06	Climate Change and New Energy Technology	3	0	0	3	MECH
119.	22MTO05	Micro and Nano Electromechanical Systems	3	0	0	3	MTS
120.	22AUO03	Public Transport Management	3	0	0	3	ECE
121.	22AUO04	Autonomous Vehicles	3	0	0	3	ECE
122.	22ECO02	Optical Engineering	3	0	0	3	EEE

123.	22EEO17	Smart Grid Technologies	3	0	0	3	EEE
124.	22EEO18	Biomass Energy Systems	3	0	0	3	EEE
125.	22EIO12	Environmental Sensors	3	0	0	3	EIE
126.	22EIO13	Pollution Control and Management	3	0	0	3	EIE
127.	22CSO04	Machine Translation	3	0	0	3	CSE
128.	22CSO05	Fundamentals of Blockchain	3	0	0	3	CSE
129.	22ITO06	Introduction to Ethical Hacking	3	0	0	3	IT
130.	22ITO07	Business Continuity Planning	3	0	0	3	IT
131.	22CDX02	Virtual Reality and Augmented Reality	3	0	0	3	CSD
132.	22ADO03	Business Analytics	3	0	0	3	AIDS
133.	22ALO03	Machine Learning for Smart Cities	3	0	0	3	AIML
134.	22CHO09	Industrial Accident Prevention and Management	3	0	0	3	СНЕМ
135.	22CHO10	Electrochemical Engineering	3	0	0	3	СНЕМ
136.	22CHO11	Smart and Functional Materials	3	0	0	3	CHEM
137.	22FTO04	Food Ingredients	3	0	0	3	FT
138.	22FTO05	Food and Nutrition	3	0	0	3	FT
139.	22CYO09	Chemistry of Nutrition for Women Health	3	0	0	3	CHEMISTRY

GENERAL OPEN ELECTIVE

(Common to All BE/BTech branches)

S.No	Course Code	Course Title	L	Т	Р	С	Offering Department	Semester
1.	22GEO01	German Language Level 1	4	0	0	4	ECE	ALL
2.	22GEO02	Japanese Language Level 1	4	0	0	4	ECE	ALL
3.	22GEO03	Design Thinking for Engineers	3	1	0	4	CSE	5
4.	22GEO04	Innovation and Business Model Development	3	1	0	4	MTS	6
5.	22GEO05	German Language Level 2	4	0	0	4	ECE	ALL

6.	22GEO06	German Language Level 3	3	0	0	3	ECE	ALL
7.	22GEO07	German Language Level 4	3	0	0	3	ECE	ALL
8.	22GEO08	Japanese Language Level 2	4	0	0	4	ECE	ALL
9.	22GEO09	Japanese Language Level 3	3	0	0	3	ECE	ALL
10.	22GEO10	Japanese Language Level 4	3	0	0	3	ECE	ALL
11.	22GEO11	French Language Level 1	4	0	0	4	ECE	ALL
12.	22GEO12	French Language Level 2	4	0	0	4	ECE	ALL
13.	22GEO13	French Language Level 3	3	0	0	3	ECE	ALL
14.	22GEO14	Spanish Language Level 1	4	0	0	4	ECE	ALL
15.	22GEO15	Spanish Language Level 2	4	0	0	4	ECE	ALL
16.	22GEO16	Spanish Language Level 3	3	0	0	3	ECE	ALL
17.	22GEO17	Entrepreneurship Development	3	0	0	3	MTS	7
18.	22GEX01	NCC Studies (Army Wing) - I	3	0	2	4	EEE	5/6
19.	22GEX02	NCC Studies (Air Wing) - 1	3	0	2	4	IT	5/6
20.	22MBO01	Cost Accounting for Engineers	3	1	0	4	MBA	5
21.	22MBO02	Economic Analysis for Decision Making	3	1	0	4	MBA	6
22.	22MBO03	Marketing Analytics	3	1	0	4	МВА	7

KEC R2022: SCHEDULING OF COURSES – B.Tech (Food Technology)(2022-2023) Total Credits: 168

Sem	Course1	Course2	Course3	Course4	Course5	Course6	Course7	Course8	Course9	Course10	Credits
l N	22EGT11 Communica tion Skills I (3-0-0-3)	22MAC11 Matrices and Ordinary Differential Equations (3-1*-2*-4)	22CYT13 Chemistry for Food Technology (3-0-0-3)	22FTT11 Fundamentals of Biochemistry (3-0-0-3)	22CSC11 Problem Solving and Programming in C (3-0-2-4)	22MET11 Engineering Drawing (2-1-0-3)	22CYL13 Chemistry laboratory for Food Technology (0-0-2-1)	22MEL11 Engineering Practices Laboratory (0-0-2-1)	22VEC11 Yoga and Values for Holistic Development (1-0-1-1)	22MNT11 Student Induction Program (0-0-0-0)	23
II	22EGT21 Communica tion Skills II (3-0-0-3)	22MAC21 Multivariable Calculus and Complex Analysis (3-1*-2*-4)	22PHT23 Physics for Food Technology (3-0-0-3)	22FTT21 Engineering Properties of Food Materials (3-0-0-3)	22ITC23 Python Programming (3-0-2-4)	22MET22 Basics of Mechanical Engineering (3-0-0-3)	22PHL23 Physics Laboratory for Food Technology (0-0-2- 1)	22MEL21 Basics of Mechanical Engineering Laboratory (0-0-2-1)	22TAM01 Heritage of Tamil (1-0-0-1)		23
III	22FTT31 Process Fluid Mechanics (3-0-0-3)	22FTT32 Food Chemistry (3-0-0-3)	22FTT33 Food Process Calculations (3-1-0-4)	22FTT34 Refrigeration and Cold Chain Management (3-1-0-3)	22FTT35 Food Packaging Technology (3-0-0-3)	22FTL31 Fluid Flow Laboratory (0-0-2-1)	22FTL32 Food Chemistry Laboratory (0-0-2-1)	22GCT31 Universal Human Values (2-0-0-2)	22TAM02 Tamils and Technology (1-0-0-1)		21
IV	22MAT41 Numerical Methods for Engineers (3-1-0-4)	22FTT41 Heat Transfer Operations (3-1-0-4)	22FTT42 Food Microbiology (3-0-0-3)	22FTT43 Mass Transfer in Food Processing Application (3-1-0-4)	22FTT44 Food Process Engineering I (3-1-0-4)	22FTL41 Heat and Mass Transfer Laboratory (0-0-2-1)	22FTL42 Food Microbiology Laboratory (0-0-2-1)	22GCL41 Professional Skills Training I (0-0-0-2)	22EGL31 Communicatio n Skills Development Laboratory (0-0-2-1)		24
V	22FTT51 Food Process Engineering II (3-0-0-3)	22FTT52 Fruit and Vegetable Processing Technology (3-0-0-3)	22FTT53 Baking and Confectionery Technology (3-0-0-3)	22FTT54 Food Science and Nutrition (3-0-0-3)	Professional Elective I (3-0-0-3)	Open Elective I (3-1/0-0/2-4)	22FTL51 Food Process Engineering Laboratory (0-0-2-1)	22FTL52 Fruit and Vegetable Processing Laboratory (0-0-2-1)	22FTL53 Baking and Confectionery Technology Laboratory (0-0-2-1)	22GCL51 Professional Skills Training II (0-0-0-2)	24
VI	22FTT61 Dairy Technology (3-0-0-3)	22FTT62 Food Quality and Safety (3-0-0-3)	Professional Elective II (3-0-0-3)	Open Elective II (3-1/0-0/2-4)	22FTL61 Dairy Technology Laboratory (0-0-2-1)	22FTL62 Food Analysis Laboratory (0-0-2-1)	22FTL63 Food Process Equipment Design and Drawing Laboratory (0-0-2-1)	22FTP61 Project Work I (0-0-8-4)	22MNT31 Environmental Science (2-0-0-0)	20GEP61 Comprehensiv e Test and Viva (0-0-0-2)	22
VII	22GCT71 Engineering Economics and Manageme nt (3-0-0- 3)	Professional Elective III (3-0-0-3)	Professional Elective IV (3-0-0-3)	Professional Elective V (3-0-0-3)	Open Elective III (3-0-0-3)	22FTP71 Project Work II Phase I (0-0-10-5)	22GEI71 Industrial Training (0-0- 0-1)				21
VIII	Professional Elective VI (3-0-0-3)	Open Elective IV (3-0-0-3)	22FTP81 Project Work II Phase II (0-0-8-4)								10

KEC R2022: SCHEDULING OF COURSES – B.Tech (Food Technology)(2023-2024) Total Credits: 168

Sem	Course1	Course2	Course3	Course4	Course5	Course6	Course7	Course8	Course9	Course10	Credits
I	22EGT11 Communication Skills I (3-0-0-3)	22MAC11 Matrices and Ordinary Differential Equations (3-1*-2*-4)	22CYT13 Chemistry for Food Technology (3-0-0-3)	22FTT11 Fundamentals of Biochemistry (3-0-0-3)	22CSC11 Problem Solving and Programming in C (3-0-2-4)	22MEC11 Engineering Drawing (2-0-2-3)	22CYL24 Chemistry laboratory for Food Technology (0-0-2-1)	22MEL11 Engineering Practices Laboratory (0-0-2-1)	22VEC11 Yoga and Values for Holistic Development (1-0-1-1)	22MNT11 Student Induction Program (0-0-0-0)	23
II	22EGT21 Communication Skills II (3-0-0-3)	22MAC21 Multivariable Calculus and Complex Analysis (3-1*-2*-4)	22PHT23 Physics for Food Technology (3-0-0-3)	22FTT21 Engineering Properties of Food Materials (3-0-0-3)	22ITC23 Python Programming (3-0-2-4)	22MET22 Basics of Mechanical Engineering (3- 0-0-3)	22PHL23 Physics Laboratory for Food Technology (0-0-2- 1)	22MEL21 Basics of Mechanical Engineering Laboratory (0-0-2-1)	22TAM01 Heritage of Tamils (1-0-0-1)		23
III	22MAT31 Numerical Methods for Engineers (3-1-0-4)	22FTT31 Process Fluid Mechanics (3-1-0-4)	22FTT32 Food Chemistry (3-0-0-3)	22FTT33 Food Process Calculations (3-1-0-4)	22FTT34 Refrigeration and Cold Chain Management (3-1-0-4)	22FTL31 Fluid Flow Laboratory (0-0-2-1)	22FTL32 Food Chemistry Laboratory (0-0-2-1)	22GCT31 Universal Human Values (2-0-0-2)	22TAM02 Tamils and Technology (1-0-0-1)		22
IV	22FTT41 Heat Transfer Operations (3-1-0-4)	22FTT42 Food Microbiology (3-0-0-3)	22FTT43 Mass Transfer in Food Processing Application (3-1-0-4)	22FTT44 Food Process Engineering I (3-1-0-4)	22FTT45 Food Packaging Technology (3-0-0-3)	22FTL41 Heat and Mass Transfer Laboratory (0-0- 2-1)	22FTL42 Food Microbiology Laboratory (0-0-2-1)	22GCL41 Professional Skills Training I (0-0-0-2)	22EGL31 Communication Skills Development Laboratory (0-0-2-1)		23
V	22FTT51 Food Process Engineering II (3-0-0-3)	22FTT52 Fruit and Vegetable Processing Technology (3-0-0-3)	22FTT53 Baking and Confectionery Technology (3-0-0-3)	Professional Elective I (3-0-0-3)	Open Elective I (3-1/0-0/2-4)	22FTL51 Food Process Engineering Laboratory (0-0-2-1)	22FTL52 Fruit and Vegetable Processing Laboratory (0-0-2-1)	22FTL53 Baking and Confectionery Technology Laboratory (0-0-2-1)	22GCL51 Professional Skills Training II (0-0-0-2)		22
VI	22FTT61 Dairy Technology (3-0-0-3)	22FTT62 Food Quality and Safety (3-0-0-3)	Professional Elective II (3-0-0-3)	Open Elective II (3-1/0-0/2-4)	22FTL61 Dairy Technology Laboratory (0-0-2-1)	22FTL62 Food Analysis Laboratory (0-0-2-1)	22FTL63 Food Process Equipment Design and Drawing Laboratory (0-0-2-1)	22FTP61 Project Work I (0-0-4-2)	22MNT31 Environmental Science (2-0-0-0)	20GEP61 Comprehensive Test and Viva (0-0-0-2)	22
VII	22GCT71 Engineering Economics and Management (3-0-0-3)	Professional Elective III (3-0-0-3)	Professional Elective IV (3-0-0-3)	Professional Elective V (3-0-0-3)	Open Elective III (3-0-0-3)	22FTP71 Project Work II Phase I (0-0-8-4)	22GEI71 Industrial Training (0- 0-0-1)				20
VIII	Professional Elective VI (3-0-0-3)	Open Elective IV (3-0-0-3)	22FTP81 Project Work II Phase II (0-0-14-7)								13

MAPPING OF COURSES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	22EGT11	Communication Skills I						✓			✓	✓	✓	✓		
1	22MAC11	Matrices and Ordinary differential equations	✓	√	✓		✓									
1	22CYT13	Chemistry for Food Technology	✓	✓	✓	✓									✓	✓
1	22FTT11	Fundamentals of Biochemistry	✓	✓	√	✓		✓				✓	✓	✓	✓	✓
1	22CSC11	Problem Solving and Programming in C	✓	✓	✓	✓	✓					✓		✓		
1	22MET11	Engineering Drawing	✓	✓	✓		✓					✓		✓	✓	✓
1	22CYL13	Chemistry laboratory for Food Technology	✓	✓	✓	✓			✓						✓	✓
1	22MEL11	Engineering Practices Laboratory	✓		✓	✓	✓	✓			✓	✓		✓	✓	✓
1	22VEC11	Yoga and Values for Holistic Development						✓		✓	✓					
1	22GCL12	Foundation Engineering Laboratory II	✓	✓	✓	✓					✓					
1	22MNT11	Student Induction Program														
2	22EGT21	Communication Skills II						✓			✓	✓	✓	✓		
2	22MAC21	Multivariable Calculus and Complex Analysis	✓	✓	✓		✓									
2	22PHT23	Physics for Food Technology	✓	✓	✓						✓	✓		✓	✓	✓
2/3	22FTT21	Engineering Properties of Food Materials	✓	✓	✓	✓	✓					✓		✓	✓	✓
2	22ITC23	Python Programming	✓	✓	✓	✓										
2	22MET22	Basics of Mechanical Engineering	✓	✓	✓			✓						✓		✓
2	22PHL23	Physics Laboratory for Food Technology	✓	✓	✓	✓					✓	✓		✓	✓	✓
2	22MEL21	Basics of Mechanical Engineering Laboratory	✓			✓					✓			✓		✓

Sem.	Course	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Jein.	Code		101	1 02	1 03	1 04	1 03	1 00	1 07	1 00	1 08	1 010	1 011	1 012	1 301	1 302
2	22GCL11	Foundation Engineering Laboratory I	✓	✓	✓		✓				✓	✓		✓		
3	22TAM01	Heritage of Tamils						✓		✓	✓	✓		✓		
3	22FTT31	Process Fluid Mechanics	✓	✓	✓	✓	✓	✓		✓		✓		✓	✓	✓
3	22FTT32	Food Chemistry	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓
3	22FTT33	Food Process Calculations	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	22FTT34	Refrigeration and Cold Chain Management	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓
3	22FTT35	Food Packaging Technology	✓	✓	✓	✓	✓			✓				✓	✓	✓
3	22FTL31	Fluid Flow Laboratory	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
3	22FTL32	Food Chemistry Laboratory	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
3	22GCT31	Universal Human Values	✓	✓	✓	✓										
3	22TAM02	Tamils and Technology						✓		✓	✓	✓		✓		
4	22MAT41	Numerical Methods for Engineers	✓	✓	✓											
4	22FTT41	Heat Transfer Operations	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	22FTT42	Food Microbiology	✓	✓	✓		✓	✓	✓	✓		✓		✓	✓	✓
4	22FTT43	Mass Transfer in Food Processing Operations	✓	✓	✓	✓	√		✓	✓		✓		✓	✓	✓
4	22FTT44	Food Process Engineering I	✓	✓	✓	✓	✓					✓		✓	✓	✓
4	22FTL41	Heat and Mass Transfer Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	22FTL42	Food Microbiology Laboratory	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓
4	22GEL41	Professional Skills Training I														
4	22EGL31	Communication Skills Development Laboratory									✓	✓		✓		
5	22FTT51	Food process Engineering II	✓	✓	✓	✓		✓				✓		✓	✓	✓
5	22FTT52	Fruit And Vegetable Processing Technology	✓	✓	✓	✓		✓				✓			✓	✓
5	22FTT53	Baking And Confectionery Technology	✓	✓	✓	✓		✓				✓		✓	✓	✓
5	22FTL51	Food Process Engineering Laboratory	✓	✓	✓	✓					✓	✓		✓	✓	✓
5	22FTL52	Fruit And Vegetable Processing Technology	✓	✓	✓	✓	✓				✓	✓		✓	✓	✓

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		Laboratory														
5	22FTL53	Baking And Confectionery Technology Laboratory	✓	✓	✓	✓		✓		✓	✓	✓		✓	✓	√
5/4	22FTE54	Food Science And Nutrition	✓	✓	✓	✓		✓				✓		✓	✓	✓
6	22FTT61	Dairy Technology	✓	✓	✓		✓	✓		✓		✓		✓	✓	✓
6	22FTT62	Food Quality And Safety	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓
6	22FTL61	Dairy Technology Laboratory	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓
6	22FTL62	Food Analysis Laboratory	✓	✓	✓	✓	✓			✓	✓	✓		✓	✓	✓
6	22FTL63	Food Process Equipment Design Drawing Laboratory	✓	✓	✓	✓	✓				✓	✓		✓	✓	✓
6	22FTP61	Project work I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6	22GEP61	Comprehensive Test And Viva	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓
6	22MNT31	Environmental Science	✓	✓	✓				✓							
7	22GCT71	Engineering Economics And Management	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
7	22FTP71	Project work II Phase I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	22FTP81	Project II Phase II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
				Prof	ession	al Elec	tive Co	urses								
5	22FTE01	Technology of Snack And Extruded Foods	✓	✓	✓	✓						✓		✓	✓	✓
5	22FTE02	Nano Technology In Food Processing	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓
5	22FTE03	Fermentation Technology	✓	✓	✓	✓	✓					✓		✓	✓	✓
5	22FTE04	Food Storage And Infestation Control	✓	✓	✓	✓	✓	✓				✓		✓	✓	✓
5	22FTE05	Food Additives And Nutraceuticals	✓	✓	✓		✓	✓		✓		✓		✓	✓	✓
6	22FTE06	Food Allergens And Toxicology	✓	✓	✓	✓		✓	✓			✓		✓	✓	✓
6	22FTE07	Modern Separation Process	✓	✓	✓		✓	✓	✓			✓		✓	✓	✓
6	22FTE08	Bioprocess Engineering	✓	✓	✓	✓	✓					✓		✓	✓	✓
6	22FTE09	Emerging Technology In Food Processing	✓	✓	✓	✓	✓	✓				✓		✓	✓	√
6	22FTE10	Plantation and Spices	✓	✓	✓			✓	✓	✓		✓		✓	✓	✓

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		Products Technology														
7	22FTE11	Enzymes in Food Processing	✓	✓	✓	✓		✓				✓		✓	✓	✓
7	22FTE12	Dairy Products Technology	✓	✓	✓	✓	✓					✓		✓	✓	✓
7	22FTE13	Technology of Fats and Oils	✓	✓	✓	✓	✓	✓				✓		✓	✓	✓
7	22FTE14	Process Instrumentation And Control	✓	✓	✓	✓	√					✓		✓	✓	✓
7	22FTE15	Fundamentals Of Computation Fluid Dynamics	✓	✓	✓	√	✓							✓	✓	✓
7	22FTE16	Energy Management In Process Industries	✓	✓	✓			✓	✓			✓		✓	✓	✓
7	22FTE17	Technology of Cereals and Pulses and Oil Seeds	✓	✓	✓	✓		✓	✓			✓		✓	✓	✓
7	22FTE18	Meat, Fish and Poultry Processing	✓	✓	✓			✓				✓		✓	✓	✓
7	22FTE19	Traditional Foods	✓	✓	✓		✓	✓		✓		✓		✓	✓	✓
7	22FTE20	Reaction Engineering	✓	✓	✓	✓	✓							✓	✓	✓
7	22FTE21	Modeling Simulation And Soft Tools For Food Technologists	✓	✓	✓	√	✓					✓		✓	✓	✓
7	22FTE22	Beverage Technology	✓	✓	✓			✓				✓		✓	✓	✓
7	22FTE23	Production Of Field And Horticulture Crops	✓	✓	✓			✓				✓		✓	✓	✓
7	22FTE24	Cane Sugar Technology	✓	✓	✓				✓			✓		✓	✓	✓
7	22GEE01	Fundamentals of Research	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	22FTE25	Waste Management and By- Product Utilization In Food Industries	✓	✓	✓	✓		✓	✓			✓		✓	✓	✓
8	22FTE26	Food Process Plant Layout And Safety	✓	✓	✓			✓	✓			✓		✓	✓	✓
8	22FTE27	Agri Business Management And Retail Marketing	✓	✓	✓							✓	✓	✓		√
8	22FTE28	Industrial Waste Water Treatment	✓	✓	✓	✓		✓	✓			✓		✓	✓	✓
8	22FTE29	Analytical Instruments In Food Industries	✓	✓		√	✓					✓		✓	✓	✓
5	22FTX01	Baking Technology	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓		
5	22FTO01	Food Processing Technology	✓	✓	✓	✓		✓				✓		✓		

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
6	22FTX02	Processing Of Milk And Milk Products	✓	✓	✓		✓	✓		✓	✓	✓		✓	✓	✓
6	22FTX03	Processing Of Fruits And Vegetables	✓	✓	✓		✓	✓		✓	✓	✓		✓	✓	✓
7	22FTO02	Principles Of Food Safety	✓	✓	✓			✓	✓	✓		✓		✓		
7	22FTO03	Fundamentals Of Food Packaging Storage	✓	✓	✓	✓	✓	✓		✓		✓		✓		
8	22FTO04	Food Ingredients	✓	✓	✓			✓		✓		✓		✓		
8	22FTO05	Food And Nutrition	✓	✓	✓			✓				✓		✓		

Open elective

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
5	22CEX01	Remote Sensing and its Applications	√	√	✓	√		√			√			√		
5	22MEX01	Renewable Energy Sources	√		✓	√	√	√	√	√	√					
5	22MTO01	Design of Mechatronics Systems	√	√	✓	√	√							√		
5	22MTX01	Data Acquisition and Virtual Instrumentation	✓	√	✓	√	√							√		
5	22MTX02	Factory Automation	✓	✓	✓	✓	✓				✓	✓		✓		
5	22AUX01	Automotive Engineering	✓	✓	✓			✓	✓		✓	✓		✓		
5	22ECX01	Basics of Electronics in Automation Appliances	√	✓	√	√		√	√	√			√	√		
5	22ECX02	Image Processing	✓	✓	✓	✓	✓				✓	✓		✓		
5	22EEO01	Solar and Wind Energy Systems	√	✓	√			√	√					√		
5	22EEO02	Electrical Wiring and Lighting	√	✓	✓	✓	✓							√		
5	22EEO03	Programmable Logic Controller and SCADA	√	✓	✓	✓		√			✓			√		
5	22EEO04	Analog and Digital Electronics	√	√	✓	√	√							√		
5	22EEO05	Power Electronics and Drives	√	√	✓	√	√	√			√					
Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
5	22EEO06	Sensors and Actuators	✓	✓	✓			✓						✓		

5	22EIO01	Measurements and Instrumentation	✓	✓	√	✓	✓								
		Biomedical		+											
5	22EIO02	Instrumentation and Applications	✓	✓	✓	✓	✓	✓		✓					
5	22EIO03	Industrial Automation	√	√	√	/	/								
5	22CSX01	Fundamentals of	✓	√	✓										
	2200/101	Databases													
5	22CSX02	Data science for Engineers	✓	√	√	√	√								
5	22CSX03	Enterprise Application	√	✓	✓	✓	✓	√	√	✓	✓	√	✓	✓	
	2200,100	Development Using Java													
5	22CSO01	Computational science	✓	✓	✓										
		for Engineers													
5	22CSO02	Formal Languages and	✓	✓	✓										
<u> </u>	2017024	Automata Theory													
5	22ITO01	Artificial Intelligence	√	√	√	√		√	√	√	√	√	√		
5	22ITX01	Next Generation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
<i>F</i>	22CDO01	Databases Fundamentals of Ligar	√	✓	✓	✓	√				√	√	✓		
5	2200001	Fundamentals of User Experience Design	•	•	*	*	*				*	'	•		
5	22ADO01	Data Warehousing and	√	√	√										
"	ZZADOUT	Data Mining	·												
5	22ALO01	Business Intelligence	√	√	√										
5	22CHO01	Industrial Enzymology	√	√	√							√	√	√	
5	22CHO02	Waste to Energy	√	√											
		Conversion													
5	22CHO03	Applied Nanotechnology	✓	✓	✓	✓	✓	✓	✓	✓				✓	
5	22FTX01	Baking Technology	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	
5	22FTO01	Food Processing	✓	✓	✓	✓		✓				√		√	
		Technology													
		Mathematical													
5	22MAO01	Foundations for Machine	✓	✓	✓	✓	✓								
_	00144000	Learning	√	✓	✓										
5	22MAO02	Numerical Computing							1		1	1			
5	22MAO03	Stochastic Processes	✓	√	✓										
5	22MAO04	and Queuing Theory Statistics for Engineers	√	✓	✓				+		+	1			
5	22PHO01	Thin Film Technology	✓	✓	→				+		√	✓		✓	
	22PHO01		∨	V ✓	V ✓				+		\ \ \ \	V ✓		V ✓	
5	22711002	High Energy Storage Devices	,	v	•						, v	•		V	
		Structural and Optical													

5	22PHO03	Characterization of Materials	✓	✓	√						√	√		✓		
5	22CYO01	Instrumental Methods of Analysis	√	√	√	√										
Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
5	22CYO02	Chemistry Concepts for Competitive Examinations	✓	✓	✓											
5	22CYO03	Organic Chemistry for Industry	√	√	✓	✓										
5	22MBO01	Cost Accounting for Engineers										√	√	√		
6	22CEO01	Disaster Management	✓	✓	✓			✓	✓					✓		
6	22MEX02	Design of Experiments	✓	✓	✓	✓	✓				✓					
6	22GEO04	Innovation and Business Model Development	√	✓	✓	✓										
6	22MTO02	Robotics	✓	✓	✓	✓	✓							✓		
6	22MTO03	3D Printing and Design	✓	✓			✓							✓		
6	22AUO01	Automotive Electronics	✓	✓	✓	✓								✓		
6	22ECX03	PCB Design and Fabrication	√		√											
6	22EEO07	Energy Conservation and Management	√	√	√		√		√	√	√			~		
6	22EEO08	Microprocessors and Microcontrollers	√	✓	√	√	✓	√	√	✓		✓	✓	✓		
		Interfacing														
6	22EEO09	Electrical Safety	✓	✓	✓				✓	✓			✓	✓		
6	22EEO10	VLSI System Design	✓	✓	✓	✓	✓				✓		✓	✓		
6	22EEO11	Automation for Industrial Applications	√	√	✓	✓			√		✓			✓		
6	22EIO04	PLC Programming with High Level Languages	✓	✓	✓	✓	✓									
6	22EIO05	Virtual Instrumentation	✓	✓	✓	✓	✓									
6	22CSX04	Foundations of Machine Learning	✓	✓	✓											
6	22CSX05	Web Engineering	√	√	✓											
6	22ITX02	Advanced Java Programming	√													
6	22ITO02	Internet of Things	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓			
6	22ITO03	Fundamentals of Software Development	√	√	√	√		√	√	√	√	√	√			

6	22ITO04	Mobile Application Development	✓	✓	✓	✓	✓	✓	✓	✓	✓	√	✓		
6	22CDX01	Fundamentals of User Interactive Design	✓	✓	√	✓									
6	22ADX01	Data Visualization	√	√	√										
6	22ALX01	Data Exploration and Visualization Techniques	√	✓	√										
6	22CHO04	Air Pollution Monitoring and Control	✓	√	✓			√	√						
6	22CHO05	Paints and Coatings	✓	✓	✓				✓						
6	22CHO06	Powder Technology	✓	✓	√			✓	√					✓	
6	22FTX02	Processing of milk and milk products	√	√	√		√	√		√	√	✓		✓	
6	22FTX03	Processing of Fruits and Vegetables	√	√	√		√	√		✓	√	✓		✓	
6	22MAO05	Graph Theory and its Applications	✓	√	√										
6	22MAX01	Data Analytics using R Programming	✓	✓	✓	✓	√								
6	22MAO06	Operations Research	✓	✓	✓										
6	22MAO07	Number Theory and Cryptography	√	√	√		√								
6	22PHO04	Synthesis, Characterization and Biological Applications of Nanomaterials	✓	✓	✓						✓	✓		✓	
6	22PHO05	Techniques of Crystal Growth	✓	√	✓						√	√		√	
6	22CYO04	Corrosion Science and Engineering	✓	√	√	√									
6	22CYO05	Chemistry of Cosmetics in Daily Life	√	√	√										
6	22CYO06	Nanocomposite Materials	✓	√	√	√									
6	22MBO02	Economic Analysis for Decision Making					√					√	✓		
7	22CEO02	Introduction to Smart Cities	✓	√	√	√	√								
7	22CEO03	Environmental Health and Safety	√	✓	√			✓	√						
7	22MEO01	Fundamentals of Ergonomics	√					√							

		Principles of													
7	22MEO02	Management and Industrial Psychology	✓					✓				✓	✓		
7	22MEO03	Waste Heat Recovery	√	✓	√	✓			-						
'	ZZIVIEOUS	System and Storage	•	*	•	*			*						
7	22GEO05	Entrepreneurship	√	√	/	/	√	/	1	/	/	1	/	/	
'	2201003	Development													
7	22MTO04	Drone System	√	✓	√	√	✓							✓	
7	22AUO02	Technology Vehicle Maintenance	√	✓			√		✓					√	
			▼	▼	 	✓	▼	✓	V ✓		✓	√	√	V ✓	
7	22ECO01	Wearable Devices											V		
7	22ECX04	Electronic Hardware and Troubleshooting	✓	✓	✓	√	√	√	√	√	√	~		✓	
7	22EEO12	Electric Vehicle	✓	✓	✓	✓		✓	✓		✓			✓	
7	22EEO13	E-Waste Management	✓	✓	✓	✓		✓	✓					✓	
7	22EEO14	Embedded System Design	√	√		✓	√	√							
7	22EEO15	Energy Storage Systems and Controllers	√	√	√			√			√		✓	~	
7	22EEO16	Al Techniques for Engineering Applications	✓	√	√	√									
7	22EIO06	Introduction to Distributed Control Systems	√	✓	✓	✓	✓			✓		✓			
7	22EIO07	Instrumentation in Aircraft Navigation and Control	✓	✓	✓	✓	✓								
7	22EIO08	Industry 4.0 with Industrial IoT	✓	✓	✓	√	√			√					
7	22EIO09	Industrial Data Communication	✓	✓	√	√	√	✓							
7	22EIO10	Wireless Instrumentation	√	✓	√	√	√		✓						
		Instrumentation			1									1	
7	22EIO11	Techniques in Agriculture	✓	✓	✓	✓	✓								
7	22CSO03	Nature Inspired optimization techniques	√	√	√										
7	22ITO05	Fundamentals of Cloud Computing	√	√	√	√	√								

Sem.	Course Code	Course Title	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
7	22ITO06	Introduction to Ethical Hacking	√													
7	22CDO02	Introduction to Mobile Game Design	✓	√	✓	√										
7	22CDO03	Introduction to Graphics Design	√	√	√	√										
7	22ADO02	Neural Networks and Deep Learning	✓	√	√	√										
7	22ALO02	Industrial Machine Learning	✓	√	√											
7	22CHO07	Hydrogen Energy	✓	√										✓		
7	22CHO08	Rubber Technology	√	√				✓	√					✓		
7	22FTO02	Principles of Food safety	√	√	✓			✓	√	√		✓		✓		
7	22FTO03	Fundamentals of Food Packaging and Storage	✓	√	√	√	√	√		√		√		√		
7	22MAO08	Non-Linear Optimization	✓	✓	√											
7	22MAO09	Optimization for Engineers	√	√	√											
7	22CYO07	Waste and Hazardous Waste Management	√	√	√	√			√							
7	22CYO08	Chemistry in Every day Life	✓	√	√	√										
7	22MBO03	Marketing Analytics										✓	✓	✓		
8	22CEO04	Infrastructure Planning and Management	✓	√	✓		√									
8	22CEO05	Environmental Laws and Policy	✓	√			√									
8	22MEO04	Safety Measures for Engineers	√					√	√	√						
8	22MEO05	Energy Conservation in Thermal Equipments	√		√		√	√	✓					√		
8	22MEO06	Climate Change and New Energy Technology	✓		√			✓	√	√						
8	22MTO05	Micro and Nano Electromechanical Systems	✓	✓	✓	✓								✓		
8	22AUO03	Public Transport Management	✓	√				√	√	√				√		
8	22AUO04	Autonomous Vehicles	✓	✓	✓	✓	✓	✓	✓					✓		
8	22ECO02	Optical Engineering	✓	✓	✓	✓		✓	✓	✓	✓			✓		

8	22EEO17	Smart Grid Technologies	✓	✓	✓	✓	✓			✓				✓	
8	22EEO18	Biomass Energy Systems	√	√	√			√	√				✓	√	
8	22EIO12	Environmental Sensors	✓	✓	✓	✓	✓		✓						
8	22EIO13	Pollution Control and Management	√	√	√	√	√	✓		~					
8	22CSO04	Machine Translation	✓	✓	✓										
8	22CSO05	Fundamentals of Blockchain	✓	√	√										
8	22ITO07	Business Continuity Planning	√	√	√	√		√	√	✓	√	√	√		
8	22CDX02	Virtual Reality and Augmented Reality	✓	√	√	✓									
8	22ADO03	Business Analytics	✓	✓	✓	✓									
8	22ALO03	Machine Learning for Smart Cities	√	√	√	✓									
8	22CHO09	Industrial Accident Prevention and Management	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	
8	22CHO10	Electrochemical Engineering	√	√	√										
8	22CHO11	Smart and Functional Materials	✓	√					√	√	✓			√	
8	22FTO04	Food Ingredients	✓	✓	✓			✓		✓		✓		✓	
8	22FTO05	Food and Nutrition	✓	✓	✓			✓				✓		✓	
8	22CYO09	Chemistry of Nutrition for Women Health	✓	√	√										
Genera	al Open Elec	tiveCourses													
ALL	22GEO01	German Language Level1								✓	✓	✓		✓	
ALL	22GEO02	Japanese Language Level 1								√	✓	√		√	
5	22GEO03	Design Thinking for Engineers	√	√	√	√									
6	22GEO04	Innovation and Business Model Development	√	√	√	√	✓	✓	√	√	√	√	~	√	
ALL	22GEO05									✓	✓	√		✓	
ALL	22GEO06	German Language Level3								✓	✓	√		✓	
ALL	22GEO07	German Language Level4								✓	✓	✓		✓	
ALL	22GEO08	Japanese Language Level 2								√	√	√		√	
ALL	22GEO09	Japanese Language Level 3								√	√	✓		√	

ALL	22GEO10	Japanese Language Level 4								√	√	/		✓	
ALL	22GEO11	French Language Level1								✓	✓	✓		✓	
ALL	22GEO12	French Language Level2								✓	✓	✓		✓	
ALL	22GEO13	French Language Level3								✓	✓	✓		✓	
ALL	22GEO14	Spanish Language Level1								✓	✓	✓		✓	
ALL	22GEO15	Spanish Language Level2								✓	✓	✓		✓	
ALL	22GEO16	Spanish Language Level3								✓	✓	✓		✓	
7	22GEO17	Entrepreneurship Development	✓	√	✓	√	✓	✓	✓	✓	✓	✓	✓	✓	
5/6	22GEX01	NCC Studies (Army Wing) - I	✓	√	✓										
5/6	22GEX02	NCC Studies (Air Wing) -1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
5	22MBO01	Cost Accounting for Engineers										√	✓	✓	
6	22MBO02	Economic Analysis for Decision Making					√					✓	✓		
7	22MBO03	Marketing Analytics										✓	✓	✓	

SEMESTER	-1								
Course Code	Course Title	I	lours Weel	•	Credit	Max	imum	Marks	Category
Code		L	Т	Р		CA	ESE	Total	-
Theory/Theo	ory with Practical								
22EGT11	Communication Skills I	3	0	0	3	40	60	100	HS
22MAC11	Matrices and Ordinary Differential Equations	3	1*	2*	4	50	50	100	BS
22CYT13	Chemistry for Food Technology	3	0	0	3	40	60	100	BS
22FTT11	Fundamentals of Biochemistry	3	0	0	3	40	60	100	PC
22CSC11	Problem Solving and Programming in C	3	0	2	4	50	50	100	ES
22MET11	Engineering Drawing	2	1	0	3	40	60	100	ES
Practical / E	mployability Enhancement								
22CYL13	Chemistry Laboratory for Food Technology	0	0	2	1	60	40	100	BS
22MEL11	Engineering Practices Laboratory	0	0	2	1	60	40	100	ES
22VEC11	Yoga and Values for Holistic Development	1	0	1	1	100	0	100	HS
22MNT11	Student Induction Program				0	100	0	100	MC
	Total Credits to be earned				23				

^{*}Alternate weeks

SEMESTER	t – II								
Code	Course Title	ŀ	lours Weel		Credit	Max	imum	Marks	Category
Code		L	Т	Р		CA	ESE	Total	
Theory/The	ory with Practical								
22EGT21	Communication Skills - II	3	0	0	3	40	60	100	HS
22MAC21	Multivariable Calculus and Complex Analysis	3	1*	2*	4	50	50	100	BS
22PHT23	Physics for Food Technology	3	0	0	3	40	60	100	BS
22FTT21	Engineering Properties of Food Materials	3	0	0	3	40	60	100	PC
22ITC23	Python Programming	3	0	2	4	50	50	100	ES
22MET22	Basics of Mechanical Engineering	3	0	0	3	40	60	100	ES
Practical / E	Employability Enhancement								
22PHL23	Physics Laboratory for Food Technology	0	0	2	1	60	40	100	BS
22MEL21	Basics of Mechanical Engineering Laboratory	0	0	2	1	60	40	100	ES
22TAM01	Heritage of Tamils	1	0	0	1	100	0	100	HS
<u></u>	Total Credits to be earned				23				

SEMESTER	– III								
Course Code	Course Title	Ηοι	ırs / V	Veek	Credit	Max	imum	Marks	Category
Code		L	T	Р		CA	ESE	Total	
Theory/The	ory with Practical								
22FTT31	Process Fluid Mechanics	3	0	0	3	40	60	100	ES
22FTT32	Food Chemistry	3	0	0	3	40	60	100	PC
22FTT33	Food Process Calculations	3	1	0	4	40	60	100	PC
22FTT34	Refrigeration and Cold Chain Management	3	1	0	3	40	60	100	PC
22FTT35	Food Packaging Technology	3	0	0	3	40	60	100	PC
Practical / E	mployability Enhancement								
22FTL31	Fluid Flow Laboratory	0	0	2	1	60	40	100	PC
22FTL32	Food Chemistry Laboratory	0	0	2	1	60	40	100	PC
22GET31	Universal Human Values	2	0	0	2	100	0	100	HS
22TAM02	Tamils and Technology	1	0	0	1	100	0	100	HS
	Total Credits to be earned				21				

SEMESTER	– IV								
Course	Course Title	Ηοι	Hours / Week			Max	imum	Category	
Code		L	T	Р		CA	ESE	Total	
Theory/The	ory with Practical								
22MAT41	Numerical Methods for Engineers	3	1	0	4	40	60	100	BS
22FTT41	Heat Transfer Operations	3	1	0	4	40	60	100	ES
22FTT42	Food Microbiology	3	0	0	3	40	60	100	PC
22FTT43	Mass Transfer in Food Processing Operations	3	1	0	4	40	60	100	PC
22FTT44	Food Process Engineering - I	3	1	0	4	40	60	100	PC
Practical / E	mployability Enhancement								
22FTL41	Heat and Mass Transfer Laboratory	0	0	2	1	60	40	100	PC
22FTL42	Food Microbiology Laboratory	0	0	2	1	60	40	100	PC
22GCL41	Professional Skills Training I		-		2	100	0	100	EC
22EGL31	Communication Skills Development Laboratory	0	0	2	1	60	40	100	HS
	Total Credits to be earned								

SEMESTER	₹ – V								
Course	Course Title	Hou	urs / V	Veek	Credit	Max	imum	Category	
Code		L	Т	Р		CA	ESE	Total	
Theory/The	eory with Practical								
22FTT51	Food Process Engineering - II	3	0	0	3	40	60	100	PC
22FTT52	Fruit and Vegetable Processing Technology	3	0	0	3	40	60	100	PC
22FTT53	Baking and Confectionery Technology	3	0	0	3	40	60	100	PC
22FTT54	Food Science and Nutrition	3	0	0	3	40	60	100	PC
	Professional Elective – I	3	0	0	3	40	60	100	PE
	Open Elective – I	3	1/0	0/2	4	40	60	100	OE
Practical /	Employability Enhancement								
22FTL51	Food Process Engineering Laboratory	0	0	2	1	60	40	100	PC
22FTL52	Fruit and Vegetable Processing Technology Laboratory	0	0	2	1	60	40	100	PC
22FTL53	Baking and Confectionery Technology Laboratory	0	0	2	1	60	40	100	PC
22GCL51	Professional Skills Training II				2	100	0	100	EC
	Total Credits to be earned				24				

SEMESTE	R − VI								
Course	Course Title	Но	urs / V	Veek	Credit	Max	imum	Category	
Code		L	Т	Р		CA	ESE	Total	
Theory/The	eory with Practical								
22FTT61	Dairy Technology	3	0	0	3	40	60	100	PC
22FTT62	Food Quality and Safety	3	0	0	3	40	60	100	PC
	Professional Elective – II	3	0	0	3	40	60	100	PE
	Open Elective – II	3	1/0	0/2	4	40	60	100	OE
Practical /	Employability Enhancement								
22FTL61	Dairy Technology Laboratory	0	0	2	1	60	40	100	PC
22FTL62	Food Analysis Laboratory	0	0	2	1	60	40	100	PC
22FTL63	Food Process Equipment Design and Drawing Laboratory	0	0	2	1	60	40	100	PC
22FTP61	Project Work I	0	0	8	4	50	50	100	EC
22MNT31	Environmental Science	2	0	0	0	100	0	100	MC
22GEP61	Comprehensive Test and Viva				2	100	0	100	EC
	Total Credits to be earned				22				

SEMESTE	R – VII								
Course	Course Title	Hours / Week			Credit	Max	imum	Category	
Code		L	T	Р		CA	ESE Total		
Theory/The	eory with Practical								
22GCT71	Engineering Economics and Management	3	0	0	3	40	60	100	HS
	Professional Elective – III	3	0	0	3	40	60	100	PE
	Professional Elective – IV	3	0	0	3	40	60	100	PE
	Professional Elective – V	3	0	0	3	40	60	100	PE
	Open Elective – III	3	0	0	3	40	60	100	OE
Practical /	Employability Enhancement								
22FTP71	Project Work II Phase I	0	0	10	5	50	50	100	EC
22GEI71	Industrial Training	0	0	0	1	100	0	100	EC
	Total Credits to be earned	•			21				

SEMESTE	ER – VIII								
Course Code	Course Title	Hours / Week			Credit	Max	imum	Category	
Code		L	T	Р		CA	ESE	Total	
Theory/Th	neory with Practical								
	Professional Elective – VI	3	0	0	3	40	60	100	PE
	Open Elective – IV	3	0	0	3	40	60	100	OE
Practical	/ Employability Enhancement								
22FTP81	Project Work II Phase II	0	0	8	4	50	50	100	EC
	Total Credits to be earned				10				

Total Credits: 168

LIST OF PROFESSIONAL ELECTIVES (PEs)											
S. No.	Course Code	Course Name	L	Т	Р	С	Domain/ Stream				
		Semester – V									
		Elective – I									
1.	22FTE01	Technology of Snack and Extruded Foods	3	0	0	3	FE				
2.	22FTE02	Nanotechnology in Food Processing	3	0	0	3	PE				
3.	22FTE03	Fermentation Technology	3	0	0	3	CA				
4.	22FTE04	Food Storage and Infestation Control	3	0	0	3	FE				
5.	22FTE05	Food Additives and Nutraceuticals	3	0	0	3	CA				
		Semester - VI	I.								
	T	Elective – II	I	ı		Τ	Г				
6.	22FTE06	Food Allergens and Toxicology	3	0	0	3	CA				
7	22FTE07	Modern Separation Process	3	0	0	3	PE				
8.	22FTE08	Bioprocess Engineering	3	0	0	3	PE				
9.	22FTE09	Emerging Technologies in Food Processing	3	0	0	3	FE				
10.	22FTE10	Plantation and Spices Products Technology	3	0	0	3	FE				
		Semester - VII									
		Elective - III									
11.	22FTE11	Enzymes in Food Processing	3	0	0	3	FE				
12.	22FTE12	Dairy Products Technology	3	0	0	3	FE				
13.	22FTE13	Technology of Fats and Oils	3	0	0	3	CA				
14.	22FTE14	Process Instrumentation and control	3	0	0	3	PE				
15.	22FTE15	Fundamentals of Computation Fluid Dynamics	3	0	0	3	PE				
		Elective – IV									
16.	22FTE16	Energy Management in Process Industries	3	0	0	3	PE				
17.	22FTE17	Technology of Cereals, Pulses and Oil Seeds	3	0	0	3	FE				
18.	22FTE18	Meat, Fish and Poultry Processing	3	0	0	3	FE				
19.	22FTE19	Traditional Foods	3	0	0	3	FE				
20.	22FTE20	Reaction Engineering	3	0	0	3	PE				

		Elective - V							
21.	22FTE21	Modeling, Simulation and Soft tools for Food Technologists	3	0	0	3	FE		
22.	22FTE22	Beverage Technology	3	0	0	3	FE		
23.	22FTE23	Production of Field and Horticulture Crops	3	0	0	3	FE		
24.	22FTE24	Cane Sugar Technology	3	0	0	3	FE		
25.	22GEE01	Fundamentals of Research	3	0	0	3	GE		
		Semester - VIII							
		Elective - VI							
26.	22FTE25	Waste Management and By-Product Utilization in Food Industries	3	0	0	3	FE		
27.	22FTE26	Food Process Plant Layout and Safety	3	0	0	3	PE		
28.	22FTE27	Agri Business Management and Retail marketing	3	0	0	3	FE		
29.	22FTE28	Industrial Waste Water Treatment	3	0	0	3	PE		
30.	22FTE29	Analytical Instruments in Food Industries	3	0	0	3	FE		
	То	tal Credits to be earned				18			

SEMESTER – I											
Course	Course Title	Hours / Week			Credit	Max	imum	Category			
Code		L	Т	Р		CA	ESE	Total			
Theory/Theo	ory with Practical										
22EGT11	Communication Skills I	3	0	0	3	40	60	100	HS		
22MAC11	Matrices and Ordinary differential equation	3	1*	2*	4	50	50	100	BS		
22CYT13	Chemistry for Food Technology	3	0	0	3	40	60	100	BS		
22CSC11	Problem Solving and Programming in C	3	0	2	4	50	50	100	ES		
22FTT11	Fundamentals of Biochemistry	3	0	0	3	40	60	100	PC		
Practical / E	mployability Enhancement										
22CYL12	Chemistry laboratory for Food Technology	0	0	2	1	60	40	100	BS		
22GCL12	Foundation Engineering Laboratory – II	0	0	6	3	100	0	100	ES		
22TAM01	Heritage of Tamils	1	0	0	1	100	0	100	HS		
22MNT11	Student Induction Program		1	1	0	100	0	100	MC		
	Total Credits to be earned										

SEMESTER - II

Course	Course Title	Course Title Hours / Week		Credit	Max	imum	Category		
Code		L	Т	Р		CA	ESE	Total	
Theory/The	ory with Practical								
22EGT21	Communication Skills II	3	0	0	3	40	60	100	HS
22MAC21	Multivariable Calculus and Complex Analysis	3	1*	2*	4	50	50	100	BS
22PHT23	Physics for Food Technology	3	0	0	3	40	60	100	BS
22ITC23	Python Programming	3	0	2	4	50	50	100	ES
22MEC11	Engineering Drawing	2	0	2	3	40	60	100	ES
Practical / E	mployability Enhancement								
22PHL23	Physics Laboratory for Food Technology	0	0	2	1	60	40	100	BS
22GCL11	Foundation Engineering Laboratory – I	0	0	6	3	100	0	100	ES
22VEC11	Yoga and Values for Holistic Development				1*	100	0	100	HS
22TAM02	Tamils and Technology	1	0	0	1	100	0	100	HS
_	Total Credits to be earned				23				

SEMESTER	: — III								
Course	Course Title	Hours / Week			Credit	Max	imum	Category	
Code		L	Т	Р		CA	ESE	Total	
Theory/The	ory with Practical								
22FTT21	Engineering Properties of Food Materials	3	0	0	3	40	60	100	PC
22FTT31	Process Fluid Mechanics	3	0	0	3	40	60	100	ES
22FTT32	Food Chemistry	3	0	0	3	40	60	100	PC
22FTT33	Food Process Calculations	3	1	0	4	40	60	100	PC
22FTT34	Refrigeration and Cold Chain Management	3	1	0	3	40	60	100	PC
Practical / E	Employability Enhancement								
22FTL31	Fluid Flow Laboratory	0	0	2	1	60	40	100	PC
22FTL32	Food Chemistry Laboratory	0	0	2	1	60	40	100	PC
22GET31	Universal Human Values	2	0	0	2	100	0	100	HS
	Total Credits to be earned				20				

SEMESTER	R – IV								
Course	Course Title	Ηοι	ırs / \	Neek	Credit	Max	kimum	Category	
Code		L	T	Р		CA	ESE	Total	
Theory/The	ory with Practical								
22MAT41	Numerical Methods for Engineers	3	1	0	4	40	60	100	BS
22FTT41	Heat Transfer Operations	3	1	0	4	40	60	100	ES
22FTT42	Food Microbiology	3	0	0	3	40	60	100	PC
22FTT43	Mass Transfer in Food Processing Operations	3	1	0	4	40	60	100	PC
22FTT54	Food Science and Nutrition	3	0	0	3	40	60	100	PC
Practical / I	Employability Enhancement								
22FTL41	Heat and Mass Transfer Laboratory	0	0	2	1	60	40	100	PC
22FTL42	Food Microbiology Laboratory	0	0	2	1	60	40	100	PC
22EGL31	Communication Skills Development Laboratory	0	0	2	1	60	40	100	HS
22GCL41	Professional Skills Training - I				2	100	0	100	EC
	Total Credits to be earned	•		•	23		•		•

^{\$} Professional Skills Training I / Industrial Training I for a total period of about 80 hr during the period of 3^{rd} Sem end summer holidays and 4^{th} sem.

SEMESTE	ER – V								
Course	Course Title	Hou	ırs / V	Veek	Credit	Max	imum	Category	
Code		L	T	Р		CA	ESE	Total	
Theory/Th	neory with Practical								
22FTT44	Food Process Engineering - I	3	1	0	4	40	60	100	PC
22FTT51	Food Process Engineering - II	3	1	0	3	40	60	100	PC
22FTT52	Fruit and Vegetable Processing Technology	3	0	0	3	40	60	100	PC
22FTT53	Baking and Confectionery Technology	3	0	0	3	40	60	100	PC
	Professional Elective - I	3	0	0	3	40	60	100	PE
	Open Elective – I	3	1/0	0/2	4	40	60	100	OE
Practical A	/ Employability Enhancement								
22FTL51	Food Process Engineering Laboratory	0	0	2	1	60	40	100	PC
22FTL52	Fruit and Vegetable Processing Laboratory	0	0	2	1	60	40	100	PC
22FTL53	Baking and Confectionery Technology Laboratory	0	0	2	1	60	40	100	PC
22GCL51	Professional Skills Training - II				2	100	0	100	EC
	Total Credits to be earned				25				

SEMESTE	SEMESTER – VI											
Course	Course Title	Но	urs/\	Neek	Credit	Max	imum	Category				
Code		L	Т	Р		CA	ESE	Total				
Theory/The												
22FTT61	Dairy Technology	3	0	0	3	40	60	100	PC			
22FTT62	Food Quality and Safety	3	0	0	3	40	60	100	PC			
	Professional Elective - II	3	0	0	3	40	60	100	PE			
	Open Elective - II	3	1/0	0/2	4	40	60	100	OE			
Practical /	Employability Enhancement											
22FTL61	Dairy Technology Laboratory	0	0	2	1	60	40	100	PC			
22FTL62	Food Analysis Laboratory	0	0	2	1	60	40	100	PC			
22FTL63	Food Process Equipment Design and Drawing Laboratory	0	0	2	1	60	40	100	PC			
22FTP62	Project Work I	0	0	10	5	100	0	100	EC			
22MNT31	Environmental Science	2	0	0	0	100	0	100	MC			
22GEP61	Comprehensive Test and Viva	-			2	100	0	100	EC			
	Total Credits to be earned				23							

SEMESTE	R – VII								
Course	Course Title	Hou	ırs / \	Neek	Credit	Max	imum	Category	
Code		L	Т	Р		CA	ESE	Total	
Theory/The	eory with Practical								
22GCT71	Engineering Economics and Management	3	0	0	3	40	60	100	HS
22FTT35	Food Packaging Technology	3	0	0	3	40	60	100	PC
	Professional Elective – III	3	0	0	3	40	60	100	PE
	Professional Elective – IV	3	0	0	3	40	60	100	PE
	Open Elective - III	3	0	0	3	40	60	100	OE
Practical /	Employability Enhancement								
22FTP72	Project Work II Phase I	0	0	12	6	50	50	100	EC
22GEI71	Industrial Training	0	0	0	1	100	0	100	EC
	Total Credits to be earned				22				

SEMESTER - VIII											
Course	Course Title	Ηοι	ırs / V	Veek	Credit	Max	imum	Category			
Code		L	Т	Р		CA	ESE	Total	, .		
Theory/T	heory with Practical										
	Professional Elective - V	3	0	0	3	40	60	100	PE		
	Open Elective - IV	3	0	0	3	40	60	100	OE		
Practical	/ Employability Enhancement										
22FTP81	Project Work II Phase II	0	0	8	4	50	50	100	EC		
	Total Credits to be earned	•	•	•	10			ı			

Total Credits: 168

		PROFESSIONAL ELECTIVE	S (PI	Es)			
S. No.	Course Code	Course Name	L	Т	Р	С	Domain/ Stream
		Semester – V					
		Elective – I					
1.	22FTE01	Technology of Snack and Extruded Foods	3	0	0	3	FE
2.	22FTE02	Nanotechnology in Food Processing	3	0	0	3	PE
3.	22FTE03	Fermentation Technology	3	0	0	3	CA
4.	22FTE04	Food Storage and Infestation Control	3	0	0	3	FE
5.	22FTE05	Food Additives and Nutraceuticals	3	0	0	3	CA
		Semester – VI	I	ı	I		
	1	Elective – II		ı			
6.	22FTE06	Food Allergens and Toxicology	3	0	0	3	CA
7.	22FTE07	Modern Separation Process	3	0	0	3	PE
8.	22FTE08	Bioprocess Engineering	3	0	0	3	PE
9.	22FTE09	Emerging Technologies in Food Processing	3	0	0	3	FE
10.	22FTE10	Plantation and Spices Products Technology	3	0	0	3	FE
		Semester – VII					
		Elective – III					
11.	22FTE11	Enzymes in Food Processing	3	0	0	3	FE
12.	22FTE12	Dairy Products Technology	3	0	0	3	FE
13.	22FTE13	Technology of Fats and Oils	3	0	0	3	CA
14.	22FTE14	Process Instrumentation and control	3	0	0	3	PE
15.	22FTE15	Fundamentals of Computation Fluid Dynamics	3	0	0	3	PE
		Elective – IV					
16.	22FTE16	Energy Management in Process Industries	3	0	0	3	PE
17.	22FTE17	Technology of Cereals, Pulses and Oil Seeds	3	0	0	3	FE
18.	22FTE18	Meat, Fish and Poultry Processing	3	0	0	3	FE
19.	22FTE19	Traditional Foods	3	0	0	3	FE
20.	22FTE20	Reaction Engineering	3	0	0	3	PE
21.	22FTE21	Modeling, Simulation and Soft tools for Food Technologists	3	0	0	3	FE

22.	22FTE22	Beverage Technology	3	0	0	3	FE
23.	22FTE23	Production of Field and Horticulture Crops	3	0	0	3	FE
24.	22FTE24	Cane Sugar Technology	3	0	0	3	FE
25.	22GEE01	Fundamentals of Research	3	0	0	3	GE
		Semester – VIII					
		Elective - V					
26.	22FTE25	Waste Management and By-Product Utilization in Food Industries	3	0	0	3	FE
27.	22FTE26	Food Process Plant Layout and Safety	3	0	0	3	PE
28.	22FTE27	Agri Business Management and Retail marketing	3	0	0	3	FE
29.	22FTE28	Industrial Waste Water Treatment	3	0	0	3	PE
30.	22FTE29	Analytical Instruments in Food Industries	3	0	0	3	FE
	То	tal Credits to be earned				15	

Domain/Stream Abbreviations : PE – PROCESS ENGINEERING, CA – CHEMISTRY AND ANALYIS, FE-– FOOD ENGINEERING , GE – GENERAL ENGINEERING

B.Tech . FOOD TECHNOLOGY CURRICULUM - R2022

(OPEN ELEC	CTIVE COURSES OFFERED TO OTHE	R D	EP/	ART	MENT	rs (oe)
S. No.	Course Code	Course Name	L	Т	Р	С	Sem
1.	22FTX01	Baking Technology	3	0	2	4	V
2.	22FTO01	Food Processing Technology	3	1	0	4	V
3.	22FTX02	Processing of milk and milk products	3	0	2	4	VI
4.	22FTX03	Processing of Fruits and Vegetables	3	0	2	4	VI
5.	22FTO02	Principles of Food safety	3	0	0	3	VII
6.	22FTO03	Fundamentals of Food Packaging and Storage	3	0	0	3	VII
7.	22FTO04	Food Ingredients	3	0	0	3	VIII
8.	22FTO05	Food and Nutrition	3	0	0	3	VIII

	22EGT11 - COMMUNICATION	SKILLS I					
	(Common to All Engineering and Techn	ology Branches)					
Programme & Branch	All B.E./B.Tech. Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	I	HS	3	0	0	3
Preamble	This course is designed to impart required levels of Commencessary for different professional contexts.	nunication Skills	and Proficiend	y in E	nglis	h lan	guage
Unit – I	Grammar, Vocabulary, Listening, Speaking, Reading &	& Writing					9
Negative - Ge - Listening to Types of Read Unit - II Grammar: Volistening - L	ts of speech - Tenses - Types of sentences: Assertive, In unds & Infinitives - Vocabulary: Affixes - Synonyms & Antonym thort talks - TV shows - Speaking: Verbal & Non-verbal comming - Intensive: scanning, word by word, survey - Writing: Dia Grammar, Vocabulary, Listening, Speaking, Reading & Coes - Impersonal passives - Vocabulary: Homonyms, Homestening to announcements & radio broadcasts - Speaking:	ns - Listening: The nunication - Pail nunication	Types of lister r conversation formal Letters mographs - L Impromptu ta	ing - E - Rol - Para istenii	e pla grap grap larra	ers to y - F h wri mpoi	Reading: ting 9 rtance of a story -
sentences	ding comprehension - Articles from Newspapers/Magazines	- Cloze exercise	es - Writing:	Essay	writ	ing,	Jumbled
Unit – III	Grammar, Vocabulary, Listening, Speaking, Reading 8	& Writing					9
Introduction -	positions - Vocabulary: Compound Nouns - Listening: List Reading: Extensive: speed, skimming - Identifying lexical & cos: Seeking permission for Industrial visits & Inviting guests Grammar, Vocabulary, Listening, Speaking, Reading &	ontextual meanir	ngs - Writing:	Instru	ction	s & \	Warnings
Listening: Lis	icles & Determiners - Vocabulary : Technical Vocabulary - A ening to conversations - Speaking : Tongue twisters - Skill & Summarizing - Writing : Recommendations & Suggestions	Analogy - Unsc Sharing - N	lote-taking - I	Readir	ıg: N	lote	making -
Unit – V	Grammar, Vocabulary, Listening, Speaking, Reading	& Writing					9
personalities -	use and effect expressions - Vocabulary: Abbreviations & a Speaking: Commonly mispronounced words - Welcome addrassages - Writing: Preparing transcript for a speech - Interpreti	ess, Chief guest	address & Vo	ote of t			
							Total:45
ТЕХТ ВООК:							
1. Sanja	Kumar & Pushp Lata, "Communication Skills", 2 nd Edition, Oxfo	ord University Pr	ess, New Del	hi, 201	8.		
REFERENCE	:						
1. Ashra	Rizvi, "Effective Technical Communication", 2 nd Edition, McGra	aw-Hill India, 201	7.				
	hanavel, "English and Communication Skills for Students of Scibad, 2009.	cience and Engin	eering", Orier	it Black	Swa	ın Pu	ıblishers,
3. Jack 0 2014.	. Richards and Chuck Sandy, "Passages" Student's Book 1, 3 rd	Edition, Cambri	dge Universit	y Press	s, Ne	w Yo	ork,
				-			

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	use language effectively by acquiring vocabulary and syntax in context	Applying (K3)
CO2	listen and comprehend different spoken discourses from a variety of situations	Applying (K3)
CO3	speak confidently in different professional contexts and with peers	Creating (K6)
CO4	comprehend different genres of texts by adopting various reading strategies	Understanding (K2)
CO5	write legibly and flawlessly at varied professional contexts proficiently with appropriate choice of words and structures	Creating (K6)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12
CO1						2			1	3	1	1
CO2									2	3		1
CO3									2	3		2
CO4						1				3	1	1
CO5										3		2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

				_			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		37	30			33	100
CAT2		30	30			40	100
CAT3		33	34			33	
ESE		17	63			20	100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	(Common to all Engineering and Techno	ology bra	nches)				
Programme & Branch	All BE/BTech Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	1	BS	3	1*	2 *	4
Preamble	To provide the skills to the students for solving differe	ent real tim	e problems b	у ар	plyin	g ma	trices and
	ordinary differential equations.						
and Eigen vect Orthogonal t Reduction of q vectors: Stretc	Matrices: Characteristic equation – Eigen values and Eigen vectors ors (without proof) – Cayley – Hamilton theorem (Statemeransformation of a symmetric matrix to diagonal form – Ladratic form to canonical form by orthogonal transformation of an elastic membrane.	ent and ap Quadratic	plications only form – Natu	y) - (re o	Ortho f Qua	gona adrat	Il matrices ic forms - and Eigen
Unit - II	Ordinary Differential Equations: Solutions of First order differential equations: Exact differential equations:	ontial equ	ations Leib	nitz'	e Line	aar E	9 Guation
	ation –Clairaut's equation - Applications: Law of natural gro			i iitZ s	5 LIII	cai L	-quation –
Unit – III	Ordinary Differential Equations of Higher Order:		5				9
	al equations of second and higher order with constant connax – $x^n - e^{ax}x^n$, e^{ax} sinbx and e^{ax} cosbx – x^n sinax and						
coefficients: Eu	er-Cauchy's equation – Legendre's equation.						
Unit – IV Method of varia	Applications of Ordinary Differential Equations: tion of parameters – Simultaneous first order linear equat	ions with a	constant coeff	ficier	nts —	Annl	9 ications of
differential equ	ations: Simple harmonic motion – Electric circuits (Different						
to be given).		illiai oqua	tions and ass	ocia	ted c	ondit	ions need
Unit _ V	Lanlace Transform	Titial equa	tions and ass	ocia	ted c	ondit	
integrals of tra	Laplace Transform: orm: Conditions for existence – Transform of elementary nsforms –Transforms of derivatives and integrals – Transforms	functions cansform of	Basic propf unit step f	ertie unct	s – [ion –	Deriva - Tra	9 atives and nsform of
Laplace Transf integrals of tra periodic function method – Con- coefficients.	orm: Conditions for existence - Transform of elementary	functions corm of ele	- Basic prop f unit step fementary fund	ertie unct	s – [ion – s –	Deriva - Tra Partia	9 atives and nsform of al fraction
Laplace Transfintegrals of traperiodic function method – Concoefficients.	orm: Conditions for existence – Transform of elementary nsforms –Transforms of derivatives and integrals – Trans. Inverse Laplace transform: Inverse Laplace transfordution theorem (Statement only) – Applications: Solution	functions corm of ele	- Basic prop f unit step fementary fund	ertie unct	s – [ion – s –	Deriva - Tra Partia	9 atives and nsform of al fraction
Laplace Transfintegrals of traperiodic function method – Concoefficients. LIST OF EXPE 1. Introdu	orm: Conditions for existence – Transform of elementary nsforms –Transforms of derivatives and integrals – Transforms. Inverse Laplace transform: Inverse Laplace transfordution theorem (Statement only) – Applications: Solution RIMENTS / EXERCISES:	functions corm of ele	- Basic prop f unit step fementary fund	ertie unct	s – [ion – s –	Deriva - Tra Partia	9 atives and nsform of al fraction
Laplace Transfintegrals of traperiodic function method – Concoefficients. LIST OF EXPE 1. Introdu 2. Compa	orm: Conditions for existence – Transform of elementary nsforms –Transforms of derivatives and integrals – Transforms. Inverse Laplace transform: Inverse Laplace transfordution theorem (Statement only) – Applications: Solution RIMENTS / EXERCISES:	functions corm of ele	- Basic prop f unit step fementary fund	ertie unct	s – [ion – s –	Deriva - Tra Partia	9 atives and nsform of al fraction
Laplace Transfintegrals of traperiodic function method – Concoefficients. LIST OF EXPE 1. Introdu 2. Compa 3. Plottin	orm: Conditions for existence – Transform of elementary nsforms –Transforms of derivatives and integrals – Transforms. Inverse Laplace transform: Inverse Laplace transfordution theorem (Statement only) – Applications: Solution RIMENTS / EXERCISES: ction to MATLAB station of eigen values and eigen vectors	functions corm of ele	- Basic prop f unit step formentary fund	ertie unct	s – [ion – s –	Deriva - Tra Partia	9 atives and nsform of al fraction
Laplace Transfintegrals of traperiodic function method – Concoefficients. LIST OF EXPE 1. Introdu 2. Composition 1. Plottin 4. Solving	orm: Conditions for existence – Transform of elementary insforms –Transforms of derivatives and integrals – Transforms. Inverse Laplace transform: Inverse Laplace transformition theorem (Statement only) – Applications: Solution RIMENTS / EXERCISES: Control of MATLAB integral of eigen values and eigen vectors and visualizing single variable functions	functions corm of ele	- Basic prop f unit step formentary fund	ertie unct	s – [ion – s –	Deriva - Tra Partia	9 atives and nsform of al fraction
Laplace Transfintegrals of traperiodic function method – Concoefficients. LIST OF EXPE 1. Introdu 2. Composition Plottin 4. Solving 5. Solution	orm: Conditions for existence – Transform of elementary insforms –Transforms of derivatives and integrals – Transforms. Inverse Laplace transform: Inverse Laplace transformition theorem (Statement only) – Applications: Solution RIMENTS / EXERCISES: ction to MATLAB station of eigen values and eigen vectors and visualizing single variable functions a first and second order ordinary differential equations	functions corm of ele	- Basic prop f unit step formentary fund	ertie unct	s – [ion – s –	Deriva - Tra Partia	9 atives and nsform of al fraction
Laplace Transfintegrals of traperiodic function method – Concoefficients. LIST OF EXPE 1. Introdu 2. Composition Plottin 4. Solving 5. Solution 6. Solving	orm: Conditions for existence – Transform of elementary insforms –Transforms of derivatives and integrals – Transforms Inverse Laplace transform: Inverse Laplace transformition theorem (Statement only) – Applications: Solution RIMENTS / EXERCISES: Cition to MATLAB Itation of eigen values and eigen vectors g and visualizing single variable functions g first and second order ordinary differential equations n of Simultaneous first order ODEs	functions ansform of orm of ele n of linear	- Basic prop f unit step formentary fund	ertie unct	s – [ion – s –	Deriva - Tra Partia	9 atives and nsform of al fraction
Laplace Transfintegrals of traperiodic function method – Concoefficients. LIST OF EXPE 1. Introdu 2. Compo 3. Plottin 4. Solving 5. Solution 6. Solving 7. Determ	orm: Conditions for existence – Transform of elementary insforms –Transforms of derivatives and integrals – Transforms. Inverse Laplace transform: Inverse Laplace transform olution theorem (Statement only) – Applications: Solution RIMENTS / EXERCISES: Integral of eigen values and eigen vectors of and visualizing single variable functions of first and second order ordinary differential equations of Simultaneous first order ODEs of second order ODE by variation of parameters	functions ansform of orm of ele n of linear	- Basic prop f unit step formentary fund	ertie unct	s – [ion – s –	Deriva - Tra Partia	9 atives and nsform of al fraction
Laplace Transfintegrals of traperiodic function method – Concoefficients. LIST OF EXPE 1. Introdu 2. Compo 3. Plottin 4. Solving 5. Solution 6. Solving 7. Determ	orm: Conditions for existence – Transform of elementary insforms –Transforms of derivatives and integrals – Transforms –Transforms of derivatives and integrals – Transforms. Inverse Laplace transform: Inverse Laplace transformulation theorem (Statement only) – Applications: Solution RIMENTS / EXERCISES: Interest of eigen values and eigen vectors of and visualizing single variable functions of first and second order ordinary differential equations of Simultaneous first order ODEs of second order ODE by variation of parameters of second order order only the parameters of the second order of the parameters of the par	functions ansform of orm of ele n of linear	- Basic prop f unit step formentary fund	ertie	s — [ion — s — orde	Deriva - Tra Partia r with	gatives and nsform of al fraction constant
Laplace Transfintegrals of traperiodic function method – Concoefficients. LIST OF EXPE 1. Introdu 2. Compo 3. Plottin 4. Solvin 5. Solutio 6. Solvin 7. Determ 8. Solutio	orm: Conditions for existence – Transform of elementary insforms –Transforms of derivatives and integrals – Transforms –Transforms of derivatives and integrals – Transforms. Inverse Laplace transform: Inverse Laplace transform olution theorem (Statement only) – Applications: Solution of theorem (Statement only) – Applications: Solution of the MATLAB of the most of	functions ansform of elen of linear ctions	- Basic proportion of unit step for the mentary funds of second of second of second of the mentary funds of the me	ertie unction ond	s — E ion — s — orde	Deriva - Tra Partia r with	gatives and nsform of al fraction constant
Laplace Transfintegrals of traperiodic function method – Concoefficients. LIST OF EXPE 1. Introdu 2. Composition 3. Plottin 4. Solving 5. Solution 7. Determ 8. Solution TEXT BOOK:	orm: Conditions for existence – Transform of elementary insforms –Transforms of derivatives and integrals – Transforms –Transforms of derivatives and integrals – Transforms. Inverse Laplace transform: Inverse Laplace transformulation theorem (Statement only) – Applications: Solution RIMENTS / EXERCISES: Interest of eigen values and eigen vectors of and visualizing single variable functions of first and second order ordinary differential equations of Simultaneous first order ODEs of second order ODE by variation of parameters of second order order only the parameters of the second order of the parameters of the par	functions ansform of elen of linear ctions	- Basic proportion of unit step for the mentary funds of second of second of second of the mentary funds of the me	ertie unction ond	s — E ion — s — orde	Deriva - Tra Partia r with	gatives and nsform of al fraction constant
Laplace Transfintegrals of traperiodic function method – Concoefficients. LIST OF EXPE 1. Introdu 2. Compo 3. Plottin 4. Solving 5. Solution 7. Determ 8. Solution TEXT BOOK: 1. Raman New D	orm: Conditions for existence – Transform of elementary insforms –Transforms of derivatives and integrals – Transforms –Transforms of derivatives and integrals – Transforms. Inverse Laplace transform: Inverse Laplace transformulation theorem (Statement only) – Applications: Solution (Statement on the MATLAB (Statement only) – Applications: Solution (Statement only	functions ansform of elen of linear ctions	- Basic proportion of unit step for the mentary funds of second of second of second of the mentary funds of the me	ertie unction ond	s — E ion — s — orde	Deriva - Tra Partia r with	gatives and nsform of al fraction constant
Laplace Transfintegrals of traperiodic function method – Concoefficients. LIST OF EXPE 1. Introdu 2. Composition 3. Plottin 4. Solving 5. Solution 7. Determ 8. Solution TEXT BOOK: 1. Raman New D REFERENCES	orm: Conditions for existence – Transform of elementary insforms –Transforms of derivatives and integrals – Transforms –Transforms of derivatives and integrals – Transforms. Inverse Laplace transform: Inverse Laplace transform olution theorem (Statement only) – Applications: Solution of theorem (Statement only) – Applications: Solution of theorem (Statement only) – Applications: Solution of MATLAB attation of eigen values and eigen vectors and visualizing single variable functions and first and second order ordinary differential equations of Simultaneous first order ODEs assecond order ODE by variation of parameters and ining Laplace and inverse Laplace transform of basic function of Second order ODE by employing Laplace transforms the Leval B V, "Higher Engineering Mathematics", 1st Edition, Telhi, 2018.	functions ansform corm of ele n of linear ctions cture:45,	- Basic proport unit step for the mentary fundamentary fu	ertie uncti etion ond	s - Eion - s - orde	Deriva - Tra Partia r with	gatives and nsform of al fraction constant
Laplace Transfintegrals of traperiodic function method – Concoefficients. LIST OF EXPE 1. Introdu 2. Composition 3. Plottin 4. Solving 5. Solution 6. Solving 7. Determ 8. Solution TEXT BOOK: 1. Raman New D REFERENCES 1. Kreysz 2. Kanda	orm: Conditions for existence – Transform of elementary insforms –Transforms of derivatives and integrals – Transforms –Transforms of derivatives and integrals – Transforms. Inverse Laplace transform: Inverse Laplace transform ollution theorem (Statement only) – Applications: Solution of theorem (Statement only) – Applications: Solution of the MATLAB of the matter	functions ansform of elen of linear ctions cture:45, ata McGra John Wile	- Basic proport unit step for mentary funds ODE of secondary funds and aw-Hill Publis by, New Delhi,	ertie unctiction ond d Pra	s - Eion - s - orde	Deriva - Tra Partia r with	gatives and nsform of al fraction constant , Total:60

			, ,			<u> </u>										
5.	Ма	trices a	ınd Ord	inary Dif	ferentia	l Equation	ons Lab	oratory	Manua	al.						
COURS On con				urse, th	e stude	ents will	be abl	e to						BT Mapp		
CO1 solve engineering problems which needs matrix computations.													pplying (nipulatio	, , .		
CO2	ide	entify th	e appro	opriate n	nethod f	or solvir	ng first o	order or	dinary o	differen	tial equa	tions.		pplying (nipulatio		
CO3	so	lve high	ner orde	er linear	differen	tial equa	ations w	ith cons	stant ar	nd varia	ble coef	ficients.		Applying (K3), Manipulation (S2)		
CO4				ot of ord roblems.		fferentia	ıl equat	ions for	model	ing and	l finding	solutions		pplying (nipulatio		
CO5	ар	ply Lap	lace Tr	ansform	to find	solution	s of Line	ear Ord	inary D	ifferent	ial Equa	tions		pplying (nipulatio		
															·	
					N	Mapping	of CO	s with I	POs an	d PSO	s					
COs/Po	Os	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	

Grewal B.S., "Higher Engineering Mathematics" 44thEdition, Khanna Publishers, New Delhi, 2018.

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2		3									
CO2	3	3	2		3									
CO3	3	3	2		3									
CO4	3	3	2		3									
CO5	3	3	3		3									

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %			
CAT1	10	20	70				100			
CAT2	10	20	70				100			
CAT3	10	20	70				100			
ESE	10	20	70				100			
* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)										

^{*}Alternate week

4.

Prerequisites NiI 1 BS 3 0 0 3 Preamble This course explores the basic principles of water treatment, electrochemistry, fuels & combustion, polyment and sustainable food processing. It aims to impart the fundamentals of chemistry towards innovations in Food Technology and also for societal applications. Unit - I WATER TECHNOLOGY Introduction - sources of water - impurities in water - types of water - hardness of water- expression of hardness of water by EDTA method - determination of alkalinity - disadvantages ouising hard water in Industries - boiler troubles - scale and studge, boiler corrosion, caustic embritiement, priming and foaming softening of water: i) internal treatment process - carbonate and calgon conditioning ii) External treatment method admineralization process iii) Treatment of water for municipal water supply (Removal of suspended particles and disinfection methods, Break-point of chlorination). Unit - II ELECTROCHEMISTRY Introduction - cells - types - representation of galvanic cell - electrode potential - Nernst equation (derivation of cell EMF) introduction - cells - types - representation of galvanic cell - electrode potential - Nernst equation (derivation of cell EMF) introduction - cells - types - representation of galvanic cell - electrode potential - Nernst equation (derivation of cell EMF) introduction - cells - types - representation of galvanic cell - electrode potential - Nernst equation (derivation of cell EMF) introduction - cells - types - representation of galvanic cell - electrode potential - Nernst equation (derivation of cell EMF) introduction - cells - types - representation of galvanic cell - electrode potential - Nernst equation (derivation of cell EMF) introduction - cells - types - representation of the cell		22CYT13 – CHEMISTRY FOR FOOD TECHN	NOLOGY	,				
Preamble This course explores the basic principles of water treatment, electrochemistry, fuels & combustion, polymen and sustainable food processing. It aims to impart the fundamentals of chemistry towards innovations in Food Technology and also for societal applications. Unit -1 WATER TECHNOLOGY 9 Introduction - sources of water - impurities in water - types of water - hardness of water- expression of hardness (simple problems) - units of hardness - sestimation of hardness of water by EDTA method - determination of alkalinity - disadvantages or softening of water in Industries - boiler troubles - scale and sludge, boiler corrosion, caustic embrittement, priming and foaming - softening of water: i) internal treatment process - carbonate and calgon conditioning ii) External treatment method - demineralization process iii) Treatment of water for municipal water supply (Removal of suspended particles and disinfection methods, Break-point of chilomination). Unit - II ELECTROCHEMISTRY Introduction - cells - types - representation of galvanic cell - electrode potential - Nernst equation (derivation of cell EMF) - calculation of cell EMF from single electrode potential - reference electrodes: construction, working and applications of standars hydrogen electrode, standard calomel electrode, glass electrode - EMF series and its applications - potenticmetric titrations - mixture of weak and strong acid vs strong base. Unit - III FUELS AND COMBUSTION Introduction - classification of fuels - characteristics of a good fuel - combustion - calorific values - gross and net calorific value - theoretical calculation of calorific value by Dulong's formula - flue gas analysis by Orsat's method - solid fuels - coal and its varieties - proximate analysis - significance - metallurgical coke - Otto-Hoffman byproduct method - fluguid fuel - refining operate learning in the proper of the proper series of polymerization of cell-bright proportice and applications of standard (BSES) system. Unit - V POLYMENS 19 Introduction	Programme & Branch	B.Tech & Food Technology	Sem.	Category	L	Т	Р	Credit
and sustainable food processing. It aims to impart the fundamentals of chemistry towards innovations in Food Technology and also for societal applications. Unit - WATER TECHNOLOGY 9	Prerequisites	Nil	1	BS	3	0	0	3
Unit — WATER TECHNOLOGY 9 Introduction — sources of water — impurities in water — types of water — hardness of water — expression of hardness (simple problems) — units of hardness — estimation of hardness of water by EDTA method — determination of alkalinity — disadvantages or using hard water in Industries — boiler troubles — scale and sludge, boiler corosion, caustic embrittlement, priming and foraming — softening of water: i) Internal treatment process — carbonate and calgon conditioning ii) External treatment method — demineralization process iii) Treatment of water for municipal water supply (Removal of suspended particles and disinfection methods, Break-point of chlorination). Unit — II	Preamble	and sustainable food processing. It aims to impart the fund						
Unit — II ELECTROCHEMISTRY 9 1 9 1 1 9 1 1 9 1	problems) – units using hard water softening of wat demineralization	WATER TECHNOLOGY urces of water – impurities in water – types of water – hardner of hardness – estimation of hardness of water by EDTA method - n Industries – boiler troubles – scale and sludge, boiler corrosion er: i) Internal treatment process – carbonate and calgon corocess iii) Treatment of water for municipal water supply (Rer	 determ caustic onditioni 	ination of alka embrittlemer ng ii) Exterr	alinity nt, pr nal t	y – d iming reatm	isadva and nent	ss (simple antages of foaming – method –
calculation of cell EMF. from single electrode potential – reference electrodes: construction, working and applications of standard hydrogen electrode, standard calomel electrode, glass electrode – EMF series and its applications – potentiometric titrations (fredox) – conductometric titrations – mixture of weak and strong acid vs strong base. Unit – III	Unit – II	ELECTROCHEMISTRY						_
Introduction – classification of fuels – characteristics of a good fuel – combustion – calorific values – gross and net calorific values – theoretical calculation of calorific value by Dulong's formula – flue gas analysis by Orsat's method – solid fuels – coal and its varieties – proximate analysis – significance – metallurgical coke – Otto-Hoffman byproduct method – liquid fuel – refining of petroleum – manufacture of synthetic petrol – hydrogenation of coal – bergius process – knocking: spark ignition engine – octane number, compression ignition engine – cetane number – power alcohol and biodiesel – gaseous fuel – water gas – introduction of Bharat Stage Emission Standard (BSES) system. Unit – IV POLYMERS 9 Introduction – terminology – classification – polymerization – types of polymerization (definition only)- structure and propert relationship of polymers (mechanical, thermal) – plastics- difference between thermoplastics and thermosetting plastics - compounding of plastics- plastic moulding methods – compression, injection, extrusion and abplications. Unit – V Sustainability: green engineering and applications of PVC, PAN, polyurethane, polyesters – biodegradable polymers – classification and applications. Unit – V Sustainability: green engineering technologies in the food processing industries – drivers for sustainable food Processing begislative, economic, consumer, corporate performance – environmental impacts of food processing: energy, solid waste, wate and wastewater – environmental impact assessment methods in food processing – carbon foot print, ecological foot print, life cycle assessment. Total:48 TEXT BOOK: 1. Wiley Editorial Board, "Wiley Engineering Chemistry", 2nd Edition, Wiley India Pvt. Ltd, New Delhi, Reprint 2019, for Unit-I, II, III, II, II, II, II, II, II, II,	calculation of cell hydrogen electrod	EMF from single electrode potential – reference electrodes: con le, standard calomel electrode, glass electrode – EMF series	struction and its	, working and	d app	licati	ons o	f standard
- theoretical calculation of calorific value by Dulong's formula – flue gas analysis by Orsat's method – solid fuels – coal and its varieties – proximate analysis – significance – metallurgical coke – Otto-Hoffman byproduct method – liquid fuel – refining of petroleum – manufacture of synthetic petrol – hydrogenation of coal – bergius process – knocking: spark ignition engine – octane number, compression ignition engine – cetane number – power alcohol and biodiesel – gaseous fuel – water gas – introduction of Bharat Stage Emission Standard (BSES) system. POLYMERS	Unit – III		**					9
Sustainability: green engineering technologies in the food processing industries – drivers for sustainable food Processing legislative, economic, consumer, corporate performance – environmental impacts of food processing: energy, solid waste, wate and wastewater – environmental impact assessment methods in food processing – carbon foot print, ecological foot print, life cycle assessment. Total:45 TEXT BOOK: 1. Wiley Editorial Board, "Wiley Engineering Chemistry", 2 nd Edition, Wiley India Pvt. Ltd, New Delhi, Reprint 2019, for Unit-I, II, III, IV. 2. Sustainable Food Processing, Brijesh K. Tiwari, Tomas Norton, Nicholas M. Holden, John Wiley & Sons, New Jersey, United States, 2013, for Unit - V. REFERENCES: 1. Palanisamy P.N., Manikandan P., Geetha A.& Manjula Rani K., "Applied Chemistry", 6 th Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2019. 2. Palanna O., "Engineering Chemistry", McGraw Hill Education, New Delhi, 2018.	number, compres Bharat Stage Emi Unit – IV Introduction – ter relationship of pr compounding of pr polymers: prepar	sion ignition engine – cetane number – power alcohol and biodies sion Standard (BSES) system. POLYMERS minology – classification – polymerization – types of polymerizallymers (mechanical, thermal) – plastics- difference between plastics- plastic moulding methods – compression, injection, extration, properties and applications of PVC, PAN, polyurethal	sel – gas zation (d thermorusion an	eous fuel – we finition only blastics and d blow mould	ater)- sti therr	gas - ructui nose meth	re and tting ods -	9 d property plastics – industrial
Sustainability: green engineering technologies in the food processing industries – drivers for sustainable food Processing legislative, economic, consumer, corporate performance – environmental impacts of food processing: energy, solid waste, wate and wastewater – environmental impact assessment methods in food processing – carbon foot print, ecological foot print, life cycle assessment. Total:4! TEXT BOOK: 1. Wiley Editorial Board, "Wiley Engineering Chemistry", 2 nd Edition, Wiley India Pvt. Ltd, New Delhi, Reprint 2019, for Unit-I, II, III, IV. 2. Sustainable Food Processing, Brijesh K. Tiwari, Tomas Norton, Nicholas M. Holden, John Wiley & Sons, New Jersey, United States, 2013, for Unit - V. REFERENCES: 1. Palanisamy P.N., Manikandan P., Geetha A.& Manjula Rani K., "Applied Chemistry", 6 th Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2019. 2. Palanna O., "Engineering Chemistry", McGraw Hill Education, New Delhi, 2018.								9
TEXT BOOK: 1. Wiley Editorial Board, "Wiley Engineering Chemistry", 2 nd Edition, Wiley India Pvt. Ltd, New Delhi, Reprint 2019, for Unit-I, II, III, IV. 2. Sustainable Food Processing, Brijesh K. Tiwari, Tomas Norton, Nicholas M. Holden, John Wiley & Sons, New Jersey, United States, 2013, for Unit - V. REFERENCES: 1. Palanisamy P.N., Manikandan P., Geetha A.& Manjula Rani K., "Applied Chemistry", 6 th Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2019. 2. Palanna O., "Engineering Chemistry", McGraw Hill Education, New Delhi, 2018.	Sustainability: greatlegislative, econor	en engineering technologies in the food processing industries mic, consumer, corporate performance – environmental impacts	of food	processing: e	nerg	y, so	lid wa	rocessing: iste, water
 Wiley Editorial Board, "Wiley Engineering Chemistry", 2nd Edition, Wiley India Pvt. Ltd, New Delhi, Reprint 2019, for Unit-I, II, III, IV. Sustainable Food Processing, Brijesh K. Tiwari, Tomas Norton, Nicholas M. Holden, John Wiley & Sons, New Jersey, United States, 2013, for Unit - V. REFERENCES: Palanisamy P.N., Manikandan P., Geetha A.& Manjula Rani K., "Applied Chemistry", 6th Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2019. Palanna O., "Engineering Chemistry", McGraw Hill Education, New Delhi, 2018. 								Total:45
 II, III, IV. Sustainable Food Processing, Brijesh K. Tiwari, Tomas Norton, Nicholas M. Holden, John Wiley & Sons, New Jersey, United States, 2013, for Unit - V. REFERENCES: Palanisamy P.N., Manikandan P., Geetha A.& Manjula Rani K., "Applied Chemistry", 6th Edition, Tata McGraw Hil Education Private Limited, New Delhi, 2019. Palanna O., "Engineering Chemistry", McGraw Hill Education, New Delhi, 2018. 	TEXT BOOK:							
 United States, 2013, for Unit - V. REFERENCES: Palanisamy P.N., Manikandan P., Geetha A.& Manjula Rani K., "Applied Chemistry", 6th Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2019. Palanna O., "Engineering Chemistry", McGraw Hill Education, New Delhi, 2018. 		torial Board, "Wiley Engineering Chemistry", 2 nd Edition, Wiley Indi	ia Pvt. Lt	d, New Delhi,	Rep	rint 2	2019,	for Unit-I,
 Palanisamy P.N., Manikandan P., Geetha A.& Manjula Rani K., "Applied Chemistry", 6th Edition, Tata McGraw Hil Education Private Limited, New Delhi, 2019. Palanna O., "Engineering Chemistry", McGraw Hill Education, New Delhi, 2018. 			. Holden	John Wiley &	& Sor	ns, N	ew Je	ersey,
Education Private Limited, New Delhi, 2019. Palanna O., "Engineering Chemistry", McGraw Hill Education, New Delhi, 2018.	REFERENCES:							
2. Palanna O., "Engineering Chemistry", McGraw Hill Education, New Delhi, 2018.			ed Cher	nistry", 6 th E	ditior	ı, Ta	ta Mo	Graw Hill
Payal B. Joshi, Shashank Deep, "Engineering Chemistry", Oxford University Press, New Delhi, 2019.	2. Palanna	D., "Engineering Chemistry", McGraw Hill Education, New Delhi, 20	018.					
	3. Payal B.	loshi, Shashank Deep, "Engineering Chemistry", Oxford University	/ Press,	New Delhi, 20)19.			

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	apply the suitable water softening methods to avoid boiler troubles.	Applying (K3)
CO2	apply the principle of electrochemistry for various applications	Applying (K3)
CO3	apply the concepts of fuels and combustion for engineering applications	Applying (K3)
CO4	make use of concept of polymerization and fabrication process to explain the types of polymers, plastics and fabrication methods of plastics	Applying (K3)
CO5	apply the green engineering principle for sustainable food processing.	Applying (K3)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1			2							

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22FTT11 - FUNDAMENTALS OF BIO	OCHEMISTRY	1		ı	ı	1
Programme & Branch	B.Tech & Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	1	PC	3	0	0	3
Decemble	To be a set to see the set the street or and see set to	- f bis la da					
Preamble	To impart knowledge about the structure and properties	of biomolecule	s, actions of e	enzy	mes a	ana m	netabolish
Unit – I	Carbohydrates: mple Sugars: mono and disaccharides, Hygroscopicity and	a a ludailitu a a a ti	!+-+:	4			9
structure-activity occurrence. Polys	relationship and sweetness index; Dextrose Equivalent saccharides: Starch-amylose and amylopectin- properties. Cy fibres - Food sources, functional role.	; Sugar alcoh	ols; Oligosad	ccha	rides:	stru	cture an structure
Unit – II	Lipids:						9
of fats and oils:	sification. Lipids -, classification - simple and compound lipid crystal formation, polymorphism, melting point, plasticity. – Hydrolysis, saponification, halogenation. Hydrolytic rancidi	. Shortening p	ower of fats,	sm	oke i	ooint.	Chemica
Unit – III	Ductoing						9
Amino acids - D biological role. F	Proteins: Definition, structure and classification. Protein - classification Properties of proteins in food systems: solubility, hydrat						
Amino acids - D biological role. F emulsifying effect Unit - IV Introduction, Natu	pefinition, structure and classification. Protein - classification - class	tion, foam forr	nation & sta	biliza	Spe	gel	formation 9 /. Enzym
Amino acids - D biological role. F emulsifying effect Unit - IV Introduction, Natu kinetics - Micheli- food Industries.	Definition, structure and classification. Protein - classification - class	tion, foam forr	nation & sta	biliza	Spe	gel	formation 9 7. Enzymenzymes i
Amino acids - D biological role. Feemulsifying effect Unit - IV Introduction, Natukinetics - Michelifood Industries.	Definition, structure and classification. Protein - classification - class	tion, foam forr	nation & sta action; active ods,selected	site;	Spe catio	gel cificity n of e	formation 9 y. Enzym nzymes i
Amino acids - D biological role. F emulsifying effect Unit - IV Introduction, Natu kinetics - Michelifood Industries. Unit - V Nucleic Acids: C	Definition, structure and classification. Protein - classification - class	tion, foam forr sm of enzyme a bilization meth	action; active ods,selected	site:	Spe catio	gel cificity n of e	9 v. Enzymenzymes i 9 trate leve
Amino acids - D biological role. F emulsifying effect Unit - IV Introduction, Natu kinetics - Michelifood Industries. Unit - V Nucleic Acids: C	Definition, structure and classification. Protein - classification - class	tion, foam forr sm of enzyme a bilization meth	action; active ods,selected	site:	Spe catio	gel cificity n of e	9 /. Enzymenzymes i 9 trate leve
Amino acids - D biological role. F emulsifying effect Unit - IV Introduction, Natu kinetics - Michelifood Industries. Unit - V Nucleic Acids: C	Definition, structure and classification. Protein - classification - class	tion, foam forr sm of enzyme a bilization meth	action; active ods,selected	site:	Spe catio	gel cificity n of e	9 /. Enzymes i psymes i gtrate level
Amino acids - Diological role. Femulsifying effect Unit - IV Introduction, Natukinetics - Michelit food Industries. Unit - V Nucleic Acids: Ophosphorylation.	Definition, structure and classification. Protein - classification - class	sm of enzyme abbilization meth	action & sta action; active ods,selected ycolysis; TC oxidation and	site:	Spe catio	gel cificity n of e	9 /. Enzymenzymes 9 trate levelesis.
Amino acids - D biological role. F emulsifying effect Unit - IV Introduction, Natu kinetics - Michelia food Industries. Unit - V Nucleic Acids: O phosphorylation. TEXT BOOK: 1. Satyanar	Definition, structure and classification. Protein - classification - class	sm of enzyme abbilization meth	action & sta action; active ods,selected ycolysis; TC oxidation and	site:	Spe catio	gel cificity n of e	9 /. Enzymenzymes 9 trate levelesis.
Amino acids - D biological role. F emulsifying effect Unit - IV Introduction, Natu kinetics - Michelia food Industries. Unit - V Nucleic Acids: O phosphorylation. TEXT BOOK: 1. Satyanar REFERENCES:	Definition, structure and classification. Protein - classification - class	sm of enzyme abbilization meth	action & sta action; active ods,selected ycolysis; TC. oxidation and	site; appli	Specation,	gel cificity n of e	9 y. Enzymes nzymes 9 trate levhesis.
Amino acids - D biological role. F emulsifying effect Unit - IV Introduction, Natu kinetics - Michelia food Industries. Unit - V Nucleic Acids: O phosphorylation. TEXT BOOK: 1. Satyanar REFERENCES: 1. Belitz H.	Definition, structure and classification. Protein - classification - class	sm of enzyme abbilization methodetabolism: Glabolism – beta	action; active ods, selected ycolysis; TC. oxidation and hi, 2017.	site; appli	Specation, Specation //cle; // acid	gel cificity n of e subs	9 /. Enzymenzymes gtrate levhesis. Total:4

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	interpret the structure and properties of carbohydrates	Understanding (K2)
CO2	outline the structure and properties of lipids	Understanding (K2)
CO3	relate the structural and functional role of proteins	Understanding (K2)
CO4	classify the enzymes and interpret the enzyme action and their immobilization	Understanding (K2)
CO5	infer the structure of nucleic acids and illustrate the basics of energy metabolism	Understanding (K2)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2		1				1	1	1	3	2
CO2	3	2	2	2		1				1	1	1	3	2
CO3	3	2	2	2		1				1	1	1	3	2
CO4	3	2	2	2		1				1	1	1	3	2
CO5	3	1	1	1						1	1	1	2	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70					100
CAT2	30	70					100
CAT3	30	70					100
ESE	20	80					100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	(Co	mmon to All Engineering and Technology branches except	CSF. IT	CSD. AIDS	& ΔI	MI 1		
Progra Branc	amme &	All BE/BTech Engineering & Technology branches , except CSE, IT, CSD, AIDS & AIML	Sem.	Category	L	т	Р	Credit
Prerec	quisites	Nil	1	BS	3	0	2	4
	<u>-</u>							
Pream	nble	The course aims to provide exposure to problem-solving fundamental concepts of C Programming. This course provide C						
Unit –	·1	Introduction to C and Operators:						9
		C program – Compiling and executing C program – C Tokens Variables – constants – Input / Output statements – Operators	- Chara	cter set in C	– Ke	ywor	ds –	identifiers-
Unit –	· II	Control Statements and Arrays:						9
		nd looping statements, Arrays: Declaring, initializing and accand their operations.	cessing a	ırrays – oper	atior	s on	arra	ys – Two-
Unit -		Functions:						9
		□ ion- Using functions, function declaration and definition – functi	on call –	return statem	ent -	- pas	sing p	arameters
		lata types and arrays – storage classes – recursive functions						
Unit -		Strings and Pointers:						9
Strings	s: Introductio	 n – operations on strings: finding length, concatenation, co 	mnaring		_ (strina	and	character
manip	ulation function	ons, Arrays of strings. Pointers: declaring pointer variables - po						
manip	ulation function, pointers and	ons, Arrays of strings. Pointers: declaring pointer variables - po						
manipo arrays Unit – User-co enume	ulation function, pointers and volume of the	ons, Arrays of strings. Pointers : declaring pointer variables – pol strings User-defined Data Types and File Handling: types: Structure: Introduction – nested structures– arrays of pe. File Handling : Introduction - opening and closing files – re	structure	e – structure	rithm	etic,	pointe	ers and 1D 9 -unions -
manipo arrays Unit – User-co enume positio	ulation function, pointers and volume of the	ons, Arrays of strings. Pointers : declaring pointer variables – pol strings User-defined Data Types and File Handling: types: Structure: Introduction – nested structures– arrays of	structure	e – structure	rithm	etic,	pointe	ers and 1D 9 -unions –
manipo arrays Unit – User-cenume positio LIST (ulation function, pointers and volume defined data type in indicator: from the control of the co	ons, Arrays of strings. Pointers : declaring pointer variables – pol strings User-defined Data Types and File Handling: types: Structure: Introduction – nested structures– arrays of pe. File Handling : Introduction - opening and closing files – reseek(), ftell() and rewind()	structure	e – structure	rithm	etic,	pointe	ers and 1D 9 -unions -
manipo arrays Unit – User-co enume positio	ulation function, pointers and V defined data tyon indicator: for EXPERIM Programs for point in the control of the control o	ons, Arrays of strings. Pointers : declaring pointer variables – pol strings User-defined Data Types and File Handling: types: Structure: Introduction – nested structures– arrays of pe. File Handling : Introduction - opening and closing files – reseek(), ftell() and rewind() ENTS / EXERCISES:	structure ading an	e – structure d writing data	and to fi	functies -I	pointe tions Manip	9 -unions -ulating file
manipi arrays Unit – User-c enume positio LIST (ulation function, pointers and V defined data exacted data tyon indicator : for five programs for the progr	ons, Arrays of strings. Pointers : declaring pointer variables – pol strings User-defined Data Types and File Handling: types: Structure: Introduction – nested structures– arrays of pe. File Handling : Introduction - opening and closing files – reseek(), ftell() and rewind() ENTS / EXERCISES: or demonstrating the use of different types of format Specifiers	structure ading an	e – structure d writing data	and to fi	functies -I	pointe tions Manip	9 -unions -ulating file
manipi arrays Unit – User-cenume positio LIST (1.2.	ulation function, pointers and volume. V defined data type indicator : for experimental programs for the pr	ons, Arrays of strings. Pointers : declaring pointer variables – pol strings User-defined Data Types and File Handling: types: Structure: Introduction – nested structures– arrays of pe. File Handling : Introduction - opening and closing files – reseek(), ftell() and rewind() ENTS / EXERCISES: or demonstrating the use of different types of operators like arith	structure ading an	e – structure d writing data	and to fi	functies -I	pointe tions Manip	9 -unions -ulating file
manipi arrays Unit – User-cenume positio LIST C 1. 2. 3.	ulation function, pointers and V defined data serated data tyon indicator : for fine for frograms for frogra	ons, Arrays of strings. Pointers : declaring pointer variables – pol strings User-defined Data Types and File Handling: types: Structure: Introduction – nested structures– arrays of pe. File Handling : Introduction - opening and closing files – reseek(), ftell() and rewind() ENTS / EXERCISES: or demonstrating the use of different types of format Specifiers or demonstrating the use of different types of operators like arithor demonstrating the use of using decision making statements	structure ading an	e – structure d writing data	and to fi	functies -I	pointe tions Manip	9 -unions -ulating file
manipi arrays Unit – User-cenume positio LIST (1) 2. 3. 4.	ulation function, pointers and volume. V defined data type indicator : for finite forms for the programs fo	ons, Arrays of strings. Pointers: declaring pointer variables – pol strings User-defined Data Types and File Handling: types: Structure: Introduction – nested structures– arrays of pe. File Handling: Introduction - opening and closing files – reseek(), ftell() and rewind() ENTS / EXERCISES: or demonstrating the use of different types of format Specifiers or demonstrating the use of different types of operators like arith or demonstrating the use of using decision making statements or demonstrating the use of repetitive structures	structure ading an	e – structure d writing data	and to fi	functies -I	pointe tions Manip	9 -unions -ulating file
manipparrays Unit – User-cenume positio LIST (1. 2. 3. 4. 5. 6.	ulation function, pointers and V defined data the period of the programs for the programs	ons, Arrays of strings. Pointers : declaring pointer variables – pol strings User-defined Data Types and File Handling: types: Structure: Introduction – nested structures– arrays of pe. File Handling : Introduction - opening and closing files – reseek(), ftell() and rewind() ENTS / EXERCISES: or demonstrating the use of different types of format Specifiers or demonstrating the use of different types of operators like arith or demonstrating the use of using decision making statements or demonstrating the use of repetitive structures or demonstrating one-dimensional arrays	structure ading an	e – structure d writing data	and to fi	functies -I	pointe tions Manip	9 -unions -ulating file
manipinarrays Unit – User-cenume positio LIST C 1. 2. 3. 4. 5. 6. 7.	ulation function, pointers and volume. V defined data type indicator: from the first programs from the programs from th	ons, Arrays of strings. Pointers: declaring pointer variables – pol strings User-defined Data Types and File Handling: types: Structure: Introduction – nested structures– arrays of pe. File Handling: Introduction - opening and closing files – reseek(), ftell() and rewind() ENTS / EXERCISES: or demonstrating the use of different types of format Specifiers or demonstrating the use of different types of operators like arith or demonstrating the use of using decision making statements or demonstrating the use of repetitive structures or demonstrating one-dimensional arrays or demonstrating two-dimensional arrays	structure ading an	e – structure d writing data	and to fi	functies -I	pointe tions Manip	9 -unions -ulating file
manipinarrays Unit – User-cenume positio LIST C 1. 2. 3. 4. 5. 6. 7.	ulation function, pointers and volume. V defined data derated data tyon indicator : for fine programs for the programs for t	user-defined Data Types and File Handling: types: Structure: Introduction – nested structures– arrays of pe. File Handling: Introduction - opening and closing files – reseek(), ftell() and rewind() ENTS / EXERCISES: or demonstrating the use of different types of format Specifiers or demonstrating the use of different types of operators like arith or demonstrating the use of using decision making statements or demonstrating the use of repetitive structures or demonstrating one-dimensional arrays or demonstrating two-dimensional arrays to demonstrate modular programming concepts using function	structure ading and	e – structure d writing data	and to fi	functies -I	pointe tions Manip	9 -unions -ulating file
manipparrays Unit – User-cenume positio LIST (1. 2. 3. 4. 5. 6. 7.	ulation function, pointers and volume. V defined data type indicator: from the first programs from the programs from th	user-defined Data Types and File Handling: types: Structure: Introduction – nested structures– arrays of pe. File Handling: Introduction - opening and closing files – reseek(), ftell() and rewind() ENTS / EXERCISES: or demonstrating the use of different types of format Specifiers or demonstrating the use of different types of operators like arith or demonstrating the use of using decision making statements or demonstrating the use of repetitive structures or demonstrating one-dimensional arrays or demonstrate modular programming concepts using function of demonstrate recursive functions.	structure ading and	e – structure d writing data	and to fi	functies -I	pointe tions Manip	9 -unions -ulating file
manipiarrays Unit – User-cenume positio LIST C 1. 2. 3. 4. 5. 6. 7. 8.	ulation function, pointers and volume.	User-defined Data Types and File Handling: types: Structure: Introduction – nested structures— arrays of pe. File Handling: Introduction - opening and closing files – reseek(), ftell() and rewind() ENTS / EXERCISES: or demonstrating the use of different types of format Specifiers or demonstrating the use of different types of operators like arith or demonstrating the use of using decision making statements or demonstrating the use of repetitive structures or demonstrating one-dimensional arrays or demonstrate modular programming concepts using function of demonstrate recursive functions.	structure ading and	e – structure d writing data	and to fi	functies -I	pointe tions Manip	9 -unions -ulating file
manipinarrays Unit – User-cenume positio LIST (1) 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	ulation function, pointers and volume. V defined data type indicator: from the programs from the prog	User-defined Data Types and File Handling: types: Structure: Introduction – nested structures– arrays of pe. File Handling: Introduction - opening and closing files – reseek(), ftell() and rewind() ENTS / EXERCISES: or demonstrating the use of different types of format Specifiers or demonstrating the use of different types of operators like arith or demonstrating the use of using decision making statements or demonstrating the use of repetitive structures or demonstrating one-dimensional arrays or demonstrate modular programming concepts using function of demonstrate recursive functions. It demonstrate the use of pointers	structure ading and	e – structure d writing data	and to fi	functies -I	pointe tions Manip	9 -unions -ulating file
manipiarrays Unit – User-cenume positio 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	ulation function, pointers and volume. V defined data type indicator: from the programs from the prog	User-defined Data Types and File Handling: types: Structure: Introduction – nested structures— arrays of pe. File Handling: Introduction - opening and closing files – reseek(), ftell() and rewind() ENTS / EXERCISES: or demonstrating the use of different types of format Specifiers or demonstrating the use of different types of operators like arithor demonstrating the use of using decision making statements or demonstrating the use of repetitive structures or demonstrating one-dimensional arrays or demonstrate modular programming concepts using function of demonstrate recursive functions. To demonstrate strings (Using built-in and user-definedfunction of illustrate the use of structures and unions	structure ading and	e – structure d writing data	and to fi	function fun	tions Manip	9 -unions -ulating file

REFE	RENCES/ MANUAL / SOFTWARE:
1.	Yashavant Kanetkar, "Let us C", 16th Edition, BPB Publications, 2018.
2.	Sumitabha Das, "Computer Fundamentals and C Programming", 1st Edition, McGraw Hill, 2018.
3.	Balagurusamy E., "Programming in ANSI C", 7th Edition, McGraw Hill Education, 2017.
4.	Behrouz A. Forouzan & Richard F.Gilberg, "Computer Science A Structured Programming Approach Using C", 3 rd Edition, Cengage,2017.
5.	https://www.cprogramming.com/tutorial/c-tutorial.html_

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	develop simple programs using input/output statements and operators	Applying (K3), Precision (S3)
CO2	identify the appropriate looping and control statements in C and develop applications using these statements	Applying (K3), Precision (S3)
CO3	develop simple C programs using the concepts of arrays and modular programming	Applying (K3), Precision (S3)
CO4	apply the concepts of pointers and develop C programs using strings and pointers	Applying (K3), Precision (S3)
CO5	make use of user-defined data types and file concepts to solve given problems	Applying (K3), Precision (S3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1				1	1		1		
CO2	3	2	2	2	1				1	1		1		
CO3	3	2	2	2	1				1	1		1		
CO4	3	2	2	2	1				1	1		1		
CO5	3	2	2	2	1				1	1		1		

^{1 –} Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	30	60				100
CAT2	10	30	60				100
CAT3	10	30	60				100
ESE	10	30	60				100

^{*} $\pm 3\%$ may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	(Common to All Engineerin	ng and Technology	Branches)				
Programme & Branch	All BE/BTech Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	1/2	ES	2	1	0	3
Preamble	To impart knowledge on orthographic, isom solving different application oriented problems		sectional views	and deve	elopmer	nt of su	rfaces by
Unit – I	General Principles of Orthographic Project	ion:					6+3
and Folding of Orthographic Pr Located in the F	raphics in Engineering Applications - Use of Draft Drawing Sheets - Lettering and Dimensioning bjection - First Angle Projection - Layout of View irst Quadrant - Determination of True Lengths an cular Lamina Inclined to both Reference Planes.	 Projections of P Projection of F 	oints, Lines an Points Located	id Planes in all Qua	- Gene drant a	eral Pri nd Stra	nciples of ight Lines
Unit – II	Projections of Solid:						6+3
Projections of S Change of Posi	Simple Solids Like Prisms, Pyramids, Cylinder a ion Method.	and Cone when the	he Axis is incli	ned to O	ne Ref	erence	Plane by
Unit – III	Sectioning of Solids:						6+3
	lids - Prisms, Pyramids, Cylinder and Cone in Sindicular to the other - Obtaining True Shape of Se		tion by Cutting	Planes in	clined to	o One I	Reference
Unit – IV	Development of Surfaces:						6+3
	Lateral Surfaces of Simple Solids Like Prisms, I Prisms, Pyramids, Cylinders and Cones.	Pyramids, Cylinder	rs and Cones -	Developm	ent of S	Simple	Truncated
Unit – V	Isometric Projection and Introduction to A	utoCAD:					6+3
	metric Projection - Isometric Scale - Isometric Fines - Conversion of Isometric Projection into Orth					risms,	Pyramids,
				Lecture:	30, Tuto	orial:15	, Total:45
TEXT BOOK:					ai 2023	2,	
	ajan.K.V. "A Textbook of Engineering Graphics",3:	5 th Edition, Dhanala	akshmi Publishe	ers, Chenn	iai, 2022		
	ajan.K.V. "A Textbook of Engineering Graphics",3	5 th Edition, Dhanala	akshmi Publishe	ers, Chenn	iai, 2022	·	
1. Natar	ajan.K.V. "A Textbook of Engineering Graphics",3 gopal K. and Prabhu Raja V., "Engineering Graphi	<u> </u>				Chenna	ii, 2022.
1. Natar REFERENCES: 1. Venu		cs", 16 th Edition, N	ew Age Internat	tional Publ		Chenna	ii, 2022.

	E OUTCOMES: Detion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	interpret international standards of drawings and sketch the projections of points, lines and planes	Applying (K3)
CO2	draw the projections of 3D primitive objects like prisms, pyramids, cylinders and cones	Applying (K3)
CO3	construct the various sectional views of solids like prisms, pyramids, cylinders and cones	Applying (K3)
CO4	develop the lateral surfaces of simple and truncated solids	Applying (K3)
CO5	sketch the isometric projections of simple and truncated solids and convert isometric drawing into orthographic projection	Applying (K3)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			2					3		2		
CO2	3	2	1		2					3		2		
CO3	3	2	1		2					3		2		
CO4	3	2	1		2					3		2		
CO5	3	2	1		2					3		2		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

		AOOL	JOINE IN LALL	LIKIN - IIILOKI			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	6	9	85				100
CAT2	6	9	85				100
CAT3	6	9	85				100
ESE	10	10	80				100
* ±3% may be va	ried (CAT 1,2,3 –	50 marks & ESE – 1	00 marks)				

Progra Branc	amme & h	B.Ted	h & Fo	od Tecl	nnolog	y				Sem.	Category	L	ТР	Credit
Prerec	quisites	Nil								1	BS	0	0 3	1
Pream		as ha differe and p	ardness, ent basio H mete	alkalin instrur r exper	ity, chl nents a	oride, I ind also	DO, CC o aims	D, iron to impa	, chron	nium an asic cor	of the water d to develoncepts of vol capability.	p the	skills in	handling
LIST	Assessm				ample fo	or tho c	uitability	of drin	kina / in	ductrial	purpose by e	octimat	ing the	
1.	carbonat									iuusiiiai	purpose by e	ssumai	ing the	
2.	Estimation	n of Calo	cium and	d magne	esium ir	food s	amples	by com	plexom	etric titra	ition.			
3.	Estimation	n of alka	linity of	river an	d borew	ell wate	er collec	ted fron	n differe	ent place	S.			
4.	Estimation	n of chlo	ride ion	in the g	jiven wa	ater san	nple usi	ng Arge	ntomet	ric metho	od.			
5.	Determin	ation of	dissolve	d oxyge	n in the	given	wastewa	ater san	nple.					
6.	Determin	ation of (COD in	the give	n waste	ewater	sample.							
7.	Determin	ation of r	nolecula	ar weigh	nt or pol	ymer /	liquid by	/ Ostwa	ld vison	neter.				
8.	Determin	ation of	corrosio	n rate o	f iron in	acidic	medium	١.						
9.	Estimation	n of sulp	hur pres	sent in f	uel usin	ıg elect	ro-analy	tical ted	hnique	S.				
10.	Compari	son of the	e acidity	of the f	ood sar	nples u	sing pH	meter.						
11.	Estimation	n of sodi	um usin	g flame	photon	neter (E	Demons	tration).						
12.	Estimation	n of iron	using s	pectrop	hotome	ter (De	monstra	ition).						
	-													Total:30
REFE	RENCES/ I	MANUAL	/SOFT	WARE:										
1.	Palanisa Rajagana						d Manju	ıla Rani	K., "Ch	emistry	Laboratory N	/lanual	', 1 st Editi	on,
	SE OUTC	OMES:											ВТ Мар	
	mpletion of estimate							k Mg ²⁺ h	ardness	s and all	calinity of the		Highest Applying	
CO1	given wa	ter samp	le.										Precision	(S3)
CO2	COD.										ride, DO and		Applying Precision	
CO3	determin demonst										samples and mer.	t	Applying Precision	
					Mappi	ng of C	COs wit	h POs a	and PS	Os				
COs/F	Pos PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO
CO	1 3	2	1	3			3							
CO	2 3	2	1	3			3							
CO		2	1	3			2							
	ght, 2 – Mc		l			l	1			1	1		1	

				(Comm	on to A	II Engir	opering :	and Ted	chnolog	y Branch	00)			
Programm	ne &	·		•		ui Liigii	icering (and rec	Jillolog	-	•		_	
Branch		All Bl	E/BTec	h Branc	ches					Sem.	Category	L	Т	Cred
Prerequisi	tes	Nil								1/ 2	ES	0	0	2 1
Preamble				is desi oractice		o provi	de a h	ands-or	n exper	ience in	basic of i	mechar	nical an	d electrica
LIST OF E	XPERIN	IENTS	/ EXER	CISES:	1									
					PA	RT A –	MECHA	ANICAL	. ENGIN	NEERING	}			
1.											t for Matino			
2.	Prepa										∢ / Tray out			
3.	Perfor		Thread	Format	ion on a	a GI/P\	/C Pipe	and P	repare a	a Water	Line from t	he Ove	rhead T	ank that i
4.	Make	a Butt /	Lap / T	ee Join	t of MS	Plate u	ising Ar	c Weldi	ng Proc	ess and	Welding Si	mulato	r.	
5.		i ty: Pre				1odel w	vith the	Knowle	edge fro	om Fittin	g / Carper	itry / P	lumbing	/ Weldin
		<u> </u>				– ELEC	CTRICA	L AND	ELECT	RONICS	ENGINEE	RING		
6.	Wiring	n circuit	for fluo	rescent	lamn a	nd Stai	r case w	virina						
7.					-		mpulse							
8.	Meas	uremen	t of Ear	th Resis	stance									
9.	Solde	ring of S	Simple (Circuits	and tro	uble sh	ootina							
10.							Rectifie	rusina	diodes					
10.	ппріс	Tieritati	on or ne	iii wave	and rui	i wave	recuiic	i using	aloues					Total:3
REFEREN	CES/ M	ANUAL	./SOFT	WARE	:									Total.o
1.	Engin	eering F	Practice	s Labor	atory M	lanual.								
COURSE														apped
On comple								omoleti	on of t	he nlann	ed models	1	(Highes Creating	t Level)
CO1	innov	ative ar	ticles									M	anipulat	
CO2	identi accur	•	use app	oropriate	e mode	rn powe	er tools	and co	mplete	the exer	cises/mode		Applying anipulat	
CO3	perfor	m hous	e wiring	and re	alize th	e impor	tance o	f earthir	ng			I		ng (K3), ation (S2)
CO4	solde	ring with	n simple	electro	nics cir	cuits						ı		ng (K3), ation (S2)
CO5	troubl	e shoot	the ele	ctrical a	nd elec	tronic c	ircuits					I		ng (K3), ation (S2)
COs/POs	PO1	PO2	PO3	PO4	Mapp PO5	ing of	COs wi	th POs PO8	and PS	PO10	PO11	PO12	PSC	1 PSO
COS/POS CO1	3	FUZ	3	1	3	1	FUI	FU0	3	3	FUII	3	, PSC	1 730
CO2	3		3	1	3	1			3	3		3		
CO2	3		3	2	1				2	2		3	3	2
CO4	3		2	1	1				2	3		3	3	2
CO5	3		3	2	1				2	2		3	3	2
-	-	ì	1	l .	ĺ	1	1	1	1	1	1			

	(Common to All Engineering an	nd Technology Brand	ches)				
Programme & Branch	All B.E./B.Tech. Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	1/2	HS	1	0	1	1
Preamble	Yoga or yogasanas are considered as art and scientification harmony of body and mind for general wellbeing. Indians for healthy living. Students in particular are	Yoga is considered	as one of the				
Unit – I	Introduction:	·					2
Asanas - Class	oga – Definitions - Concepts - Aims and objectives of ifications of Yogasanas – Patanjali's Ashtanga Yoga ms of Yoga – Modern Trends in yoga.						
Unit – II	Yoga and Mind:						2
	ind - Five Elements and the Mind - Meditation and th Disorders, Major Depressive Disorder, Cyclothymic D		of the Mind - R	ole of	Yoga	ain P	sychological
Unit – III	Yoga and Values, Diet:						2
	 Social Values – Role of Yoga in Personality Integrat Diet – Constructive Diet. 	tion - Concepts of N	latural Diet - N	aturop	athy	Diet -	- Eliminative
Unit – IV	Asanas:						2
	g & Closing - Preparatory practices – Loosening F cticing Asanas. Asanas: Standing – Sitting – Prone –			and C	bject	ives	of Asanas -
Unit – V	Pranayama and Meditation:						2
	ces for awareness - Definitions and Objectives of F Kapalabathi – Sitali – Sitkari – Bhranari – Ujjayi – Rel			ng Pra	anaya	ama.	Pranayama:
			Lecture	: 10, I	Pract	ical:	10, Total:20
TEXT BOOK:							
	satyananda saraswathi, "Asana pranayama mudra ba	ndha", Bihar school	of yoga, 4 th Ec	lition,	1969.		
1. Swami s							
	mukthi Bodhanandha, "Hatha yoga pradipika", Bihar s	school of yoga, 4 th E	dition, 1985.				
	, , , , , , , , , , , , , , , , , , , ,	school of yoga, 4 th E	dition, 1985.				
2. Swami i	, , , , , , , , , , , , , , , , , , , ,	7 0 1	dition, 1985.				

	BT Mapped (Highest Level)
realize the importance of yoga in physical health.	Applying (K3)
realize the importance of yoga in mental health.	Applying (K3)
realize the role of yoga in personality development and diet.	Applying (K3)
do the loosening practices, Asanas and realize its benefits.	Applying (K3)
do the practice of Pranayama, meditation and realize its benefits	Applying (K3)
	realize the importance of yoga in mental health. realize the role of yoga in personality development and diet. do the loosening practices, Asanas and realize its benefits.

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						3		2	1			
CO2						3		2				
CO3						3		3				
CO4						3		2	3			
CO5						3		3				

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	-	-	-	-	-	-
CAT2	-	-	-	-	-	-	-
CAT3	20	30	50	-	-	-	100
ESE	-	-	-	-	-	-	-

^{* ±3%} may be varied (CAT3 - 100 marks)

	22TAM01 - தமிழர் மரபு (Common to All Engineering and Technolo	ogy Branch	es)				
Programme & Branch	All BE / BTech Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	1/2	HS	1	0	0	1
Preamble	தமிழாகளின் மொழி, இலக்கியம், ஓவியங்கள், வீர் விளையாட்டுக்கள், திணைக் கோட்பாடுகள் பங்களிப்பைப் பற்றிய அறிவை வழங்குவதே இ	r, இந்திய	ப பண்பாட்	டிற்	தத் ்	் தமி	கலைகள் பிழர்களின்
அலகு – 1	மொழி மற்றும் இலக்கியம்						3
அறம் – திருக் சமயங்களின் தமிழில் நவீன ஆகியோரின் ப அலகு – 11 நடுகல் முதல்	யங்கள் – சங்க இலக்கியத்தின் சமயச் சார்பற்ற ஒ ககுறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ் கா தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றுட இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வள பங்களிப்பு.	பப்பியங்க ம் நாய்வ ரச்சியில் ங்கள் வ கள் – ட	ன், தமிழ்ச எமார்கள் - பாரதியா ரை – சிற்ப பழங்குடியி	த்தி - சிர - மர் க் க எ	ல் ச ற்றிவ ற்றுப் லை மற்ழ	மண லக்கி ம் பா றும்	ப பௌத்த யங்கள் ரதிதாசன் 3 அவர்கள்
நாட்டுப்புறத் செ	திதய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சி யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருள	തെ -	இசைக் கடு	நவிக	கள்	– ம <u>்</u>	ருதங்கம்
	நாட்டுப்புறக் கலைகள் மற்றும் வீர் விளையாட்டு)	0			3
தெருக்கூத்து, சிலம்பாட்டம்,	கர்காட்டம், வில்லுப்பாட்டு, கணியான் கூத்து வளி, புலியாட்டம், தமிழாகளின் விளையாட்டுகள்	, ஒயில	றாட்டம், (தோ	ЫПб	തഖദ്	
தெருக்கூத்து, சிலம்பாட்டம், அலகு – IV தமிழகத்தின் த புறக் கோட்பா(கல்வியும் – ச	கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து	, ஒயில ா. ற்றும் சா ங்க கால	ங்க இலக்கி மத்தில் தமி)யத் _{த்}	தில் தில்	அகட	3 ம மற்றும் தத்தறிவுட
அலகு – IV தமிழகத்தின் த புறக் கோட்பா(கல்வியும் – ச	கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து வளி, புலியாட்டம், தமிழாகளின் விளையாட்டுகள் த மிழாகளின் திணைக் கோட்பாடுகள் எவரங்களும், விலங்குகளும் – தொல்காப்பியம் ம டுகள் – தமிழாகள் போற்றிய அறக்கோட்பாடு– ச ங்ககால நகரங்களும் துறை முகங்களும் – சங்கக எடுகளில் சோழாகளின் வெற்றி.	, ஒயில 1. ற்றும் சா ங்க கால எலத்தில்	ங்க இலக்கி லத்தில் தமி ஏற்றுமதி	 ழகத் மற்	தில் தில்	அகட	் கூத்து 3 ம மற்றுப் தத்தறிவுப்
தெருக்கூத்து, சிலம்பாட்டம், அலகு – IV தமிழகத்தின் த புறக் கோட்பா(கல்வியும் – ச கடல்கடந்த நா அலகு – V இந்திய விடுத	கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து வளி, புலியாட்டம், தமிழாகளின் விளையாட்டுகள் த மிழாகளின் திணைக் கோட்பாடுகள் எவரங்களும், விலங்குகளும் – தொல்காப்பியம் ம டுகள் – தமிழாகள் போற்றிய அறக்கோட்பாடு– ச ங்ககால நகரங்களும் துறை முகங்களும் – சங்கக ரடுகளில் சோழாகளின் வெற்றி.	, ஒயில ர். ற்றும் சா ங்க கால ராலத்தில் ட்டிற்குத் பின் பி <u>ம</u>	வக இலக்கி நத்தில் தமி ஏற்றுமதி தமிழாக வ	ியத்த பழகத் மற் ரின் ல த	தில் நில் றும் மிழ்	அக்ட எழு இற	3 ம் மற்றுட ஒத்தறிவுட க்குமதி 3
தெருக்கூத்து, சிலம்பாட்டம், அலகு – IV தமிழகத்தின் த புறக் கோட்பா(கல்வியும் – ச கடல்கடந்த நா அலகு – V இந்திய விடுத	கரகாட்டம், வில்லுப்பாட்டு, கணியான கூத்து வளி, புலியாட்டம், தமிழாகளின் விளையாட்டுகள் நாவரங்களும், விலங்குகளும் – தொல்காப்பியம் ம டுகள் – தமிழாகள் போற்றிய அறக்கோட்பாடு– ச ங்ககால நகரங்களும் துறை முகங்களும் – சங்கக டிகளில் சோழாகளின் வெற்றி. இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பா பங்களிப்பு நலைப்போரில் தமிழாகளின் பங்கு – இந்தியாவ மரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித்	, ஒயில ர். ற்றும் சா ங்க கால ராலத்தில் ட்டிற்குத் பின் பி <u>ம</u>	வக இலக்கி நத்தில் தமி ஏற்றுமதி தமிழாக வ	ியத்த பழகத் மற் ரின் ல த	தில் நில் றும் மிழ்	அக்ட எழு இற	3 ம் மற்றுட ஒத்தறிவுட க்குமதி 3
தெருக்கூத்து, சிலம்பாட்டம், அலகு – IV தமிழகத்தின் த புறக் கோட்பாடு கல்வியும் – ச கடல்கடந்த நா அலகு – V இந்திய விடுத தாக்கம் – சுய நகயெழுத்துப்ப	கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து வளி, புலியாட்டம், தமிழாகளின் விளையாட்டுகள் ரவரங்களும், விலங்குகளும் – தொல்காப்பியம் ம டுகள் – தமிழாகள் போற்றிய அறக்கோட்பாடு– ச ங்ககால நகரங்களும் துறை முகங்களும் – சங்கக டிகளில் சோழாகளின் வெற்றி. இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பா பங்களிப்பு நலைப்போரில் தமிழாகளின் பங்கு – இந்தியாவ மரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித் படிகள் – தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.	, ஒயில ர். ற்றும் சா ங்க கால ராலத்தில் ட்டிற்குத் பின் பி <u>ம</u>	வக இலக்கி நத்தில் தமி ஏற்றுமதி தமிழாக வ	ியத்த பழகத் மற் ரின் ல த	தில் நில் றும் மிழ்	அக்ட எழு இற	3 ப மற்றுட தத்தறிவுட க்குமதி 3 னபாட்டிக வட்டுகள்
தெருக்கூத்து, சிலம்பாட்டம், அலகு – IV தமிழகத்தின் த புறக் கோட்பா(கல்வியும் – ச கடல்கடந்த நா அலகு – V இந்திய விடுத் தாக்கம் – சுய நக்கெம் – சுய நக்கெம் – சுய நக்கெம் (முத்துப்	கரகாட்டம், வில்லுப்பாட்டு, கணியான கூத்து வளி, புலியாட்டம், தமிழாகளின் விளையாட்டுகள் நாவரங்களும், விலங்குகளும் – தொல்காப்பியம் ம டுகள் – தமிழாகள் போற்றிய அறக்கோட்பாடு– ச ங்ககால நகரங்களும் துறை முகங்களும் – சங்கக டிகளில் சோழாகளின் வெற்றி. இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பா பங்களிப்பு நலைப்போரில் தமிழாகளின் பங்கு – இந்தியாவ மரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித்	, ஒயில ர். ற்றும் சா ங்க கால ராலத்தில் ட்டிற்குத் பின் பி <u>ம</u>	வக இலக்கி நத்தில் தமி ஏற்றுமதி தமிழாக வ	ியத்த பழகத் மற் ரின் ல த	தில் நில் றும் மிழ்	அக்ட எழு இற	3 ப மற்றுட தத்தறிவுட க்குமதி 3 னபாட்டிக வட்டுகள்
தெருக்கூத்து, சிலம்பாட்டம், அலகு – IV தமிழகத்தின் த புறக் கோட்பாடு கல்வியும் – ச கடல்கடந்த நா அலகு – V இந்திய விடுத் தாக்கம் – சுயி கையெழுத்துப்ப	கரகாட்டம், வில்லுப்பாட்டு, கணியான கூத்து வளி, புலியாட்டம், தமிழாகளின் விளையாட்டுகள் தமிழாகளின் திணைக் கோட்பாடுகள் எவரங்களும், விலங்குகளும் – தொல்காப்பியம் ம டுகள் – தமிழாகள் போற்றிய அறக்கோட்பாடு– ச ங்ககால நகரங்களும் துறை முகங்களும் – சங்கக படுகளில் சோழாகளின் வெற்றி. இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பா பங்களிப்பு நலைப்போரில் தமிழாகளின் பங்கு – இந்தியாவ மரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித் படிகள் – தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.	, ஒயில ர் ற்றும் சா ங்க கால நாலத்தில் ட் டிற்குத் பின் பிற	ங்க இலக்கி லத்தில் தமி ஏற்றுமதி தமிழர்க ை நபகுதிகளில் துவத்தின் ப	பார்க் மற் மற் மற் மற்	தில் தில் றும்	அகட எழு இற பன் கல்ெ	3 ம மற்றும் ஒத்தறிவும க்குமதி 3 னபாட்டிகள் Total: 1
தெருக்கூத்து, சிலம்பாட்டம், அலகு – IV தமிழகத்தின் த புறக் கோட்பாடு கல்வியும் – ச கடல்கடந்த நா அலகு – V இந்திய விடுத் தாக்கம் – சுயி கையெழுத்துப் ரEXT BOOK: 1. ஆ. பூபா REFERENCES:	கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து வளி, புலியாட்டம், தமிழாகளின் விளையாட்டுகள் ரவரங்களும், விலங்குகளும் – தொல்காப்பியம் ம டுகள் – தமிழாகள் போற்றிய அறக்கோட்பாடு– ச ங்ககால நகரங்களும் துறை முகங்களும் – சங்கக டிகளில் சோழாகளின் வெற்றி. இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பா பங்களிப்பு நலைப்போரில் தமிழாகளின் பங்கு – இந்தியாவ மரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித் படிகள் – தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.	, ஒயில ர் ற்றும் சா ங்க கால நாலத்தில் ட் டிற்குத் பின் பிற	ங்க இலக்கி லத்தில் தமி ஏற்றுமதி தமிழர்க ை நபகுதிகளில் துவத்தின் ப	பார்க் மற் மற் மற் மற்	தில் தில் றும்	அகட எழு இற பன் கல்ெ	3 ம மற்றுட ஒத்தறிவுட க்குமதி வட்டுகள் Total: 1
தெருக்கூத்து, சிலம்பாட்டம், அலகு – IV தமிழகத்தின் த புறக் கோட்பாடு கல்வியும் – ச கடல்கடந்த நா அலகு – V இந்திய விடுத் தாக்கம் – சுயி கையெழுத்துப்ப சாக்கம் – சுயி கையெழுத்துப்ப கடையை இத்துப்ப கடையை இத்துப்ப	கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து வளி, புலியாட்டம், தமிழாகளின் விளையாட்டுகள் நமிழாகளின் திணைக் கோட்பாடுகள் நவரங்களும், விலங்குகளும் – தொல்காப்பியம் ம டுகள் – தமிழாகள் போற்றிய அறக்கோட்பாடு– ச ங்ககால நகரங்களும் துறை முகங்களும் – சங்கக நடுகளில் சோழாகளின் வெற்றி. இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பா பங்களிப்பு நலைப்போரில் தமிழாகளின் பங்கு – இந்தியாவ மரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித் படிகள் – தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.	, ஒயில ர் ற்றும் சா ங்க கால நாலத்தில் ட் டிற்குத் பின் பிற	ங்க இலக்கி லத்தில் தமி ஏற்றுமதி தமிழர்க ை நபகுதிகளில் துவத்தின் ப	பார்க் மற் மற் மற் மற்	தில் தில் றும்	அகட எழு இற பன் கல்ெ	3 ம மற்றும் ஒத்தறிவும க்குமதி வட்டுகள் Total: 1
தெருக்கூத்து, சிலம்பாட்டம், அலகு – IV தமிழகத்தின் த புறக் கோட்பாடு கல்வியும் – ச கடல்கடந்த நா அலகு – V இந்திய விடுத் தாக்கம் – சுயி கையெழுத்துப்ப சாக்கம் – சுயி கையெழுத்துப்ப கையெழுத்துப்ப கல்வியி கல்வியி கணினி	கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து வளி, புலியாட்டம், தமிழாகளின் விளையாட்டுகள் நமிழாகளின் திணைக் கோட்பாடுகள் நாவரங்களும், விலங்குகளும் – தொல்காப்பியம் ம நகள் – தமிழாகள் போற்றிய அறக்கோட்பாடு– ச ங்ககால நகரங்களும் துறை முகங்களும் – சங்கக நடுகளில் சோழாகளின் வெற்றி. இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பா பங்களிப்பு நலைப்போரில் தமிழாகளின் பங்கு – இந்தியாவ மரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித் படிகள் – தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு. எலன், தமிழா மரபு, VRB Publishers Pvt Ltd, 2022.	, ஒயில ர் ற்றும் சா ங்க கால நாலத்தில் ட்டிற்குத் பின் பிழ த மருத்த	வக இலக்கி நத்தில் தமி த மிழர்கள் நபகுதிகளின் நுவத்தின் ப	_ நூ மற் மற் மங்கு	தில் தில் றும் மிழ் ் – ச	அகட எழு இற பன் கல்ெ	3 ம மற்றும் ஒத்தறிவும க்குமதி வட்டுகள் Total: 1

	SE OUTCOMES:	BT Mapped
படிப்	றப முடித்தவுடன், மாணவர்கள்	(Highest Level)
CO1	தமிழ் மொழி மற்றும் இலக்கியத்தில் மதிப்புமிக்க கருத்துக்களை விளக்க முடியும்.	Understanding (K2)
CO2	தமிழர்களின் சிற்பம் மற்றும் அவர்களின் ஓவியங்கள் பற்றி விளக்க முடியும்.	Understanding (K2)
CO3	தமிழர்களின் நாட்டுப்புற மற்றும் தற்காப்புக் கலைகளைப் பற்றி சுருக்கமாகக் கூற முடியும்.	Understanding (K2)
CO4	தமிழாகளின் திணைக் கோட்பாடுகளைப் பற்றி விளக்க முடியும்.	Understanding (K2)
CO5	இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு பற்றி விளக்க முடியும்.	Understanding (K2)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3		3	2	2		3		
CO2						3		3	2	2		3		
CO3						3		3	2	2		3		
CO4						3		3	2	2		3		
CO5						3		3	2	2		3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	40	60					100
CAT3	40	60					100
ESE				NA			

 * ±3% may be varied (CAT 1, 2 & 3 – 50 marks)

	22TAM01 - HERITA	GE OF TAMILS					
	(Common to All Engineering ar	nd Technology Branch	es)				
Programme & Branch	All BE / BTech Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	1/2	HS	1	0	0	1
Preamble	The objective of this course is to impart knowled arts, heroic games, doctrines, contribution of Tar		ge, literature,	pain	tings,	sculp	tures, folk
UNIT I	Language and Literature						3
sangam literatur buddhism & jair	es in india - dravidian languages – tamil as a class re – distributive justice in sangam literature - mar nism in tamil land - bakthi literature azhwars and r I - contribution of bharathiyar and bharathidhasan.	nagement principles ir	thirukural -	tamil	epic	s and	l impact of
UNIT II	Heritage - Rock Art Paintings to Modern Art -	- Sculpture					3
sculptures, villag	nodern sculpture - bronze icons - tribes and their ge deities, thiruvalluvar statue at kanyakumari, mak ım - role of temples in social and economic life of tan	ting of musical instrum					
UNIT III	Folk and Martial Arts						3
Therukoothu – k and games of ta	aragattam - villu pattu - kaniyan koothu – oyillattam mils.	- leather puppetry – s	lambattam –	valar	i - tig	er dar	nce - sports
UNIT IV	Thinai Concept of Tamils						3
Flora and fauna	a of tamils & aham and puram concept from thole teracy during sangam age - ancient cities and po						of tamils -
Flora and fauna education and li	a of tamils & aham and puram concept from thole teracy during sangam age - ancient cities and po	rts of sangam age - e	export and im				of tamils -
Flora and fauna education and li overseas conque UNIT V	a of tamils & aham and puram concept from thole teracy during sangam age - ancient cities and polest of cholas.	rts of sangam age - evenent and Indian Confluence of tamils over	export and imulation in the other parts	iport arts c	durin of ind	g sar	of tamils - gam age - 3 self-respect
Flora and fauna education and li overseas conque UNIT V	a of tamils & aham and puram concept from tholeteracy during sangam age - ancient cities and potest of cholas. Contribution of Tamils to Indian National Mortamils to indian freedom struggle - the cultural inf	rts of sangam age - evenent and Indian Confluence of tamils over	export and imulation in the other parts	iport arts c	durin of ind	g sar	of tamils - gam age - 3 self-respect
Flora and fauna education and li overseas conque UNIT V Contribution of	a of tamils & aham and puram concept from tholeteracy during sangam age - ancient cities and potest of cholas. Contribution of Tamils to Indian National Mortamils to indian freedom struggle - the cultural inf	rts of sangam age - evenent and Indian Confluence of tamils over	export and imulation in the other parts	iport arts c	durin of ind	g sar	of tamils - gam age - 3 self-respect nil books.
Flora and fauna education and li overseas conque UNIT V Contribution of movement - role TEXT BOOK: 1. S.Muthu	a of tamils & aham and puram concept from tholeteracy during sangam age - ancient cities and potest of cholas. Contribution of Tamils to Indian National Mortamils to indian freedom struggle - the cultural inf	vement and Indian Confluence of tamils over ine – inscriptions & ma	export and im Ilture the other pa nuscripts – pi	iport arts c	durin of ind	g sar	of tamils - gam age - 3 self-respect nil books.
Flora and fauna education and li overseas conque UNIT V Contribution of movement - role TEXT BOOK: 1. S.Muthu REFERENCES:	a of tamils & aham and puram concept from tholeteracy during sangam age - ancient cities and potest of cholas. Contribution of Tamils to Indian National Movetamils to indian freedom struggle - the cultural information of siddha medicine in indigenous systems of medicine in indigenous systems of medicine in indigenous systems.	vement and Indian Confluence of tamils over ine – inscriptions & ma	export and imulature the other panuscripts – panuscripts – panuscripts – vt Ltd, 2023.	arts c	durin	g sar	of tamils - gam age - 3 self-respect nil books. Total: 15
Flora and fauna education and li overseas conque UNIT V Contribution of movement - role TEXT BOOK: 1. S.Muthu REFERENCES: 1. Historica Tamil Si	a of tamils & aham and puram concept from tholeteracy during sangam age - ancient cities and potest of cholas. Contribution of Tamils to Indian National Mortamils to indian freedom struggle - the cultural infof siddha medicine in indigenous systems of medicinary arramalingam, M.Saravanakumar, Heritage of Tamils, all Heritage of the Tamils (Dr.S.V.Subatamanian, Dr. tudies).	vement and Indian Confluence of tamils over ine – inscriptions & many, Yes Dee Publishing F	export and imulature the other particular particular produced by the control of t	arts crint hi	of ind story	g sar	of tamils - gam age - 3 self-respect nil books. Total: 15
Flora and fauna education and li overseas conque UNIT V Contribution of movement - role TEXT BOOK: 1. S.Muthu REFERENCES: 1. Historica Tamil St. 2. The Constudies	a of tamils & aham and puram concept from tholeteracy during sangam age - ancient cities and potest of cholas. Contribution of Tamils to Indian National Mortamils to indian freedom struggle - the cultural information of siddha medicine in indigenous systems of medicine arramalingam, M.Saravanakumar, Heritage of Tamils, all Heritage of the Tamils (Dr.S.V.Subatamanian, Dr. tudies). Intribution of Tamil of the Tamils to Indian Culture(vement and Indian Confluence of tamils over ine – inscriptions & many, Yes Dee Publishing Fundamental (Dr.M.Valarmathi)(Pupling)	export and imulature the other panuscripts – provided by Interest and imulation with the other panuscripts – provided by Interest and imulation with the other panuscripts – provided by Interest and imulation with the other panuscripts – provided by Interest and imulation with the other panuscripts – provided by Interest panuscrip	arts crint hi	of ind story	g sar	of tamils - gam age - 3 self-respect nil books. Total: 15 Institute of te of Tamil

npletion of the course, the students will be able to	BT Mapped (Highest Level)
explain valuable concepts in language and literature of tamils.	Understanding (K2)
illustrate about the tamils sculpture and their paintings.	Understanding (K2)
summarize about the tamils folk and martial arts.	Understanding (K2)
explain the thinai concept of tamils.	Understanding (K2)
explain the contribution of Tamils to the Indian National Movement and Indian culture.	Understanding (K2)
	explain valuable concepts in language and literature of tamils. illustrate about the tamils sculpture and their paintings. summarize about the tamils folk and martial arts. explain the thinai concept of tamils.

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3		3	2	2		3		
CO2						3		3	2	2		3		
CO3						3		3	2	2		3		
CO4						3		3	2	2		3		
CO5						3		3	2	2		3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	40	60					100
CAT3	40	60					100
ESE				NA			

 * ±3% may be varied (CAT 1, 2 & 3 – 50 marks)

Programme &	All BE/BTech Branches	Sem.	Category	L	т	Р	Credit
Branch Prerequisites	Nil	2/3	HS	1	0	0	1
- Toroquionos		270	1.0	•			•
முன்னுரை	தமிழ் கலாச்சாரத்தோடு ஒன்றிய தொழில் நுட்	பங்களை	ள பற்றிப் எ	டுத்	துை	ரத்த	ல ்
அலகு – I	நெசவு மற்றும் பானை தொழில்நுட்பம்						3
சங்க காலத்தில் கீறல் குறியீடுகள	் நெசவு தொழில் – பானைத் தொழில்நுட்பம் ச ள்	கருப்பு சீ	ിഖப்பு பாൽ	π∟ங்	பகள்	– ⊔	ாண்டகளி
ച ക്രെ – 11	வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்						3
சங்க காலத்தி	ல் வடிவமைப்பு மற்றும் கட்டுமானங்கள் &	சங்க	காலத்தில்) 6	บู∟์(เ	நப்பெ	ாருட்களி
வடிவமைப்பு –	சங்க காலத்தில் கட்டுமான பொருட்களும்	நடுகல்	<u> த</u> ும் – சில	ەلىلە	திகா	ரத்தி	ல் மே
அமைப்பு பற் <u>ர</u> ீ				-		÷riidi Liidi	
ு. பெருங்கோயில்			•	ாலச்		-	<u></u>
•	ப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்ம	•					
•		•	. •		_		-
	உற்பத்தித் தொழில்நுட்பம்	ஸ் இய்	الماران الرق	0 0011	0) 0)	СЩС	3
<u> அலகு - III</u>							
	கலை – உலோகவியல் – இரும்புத் தொழிற்க	சாலை	– இரும	⊔ 2	_(Ҧ8	ატტნ	ຎ, எ∴கு
, ,	ாறுகளாக செம்பு மற்றும் தங்க நாணயங்கள்	•		அ	բ գր	த்தல்	– ഥൽ
, ,	ாறுகளாக செம்பு மற்றும் தங்க நாணயங்கள் தாழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி	•		அ	բ գր	த்தல்	– ഥൽ
உருவாக்கும் ெ	. , ,	மணிக	ள் – சுடும	அ ெண்	д ЭШ	த்தல் னிக	ள் – மன ப் – சங்
உருவாக்கும் ெ மணிகள் – எலு	தாழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி	மணிக ப்பதிகார	ள் – சுடும	அ ெண்	д ЭШ	த்தல் னிக	ள் – மன ப் – சங்
உருவாக்கும் ெ மணிகள் – எலு! அலகு – IV	தாழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி ம்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப் வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நு ட்	மணிக ப்பதிகார _ பம்	ள் – சுடும த்தில் மணி	அ மன் களி	ச்சடி ம ன் ச	த்தல் னிகவ பகை	் – ഥன ள் – சங் கள். 3
உருவாக்கும் ெ மணிகள் – எலும் அலகு – IV அணை, ஏரி, கு	தாழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி ம்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலம் வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட் ளங்கள், மதகு – சோழர்கால குமிழித் தூம்பின்	மணிக ப்பதிகார பம் முக்கிய	ள் – சுடும த்தில் மணி பத்துவம் –	அ மன் களி கா	ச் சடி மல ன் எ லந்தை	த்தல் னிகவ பகை 	் – மன ள் – சங் கள். 3 பராமரிப்பு
உருவாக்கும் ெ மணிகள் – எலு! அலகு – IV அணை, ஏரி, கு கால்நடைகளுக்க	தாழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி ம்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப் வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட் ளங்கள், மதகு – சோழர்கால குமிழித் தூம்பின் காக வடிவமைக்கப்பட்ட கிணறுகள் – வேள	மணிக ப்பதிகார பம் முக்கிய ராண்மை	ள் – சுடும த்தில் மணி பத்துவம் – ப மற்றும்	அ மண் களி கா கோ	ச்சடி மல் ன் வ லந்தை வளா	த்தல் னிகவ பகை பட ட ண்ண	் – மன ள் – சங் கள். 3 பராமரிப்பு ம்ம சார்ந்
உருவாக்கும் ெ மணிகள் – எலு! அலகு – IV அணை, ஏரி, கு காலநடைகளுக்க செயல்பாடுகள்	தாழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி ம்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலம் வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட் ளங்கள், மதகு – சோழர்கால குமிழித் தூம்பின் காக வடிவமைக்கப்பட்ட கிணறுகள் – வேள – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும்	மணிக ப்பதிகார பம் முக்கிய ராண்மை	ள் – சுடும த்தில் மணி பத்துவம் – ப மற்றும்	அ மண் களி கா கோ	ச்சடி மல் ன் வ லந்தை வளா	த்தல் னிகவ பகை பட ட ண்ண	் – மன ள் – சங் கள். 3 பராமரிப்பு ம்ம சார்ந்
உருவாக்கும் வெணிகள் – எலு அலகு – IV அணை, ஏரி, கு காலநடைகளுக்க செயல்பாடுகள் பண்டைய அறிவ	தாழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி ம்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப் வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட் எங்கள், மதகு – சோழர்கால குமிழித் தூம்பின் காக வடிவமைக்கப்பட்ட கிணறுகள் – வேள – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றுப் பு – அறிவுசார் சமூகம்.	மணிக ப்பதிகார பம் முக்கிய ராண்மை	ள் – சுடும த்தில் மணி பத்துவம் – ப மற்றும்	அ மண் களி கா கோ	ச்சடி மல் ன் வ லந்தை வளா	த்தல் னிகவ பகை பட ட ண்ண	் – மன ள் – சங் கள். 3 பராமரிப்பு ம்ம சார்ந் _ல் குறித்
உருவாக்கும் வெ மணிகள் – எலும் அலகு – IV அணை, ஏரி, கு கால்நடைகளுக்க செயல்பாடுகள் பண்டைய அறிவ அலகு – V	தாழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி ம்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலம் வளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட் களங்கள், மதகு – சோழர்கால குமிழித் தூம்பின் காக வடிவமைக்கப்பட்ட கிணறுகள் – வேள – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் வு – அறிவுசார் சமூகம். அறிவியல் தமிழ் மற்றும் கணினித்தமிழ்	மணிக ப்பதிகார பம் முக்கிய ாண்மை ம் முத்து	ள் – சுடும த்தில் மணி பத்துவம் – பற்றும் புக்குளித்தல்	அ மன் களி கா (66 – (ச்சடி ம் ன் எ ப்நன பளா பெரு	த்தல் னிக பகை பட ட ண்ண நங்கட	் – மன் ர் – சங் கள். 3 பராமரிப்பு ம்ம சார்ந் _ல் குறித்
உருவாக்கும் வெணிகள் – எலு அலகு – IV அணை, ஏரி, கு காலநடைகளுக்க செயல்பாடுகள் பண்டைய அறிவ அலகு – V அறிவியல் தமிழ்	தாழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி ம்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப் வெளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட் எங்கள், மதகு – சோழர்கால குமிழித் தூம்பின் காக வடிவமைக்கப்பட்ட கிணறுகள் – வேள – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றுப் பு – அறிவுசார் சமூகம். அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் ழின் வளர்ச்சி – கணினிதத்தமிழ் வளர்ச்சி – தமி	மணிக ப்பதிகார ப ம் முக்கிய மன்மை ம முத்த	ள் – சுடும த்தில் மணி பத்துவம் – மற்றும் புக்குளித்தல் களை மின்ம	அ மண் களி கா கோ – (ச்சடி ம் ன் எ ல்நன வளா பெரு	த்தல் னிக பகை பட ட ண்ண நங்கட	் — மன் கள். 3 பராமரிப்பு ம்ம சார்ந் _ல் குறித் ல் – தமி
உருவாக்கும் வெணிகள் – எலும் அலகு – IV அணை, ஏரி, கு கால்நடைகளுக்க செயல்பாடுகள் பண்டைய அறிவ அலகு – V அறிவியல் தமிழ் மென்பொருட்கள்	தாழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி ம்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலம் வளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட் காங்கள், மதகு – சோழர்கால குமிழித் தூம்பின் காக வடிவமைக்கப்பட்ட கிணறுகள் – வேள – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் பு – அறிவுசார் சமூகம். அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் ழின் வளர்ச்சி – கணினிதத்தமிழ் வளர்ச்சி – தமி ர உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம்	மணிக ப்பதிகார ப ம் முக்கிய மன்மை ம முத்த	ள் – சுடும த்தில் மணி பத்துவம் – மற்றும் புக்குளித்தல் களை மின்ம	அ மண் களி கா கோ – (ச்சடி ம் ன் எ ல்நன வளா பெரு	த்தல் னிக பகை பட ட ண்ண நங்கட	் — மன ன் — சங் கள். 3 பராமரிப்பு ம்ம சார்ந் _ல் குறித் 3
உருவாக்கும் வெணிகள் – எலும் அலகு – IV அணை, ஏரி, கு கால்நடைகளுக்க செயல்பாடுகள் பண்டைய அறிவ அலகு – V அறிவியல் தமிழ் மென்பொருட்கள்	தாழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி ம்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப் வெளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட் எங்கள், மதகு – சோழர்கால குமிழித் தூம்பின் காக வடிவமைக்கப்பட்ட கிணறுகள் – வேள – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றுப் பு – அறிவுசார் சமூகம். அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் ழின் வளர்ச்சி – கணினிதத்தமிழ் வளர்ச்சி – தமி	மணிக ப்பதிகார ப ம் முக்கிய மன்மை ம முத்த	ள் – சுடும த்தில் மணி பத்துவம் – மற்றும் புக்குளித்தல் களை மின்ம	அ மண் களி கா கோ – (ச்சடி ம் ன் எ ல்நன வளா பெரு	த்தல் னிக பகை பட ட ண்ண நங்கட	் — மன ன் — சங் கள். 3 பராமரிப்பு ம்ம சார்ந் _ல் குறித் 3
உருவாக்கும் வெணிகள் – எலும் அலகு – IV அணை, ஏரி, கு கால்நடைகளுக்க செயல்பாடுகள் பண்டைய அறிவ அலகு – V அறிவியல் தமிழ் மென்பொருட்கள்	தாழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி ம்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலம் வளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட் காங்கள், மதகு – சோழர்கால குமிழித் தூம்பின் காக வடிவமைக்கப்பட்ட கிணறுகள் – வேள – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் பு – அறிவுசார் சமூகம். அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் ழின் வளர்ச்சி – கணினிதத்தமிழ் வளர்ச்சி – தமி ர உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம்	மணிக ப்பதிகார ப ம் முக்கிய மன்மை ம முத்த	ள் – சுடும த்தில் மணி பத்துவம் – மற்றும் புக்குளித்தல் களை மின்ம	அ மண் களி கா கோ – (ச்சடி ம் ன் எ ல்நன வளா பெரு	த்தல் னிக பகை பட ட ண்ண நங்கட	் — மன ன் — சங் கள். 3 பராமரிப்பு ம்ம சார்ந் _ல் குறித் 3
உருவாக்கும் வெணிகள் – எலும் அலகு – IV அணை, ஏரி, கு கால்நடைகளுக்க செயல்பாடுகள் பண்டைய அறிவ அலகு – V அறிவியல் தமிழ் மென்பொருட்கள்	தாழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி ம்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலம் வளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட் காங்கள், மதகு – சோழர்கால குமிழித் தூம்பின் காக வடிவமைக்கப்பட்ட கிணறுகள் – வேள – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் பு – அறிவுசார் சமூகம். அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் ழின் வளர்ச்சி – கணினிதத்தமிழ் வளர்ச்சி – தமி ர உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம்	மணிக ப்பதிகார ப ம் முக்கிய மன்மை ம முத்த	ள் – சுடும த்தில் மணி பத்துவம் – மற்றும் புக்குளித்தல் களை மின்ம	அ மண் களி கா கோ – (ச்சடி ம் ன் எ ல்நன வளா பெரு	த்தல் னிக பகை பட ட ண்ண நங்கட	் — மன ன் — சங் கள். 3 பராமரிப்பு ம்ம சார்ந் _ல் குறித் ல் — தமி நண்யத்தி
உருவாக்கும் வெணிகள் – எலு அலகு – IV அணை, ஏரி, கு காலநடைகளுக்க செயல்பாடுகள் பண்டைய அறிவ அலகு – V அறிவியல் தமிழ் மென்பொருட்கள் தமிழ் அகராதிகள் காலமக வா	தாழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி ம்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலம் வளா ண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட் காங்கள், மத்கு – சோழர்கால குமிழித் தூம்பின் காக வடிவமைக்கப்பட்ட கிணறுகள் – வேள – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் பு – அறிவுசார் சமூகம். அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் ழின் வளர்ச்சி – கணினிதத்தமிழ் வளர்ச்சி – தமி ம உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம	மணிக ப்பதிகார ப ம் முக்கிய மன்மை ம் முத்த பழ் நூல் ம் – தமி	ள் – சுடும த்தில் மணி பத்துவம் – மற்றும் புக்குளித்தல் களை மின்ப	அல் மண் களி காசே – (1	ச்சடி மன் எ ல்நன வளா பெரு	த்தல் னிக பகை பட ட ண்ண நங்கட	் — மன் ர் — சங் கள். 3 பராமரிப்பு ம் சார்ந் _ல் குறித் 3 ல் — தமி நண்யத்தி
உருவாக்கும் வெணிகள் – எலு அலகு – IV அணை, ஏரி, கு கால்நடைகளுக்க செயல்பாடுகள் பண்டைய அறிவ அலகு – V அறிவியல் தமிழ மென்பொருட்கள் தமிழ் அகராதிகள் தமிழ் அகராதிகள் TEXT BOOK:	தாழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி ம்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலம் வளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட் ளங்கள், மதகு – சோழர்கால குமிழித் தூம்பின் காக வடிவமைக்கப்பட்ட கிணறுகள் – வேள – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் பு – அறிவுசார் சமூகம். அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் ழின் வளர்ச்சி – கணினிதத்தமிழ் வளர்ச்சி – தமி ர உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம ள் சொற்குவைத் திட்டம்.	மணிக ப்பதிகார பம் முக்கிய மன்மை ம் முத்து ம் – தமி	ள் – சுடும த்தில் மணி பத்துவம் – பமற்றும் புக்குளித்தல் களை மின்ப ந்த மின் நூ	அல் மண் களி காசே – (1	ச்சடி மன் எ ல்நன வளா பெரு	த்தல் னிக பகை பட ட ண்ண நங்கட	் — மன் ர் — சங் கள். 3 பராமரிப்பு ம் சார்ந் _ல் குறித் 3 ல் — தமி நண்யத்தி
உருவாக்கும் வெணிகள் – எலு அலகு – IV அணை, ஏரி, கு காலநடைகளுக்க செயல்பாடுகள் பண்டைய அறிவ அலகு – V அறிவியல் தமிழ மென்பொருட்கள் தமிழ் அகராதிகள் TEXT BOOK:	தாழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி ம்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலம் வளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட் வங்கள், மதகு – சோழர்கால குமிழித் தூம்பின் காக வடிவமைக்கப்பட்ட கிணறுகள் – வேள – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் பு – அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் இன் வளர்ச்சி – கணினிதத்தமிழ் வளர்ச்சி – தமி ன் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் வளர்க்கம் – தமிழ் இணையக் கல்விக்கழகம் வள் சொற்குவைத் திட்டம்.	மணிக ப்பதிகார ப ம் முக்கிய பான்மை ம் முத்த ம் – தமி	ள் – சுடும த்தில் மணி பத்துவம் – பமற்றும் புக்குளித்தல் களை மின்ப ந்த மின் நூ	அல் மண் களி காசே – (1	ச்சடி மன் எ ல்நன வளா பெரு	த்தல் னிக பகை பட ட ண்ண நங்கட	் — மன ர் — சங் கள். 3 பராமரிப்பு ம் சார்ந் _ல் குறித் 3 ல் — தமி நண்யத்தி
உருவாக்கும் வெணிகள் – எலு அலகு – IV அணை, ஏரி, கு கால்நடைகளுக்க செயல்பாடுகள் பண்டைய அறிவ அலகு – V அறிவியல் தமிழ மென்பொருட்கள் தமிழ் அகராதிகள் TEXT BOOK: 1. தமிழக வர கல்வியில் 2. கணினித்து	தாழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி ம்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலம் வளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட் ளங்கள், மதகு – சோழர்கால குமிழித் தூம்பின் காக வடிவமைக்கப்பட்ட கிணறுகள் – வேள – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் பு – அறிவுசார் சமூகம். அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் ழின் வளர்ச்சி – கணினிதத்தமிழ் வளர்ச்சி – தமி ர உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம ள் சொற்குவைத் திட்டம்.	மணிக ப்பதிகார ப ம் முக்கிய பான்மை ம் முத்த ம் – தமி	ள் – சுடும த்தில் மணி பத்துவம் – பமற்றும் புக்குளித்தல் களை மின்ப ந்த மின் நூ	அல் மண் களி காசே – (1	ச்சடி மன் எ ல்நன வளா பெரு	த்தல் னிக பகை பட ட ண்ண நங்கட	் — மன் ர் — சங் கள். 3 பராமரிப்பு ம் சார்ந் _ல் குறித் 3 ல் — தமி நண்யத்தி
உருவாக்கும் வெணிகள் – எலு அலகு – IV அணை, ஏரி, கு கால்நடைகளுக்க செயல்பாடுகள் பண்டைய அறிவ அலகு – V அறிவியல் தமிழ மென்பொருட்கள் தமிழ் அகராதிகள் TEXT BOOK: 1. தமிழக வர கல்வியில் 2. கணினித்து	தாழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி ம்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலம் வளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட் வங்கள், மதகு – சோழர்கால குமிழித் தூம்பின் காக வடிவமைக்கப்பட்ட கிணறுகள் – வேள – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் பு – அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் இன் வளர்ச்சி – கணினிதத்தமிழ் வளர்ச்சி – தமி ன் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் வளர்க்கம் – தமிழ் இணையக் கல்விக்கழகம் வள் சொற்குவைத் திட்டம்.	மணிக ப்பதிகார ப ம் முக்கிய பான்மை ம் முத்த ம் – தமி	ள் – சுடும த்தில் மணி பத்துவம் – பமற்றும் புக்குளித்தல் களை மின்ப ந்த மின் நூ	அல் மண் களி காசே – (1	ச்சடி மன் எ ல்நன வளா பெரு	த்தல் னிக பகை பட ட ண்ண நங்கட	் — மன ர் — சங் கள். 3 பராமரிப்பு ம் சார்ந் _ல் குறித் 3 ல் — தமி நண்யத்தி
உருவாக்கும் வெணிகள் – எலு அலகு – IV அணை, ஏரி, கு காலநடைகளுக்கு செயல்பாடுகள் பண்டைய அறிவ அலகு – V அறிவியல் தமிழ் மென்பொருட்கள் தமிழ் அகராதிகள் TEXT BOOK: 1. தமிழக வர கல்வியில் 2. கணினித்து REFERENCES:	தாழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி ம்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலம் வளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட் வங்கள், மதகு – சோழர்கால குமிழித் தூம்பின் காக வடிவமைக்கப்பட்ட கிணறுகள் – வேள – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் பு – அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் இன் வளர்ச்சி – கணினிதத்தமிழ் வளர்ச்சி – தமி ன் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் வளர்க்கம் – தமிழ் இணையக் கல்விக்கழகம் வள் சொற்குவைத் திட்டம்.	மணிக ப்பதிகார ப ப்ப முக்கிய ராண்மை ம் முத்த இ நூல் ம் – தமி	ள் – சுடும த்தில் மணி பத்துவம் – மற்றும் புக்குளித்தல் களை மின் நு களை மின் நு	அல் மண் களி காசே _ (()	ச்சடி மன் எ லந்த வளா பெரு	த்தல் னிக பகை பட ட ண்ண நங்கட	் — மன ர் — சங் கள். 3 பராமரிப்பு ம் சார்ந் _ல் குறித் 3 ல் — தமி நண்யத்தி
உருவாக்கும் வெணிகள் – எலு அலகு – IV அணை, ஏரி, கு கால்நடைகளுக்க செயல்பாடுகள் பண்டைய அறிவ அலகு – V அறிவியல் தமிழ மென்பொருட்கள் தமிழ் அகராதிகள் TEXT BOOK: 1. தமிழக வர கல்வியில் 2. கணினித்து REFERENCES:	தாழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி ம்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலம் வளா <mark>ண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்</mark> காங்கள், மத்கு – சோழர்கால குமிழித் தூம்பின் காக வடிவமைக்கப்பட்ட கிணறுகள் – வேள – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் பு – அறிவுசார் சமூகம். அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் ழின் வளர்ச்சி – கணினிதத்தமிழ் வளர்ச்சி – தமி ர உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம ள் சொற்குவைத் திட்டம்.	மணிக ப்பதிகார பம் முக்கிய ாண்மை ம் முத்து இத் நூல் ம் – தமி வேளிய ம், சென்	ள் – சுடும த்தில் மணி பத்துவம் – மற்றும் புக்குளித்தல் களை மின் நு களை மின் நு	அல் மண் களி காசே _ (()	ச்சடி மன் எ லந்த வளா பெரு	த்தல் னிக பகை பட ட ண்ண நங்கட	் — மன ர் — சங் கள். 3 பராமரிப்பு ம் சார்ந் _ல் குறித் 3 ல் — தமி நண்யத்தி
உருவாக்கும் வெணிகள் – எலு அலகு – IV அணை, ஏரி, கு கால்நடைகளுக்க செயல்பாடுகள் பண்டைய அறிவ அலகு – V அறிவியல் தமிழ மென்பொருட்கள் தமிழ் அகராதிகள் கட்டியல் தமிழ் கைராதிகள் கல்வியில் 2. கணினித்து REFERENCES: 1. கீழடி–வைவே 2. பொருநை–	தாழிற்சாலைகள் — கல்மணிகள் — கண்ணாடி ம்புத்துண்டுகள் — தொல்லியல் சான்றுகள் — சிலம் வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட் எங்கள், மதகு — சோழர்கால குமிழித் தூம்பின் காக வடிவமைக்கப்பட்ட கிணறுகள் — வேள — கடல்சார் அறிவு — மீன்வளம் — முத்து மற்றும் பு — அறிவுசார் சமூகம். — அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் இன் வளர்ச்சி — கணினிதத்தமிழ் வளர்ச்சி — தமி ர உருவாக்கம் — தமிழ் இணையக் கல்விக்கழகம ள் சொற்குவைத் திட்டம். — லாறு — மக்களும் பண்பாடும் — கே கே பிள்ளை பணிகள் கழகம்), உலகத் தமிழாராய்ச்சி நிறுவன மிழ் முனைவர் இல. சுந்தரம், விகடன் பிரசுரம், 2	மணிக ப்பதிகார பம் முக்கிய ரான்மை ம் முத்த இது நூல் ம் – தமி வெளிய ம், சென் 2016	ள் – சுடும த்தில் மணி பத்துவம் – ப மற்றும் பக்குளித்தல் களை மின்ப களை மின்ப பிழ் மின் நூ பீடு தமிழ்நா னை, 2002	அல் மண் களி காசே _ (()	ச்சடி மன் எ லந்த வளா பெரு	த்தல் னிக பகை பட ட ண்ண நங்கட	் — மன் ர் — சங் கள். 3 பராமரிப்பு ம் சார்ந் _ல் குறித் 3 ல் — தமி நண்யத்தி

- The Contribution of the Tamil to Indian Culture (Dr.M.Valarmathi) (Puplished by International Institute of Tamil Studies).
 Keeladi 'Sangam City Civilzation on the banks of river Vaigai; (Jointly Published by: Department of Archaeology & Tamilnadu Text Book and Educational Services Corporation, Tamilnadu)
 Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author)
 Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu)
- 10. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) Reference Book.

COUF	RSE OUTCOMES:	BT Mapped
படிப்எ	oப முடித்தவுடன், மாணவர்கள்	(Highest Level)
CO1	தமிழ் கலாச்சாரம் மற்றும் தமிழ் சமூகத்தினுடைய நெசவு மற்றும் பானை தொழில்நுட்பம் பற்றி விளக்க முடியும்.	Understanding (K2)
CO2	தமிழர்களின் வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்ப ஆற்றல் பற்றி விளக்க முடியும்.	Understanding (K2)
CO3	தமிழர்களின் உற்பத்தித் தொழில்நுட்பம் பற்றி சுருக்கமாகக் கூற முடியும்.	Understanding (K2)
CO4	தமிழர்களின் வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் பற்றி விளக்க முடியும்.	Understanding (K2)
CO5	தமிழர்களின் அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் பற்றி விளக்க முடியும்.	Understanding (K2)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3		3	2	2		3		
CO2						3		3	2	2		3		
CO3						3		3	2	2		3		
CO4						3		3	2	2		3		
CO5						3		3	2	2		3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	40	60					100
CAT3	40	60					100
ESE				NA			

* ±3% may be varied (CAT 1,2,3 - 50 marks)

		22TAM02 - TAMILS AND TECHNO	LOGY					
		(Common to All Engineering and Technology	ogy Brand	hes)	1			T
Progr Bran	ramme & ch	All BE/BTech Branches	Sem.	Category	L	Т	Ρ	Credit
Prere	equisites	Nil	2/3	HS	1	0	0	1
Prear	mble	This course aims to impart the essential knowledge on the tamil	culture and	d related techno	logy			
UNIT	·-I	WEAVING AND CERAMIC TECHNOLOGY						3
Weav	ving Industr	y during Sangam Age – Ceramic technology – Black and Red War	e Potteries	s (BRW) – Graf	fiti on	Potte	eries.	
UNIT	. – II	DESIGN AND CONSTRUCTION TECHNOLOGY						3
stone Temp	es of Sanga oles of Cho	Structural construction House & Designs in household materials am age – Details of Stage Constructions in Silappathikaram – las and other worship places – Temples of Nayaka Period – Tyl - Chetti Nadu Houses, Indo – Saracenic architecture at Madras du	Sculptures pe study (and Temples Madurai Meena	of Ma	amal	lapura	am – Great
UNIT	- III	MANUFACTURING TECHNOLOGY						3
Mintir	ng of Coins	ding – Metallurgical studies – Iron industry – Iron smelting, steel – Beads making – industries Stone beads – Glass beads –Terrac n stone types described in Silappathikaram.						
UNIT	- IV	AGRICULTURE AND IRRIGATION TECHNOLOGY						3
		ds, Sluice, Significance of Kumizhi Thoompu of Chola Period, A Agro Processing – Knowledge of Sea – Fisheries – Pearl – Conche						
	ific Society.		o diving	Ancient Knowie	edge o	of Oce	ean –	Knowleage
Speci UNIT Deve	- V	SCIENTIFIC TAMIL & TAMIL COMPUTING Scientific Tamil – Tamil computing – Digitalization of Tamil Book						3
UNIT Deve Acade	- V elopment of lemy – Tam	SCIENTIFIC TAMIL & TAMIL COMPUTING						3 amil Virtual
UNIT Deve Acade	-Velopment of lemy – Tam	SCIENTIFIC TAMIL & TAMIL COMPUTING Scientific Tamil – Tamil computing – Digitalization of Tamil Bool il Digital Library – Online Tamil Dictionaries – Sorkuvai Project.	ks – Deve	lopment of Tan				3 amil Virtual
UNIT Deve Acade	-Velopment of lemy – Tam	SCIENTIFIC TAMIL & TAMIL COMPUTING Scientific Tamil – Tamil computing – Digitalization of Tamil Book	ks – Deve	lopment of Tan				3 amil Virtual
UNIT Deve Acade TEXT	Plopment of lemy – Tam F BOOK: Social Life	SCIENTIFIC TAMIL & TAMIL COMPUTING Scientific Tamil – Tamil computing – Digitalization of Tamil Bool il Digital Library – Online Tamil Dictionaries – Sorkuvai Project.	ks – Deve	lopment of Tan	nil So	ftwar	e – T	3 amil Virtual
Deve Acade TEXT 1.	Plopment of lemy – Tam F BOOK: Social Life	SCIENTIFIC TAMIL & TAMIL COMPUTING Scientific Tamil – Tamil computing – Digitalization of Tamil Book il Digital Library – Online Tamil Dictionaries – Sorkuvai Project. of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and R	ks – Deve	lopment of Tan	nil So	ftwar	e – T	3 amil Virtual
Speci UNIT Deve Acade TEXT 1.	Plopment of lemy – Tam F BOOK: Social Life Social Life ERENCES: தமிழக 6	SCIENTIFIC TAMIL & TAMIL COMPUTING Scientific Tamil – Tamil computing – Digitalization of Tamil Book il Digital Library – Online Tamil Dictionaries – Sorkuvai Project. of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and R	ks – Deve MRL – (in by: Intern யீடு தமி	lopment of Tan print) ational Institute	nil So	ftwar	e – T	3 famil Virtual Total:15
Deve Acade TEXT 1. 2. REFE 1.	Plopment of lemy – Tam F BOOK: Social Life Social Life ERENCES: தமிழக எ பணிகள்	SCIENTIFIC TAMIL & TAMIL COMPUTING Scientific Tamil – Tamil computing – Digitalization of Tamil Bool il Digital Library – Online Tamil Dictionaries – Sorkuvai Project. of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and R of the Tamils – The Classical Period (Dr.S.Sigaravelu) (Published பரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளி	ks – Deve MRL – (in by: Intern யீடு தமி	lopment of Tan print) ational Institute	nil So	ftwar	e – T	3 famil Virtual Total:15
Deve Acade TEXT 1. 2. REFE 1.	Plopment of lemy – Tam F BOOK: Social Life Social Life ERENCES: தமிழக எ	SCIENTIFIC TAMIL & TAMIL COMPUTING Scientific Tamil – Tamil computing – Digitalization of Tamil Book il Digital Library – Online Tamil Dictionaries – Sorkuvai Project. of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and R of the Tamils – The Classical Period (Dr.S.Sigaravelu) (Published வரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளி கழகம்), உலகத் தமிழாராய்ச்சி நிறுவனம், சென்னை,	ks – Deve MRL – (in by: Intern யீடு தமி 2002	lopment of Tan print) ational Institute ழ்நாடு பாடமு	nil So	ftwar	e – T	3 famil Virtual Total:15
Deve Acade TEXT 1. 2. REFE 1. 2.	F BOOK: Social Life Social Life ERENCES: தமிழக எ பணிகள் கணினி	SCIENTIFIC TAMIL & TAMIL COMPUTING Scientific Tamil – Tamil computing – Digitalization of Tamil Bool il Digital Library – Online Tamil Dictionaries – Sorkuvai Project. of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and R of the Tamils – The Classical Period (Dr.S.Sigaravelu) (Published வரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளிக் தழகம்), உலகத் தமிழாராய்ச்சி நிறுவனம், சென்னை, த்தமிழ் முனைவர் இல. சுந்தரம், விகடன் பிரசுரம், 2016	ks – Deve MRL – (in by: Intern யீடு தமி 2002	lopment of Tan print) ational Institute ழ்நாடு பாடமு	nil So	ftwar	e – T	3 famil Virtual Total:15
TEXT 1. 2. REFE 1. 2. 4.	F V elopment of lemy – Tam F BOOK: Social Life Social Life ERENCES: தமிழக எ பணிகள் கணினி கணினி	SCIENTIFIC TAMIL & TAMIL COMPUTING Scientific Tamil – Tamil computing – Digitalization of Tamil Bool il Digital Library – Online Tamil Dictionaries – Sorkuvai Project. of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and R of the Tamils – The Classical Period (Dr.S.Sigaravelu) (Published பரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளி கழகம்), உலகத் தமிழாராய்ச்சி நிறுவனம், சென்னை, த்தமிழ் முனைவர் இல. சுந்தரம், விகடன் பிரசுரம், 2016 வகை நதிக்கரையில் சங்ககால நகர நாகரிகம்.(தொல்வ	ks – Deve RMRL – (in by: Intern யீடு தமி 2002 லியல் துவ	lopment of Tan print) ational Institute ழ்நாடு பாடந	nil So of Ta நூல் ப	mil S மற்ற	e – T tudie:	3 famil Virtual Total:15 s).
TEXT 1. 2. REFE 1. 2. 3. 4.	Plopment of lemy – Tam F BOOK: Social Life Social Life ERENCES: தமிழக எ பணிகள் கணினித் கீழடி சை பொருளை Historical I Studies)	SCIENTIFIC TAMIL & TAMIL COMPUTING Scientific Tamil – Tamil computing – Digitalization of Tamil Book il Digital Library – Online Tamil Dictionaries – Sorkuvai Project. of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and R of the Tamils – The Classical Period (Dr.S.Sigaravelu) (Published மரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளி கழகம்), உலகத் தமிழாராய்ச்சி நிறுவனம், சென்னை, த்தமிழ் முனைவர் இல. சுந்தரம், விகடன் பிரசுரம், 2016 வகை நதிக்கரையில் சங்ககால நகர நாகரிகம்.(தொல்ல ந ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு-leritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukatbution of the Tamils to Indian Culture (Dr.M.Valarmathi)(Puplished	ks – Deve MRL – (in by: Intern பீடு தமி 2002 பியல் துவ நி arasu) (Pul	lopment of Tan print) ational Institute ந்நாடு பாடந றை வெளியீடு blished by : Inte	of Tai	mil S மற்று	e – T tudies பட்ட க	3 'amil Virtual Total:15 s). ல்வியில் e of Tamil
TEXT 1. 2. REFE 1. 2. 3. 4. 5.	Plopment of lemy – Tam F BOOK: Social Life Social Life Social Life ERENCES: தமிழக எ பணிகள் கணினித் கீழடி சை பொருளை Historical I Studies) The Contri	SCIENTIFIC TAMIL & TAMIL COMPUTING Scientific Tamil – Tamil computing – Digitalization of Tamil Bool il Digital Library – Online Tamil Dictionaries – Sorkuvai Project. of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and R of the Tamils – The Classical Period (Dr.S.Sigaravelu) (Published பரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளி கழகம்), உலகத் தமிழாராய்ச்சி நிறுவனம், சென்னை, த்தமிழ் முனைவர் இல. சுந்தரம், விகடன் பிரசுரம், 2016 வகை நதிக்கரையில் சங்ககால நகர நாகரிகம்.(தொல்ல ந ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavuka	ks – Deve MRL – (in by: Intern பீடு தமி 2002 பியல் துவ நி arasu) (Pul	lopment of Tan print) ational Institute ந்நாடு பாடந றை வெளியீடு blished by : Inte	of Tai	mil S மற்று	e – T tudies பட்ட க	3 'amil Virtual Total:15 s). ல்வியில் e of Tamil
TEXT 1. 2. REFE 1. 3. 4. 5. 6.	F V elopment of lemy – Tam F BOOK: Social Life Social Life Social Life ERENCES: தமிழக எ பணிகள் கணினிழ கீழடி சை பொருசை Historical H Studies) The Contri Keeladi – ' Text Book	SCIENTIFIC TAMIL & TAMIL COMPUTING Scientific Tamil — Tamil computing — Digitalization of Tamil Bool il Digital Library — Online Tamil Dictionaries — Sorkuvai Project. of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and R of the Tamils — The Classical Period (Dr.S.Sigaravelu) (Published மரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளி கழகம்), உலகத் தமிழாராய்ச்சி நிறுவனம், சென்னை, த்தமிழ் முனைவர் இல. சுந்தரம், விகடன் பிரசுரம், 2016 வகை நதிக்கரையில் சங்ககால நகர நாகரிகம்.(தொல்ல ந ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavuka bution of the Tamils to Indian Culture (Dr.M.Valarmathi)(Puplished Sangam City Civilzation on the banks of river Vaigai; (Jointly Publi	ks – Deve MRL – (in by: Intern பீடு தமி 2002 வாக்கம்) (Pul I by Interna shed by: E	lopment of Tan print) ational Institute ந்நாடு பாடந றை வெளியீ(i plished by : Inte	of Tal of Tal priல் ப rnatio of Tar Archae	ftwar mil S மற்று	e – T tudies பட்ட க	3 'amil Virtual Total:15 s). ல்வியில் e of Tamil
Speci UNIT Deve Acado TEXT 1. 2. REFE	Popular of lemy – Tam FBOOK: Social Life Social Life Social Life ERENCES: தமிழக 6 பணிகள் கணினித் கீழடி சை பொருளை Historical I Studies) The Contri Keeladi – ' Text Book Studies in Porunai Ci	Scientific Tamil — Tamil computing — Digitalization of Tamil Bool il Digital Library — Online Tamil Dictionaries — Sorkuvai Project. of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and R of the Tamils — The Classical Period (Dr.S.Sigaravelu) (Published மரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளி கழகம்), உலகத் தமிழாராய்ச்சி நிறுவனம், சென்னை, த்தமிழ் முனைவர் இல. சுந்தரம், விகடன் பிரசுரம், 2016 வகை நதிக்கரையில் சங்ககால நகர நாகரிகம்.(தொல்ல ந ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீ(Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavuka bution of the Tamils to Indian Culture (Dr.M.Valarmathi)(Puplished Sangam City Civilzation on the banks of river Vaigai; (Jointly Publiand Educational Services Corporation, Tamilnadu)	ks – Deve MRL – (in by: Intern பபீடு தமி 2002 பியல் துஎ நி arasu) (Pul I by Interna shed by: E	print) ational Institute ந்நாடு பாடந op வெளியீடு blished by : Inte	of Ta	mil S மற்று nnal li mil St eolog	e – T tudies nstitut udies	3 'amil Virtual Total:15 s). ல்வியில் e of Tamil). amilnadu

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	explain weaving and ceramic technology in tamil culture and tamil society.	Understanding (K2)
CO2	Illustrate about the design and construction technology.	Understanding (K2)
CO3	summarize about the manufacturing technology.	Understanding (K2)
CO4	explain the agriculture and irrigation technology.	Understanding (K2)
CO5	explain the significance of tamil in scientific and computing.	Understanding (K2)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3		3	2	2		3		
CO2						3		3	2	2		3		
CO3						3		3	2	2		3		
CO4						3		3	2	2		3		
CO5						3		3	2	2		3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	40	60					100
CAT3	40	60					100
ESE				NA			

 $* \pm 3\%$ may be varied (CAT 1,2,3 – 50 marks)

		(Common to All BE	(BTech branches)					
Progr Branc	amme&	All BE/BTech branches	Sem.	Category	L	Т	Р	Credit
Prere	quisites	Nil	1/2	ES	0	0	6	3
Pream	nble	This course is designed to provide found on developing a prototype model with the Processes, 3D Printing Technology, Robo	e basic knowledge of Co	omputer-aide				
LIST	OF EXPER	MENTS / EXERCISES:						
		PART A – Manufac	cturing (30 Hours)					
1.	Selection	n of product, free hand sketching and detailing	9					
2.	Construc	ction of model using Arc/TIG/MIG/Gas/Spot w	elding operations					
3.	Enhanci	ng the model with sheet metal						
4.	Creating	the parts of the model using lathe						
5.	Creating	the parts of the model using milling and drilli	ng machines					
		PART B – Product Design a	nd Development (30 H	ours)				
1.	Free har	nd sketching and detailing of the component						
2.	3D part	modelling of the component using CAD softw	are					
3.	Enginee	ring Analysis of the component model						
4.	Generat	e the component using 3D printer						
5.	Value a	ddition to the produced component using C	CNC milling machine, C	NC laser cu	tting	mac	nine a	and CNC
	1 12 2 1 2 1	PART C - Robot	tics (30 Hours)					
1.	Design o	of electronic circuit and its debugging						
2.	Interfaci	ng of sensors, actuators and wireless commu	nion modules with micro	ocontroller				
3.	Assemb	ly of Tracker Robot with accessories						
4.	Develop	ment of control strategies for motion control,	path planning and obsta	cle avoidance)			
5.	Demons	tration and testing of Robot in static environn	nent					
								Total:90
		MANUAL /SOFTWARE:						
1.	Laborato	ry Manual						

		UTCO tion of		urse, th	e stude	ents wi	l be ab	le to						BT Map _l lighest L	
CO1		•	he prot proces		model (using n	nechani	cal ope	erations	like w	elding, f	orming an		Applying (Precision	
CO2						he proto er and 0		-	dern ma	achines	like 3D p	orinter, CN		Applying (Precision	
CO3	des	sign and	d develo	op the a	utonom	ous rob	ot for re	eal-time	applica	tions				Applying (Precision	
						Маррі	ing of C	Os wit	h POs	and PS	Os				
COs/P	Os	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	3	3	3		2				3	2		2		
CO2	2	3	3	3		3				3	2		2		
COS	3	3	3	3		2				3	2		2		
1 – Slig	ght, 2	2 – Mod	erate, 3	B – Subs	stantial,	BT- Blo	om's T	axonom	ıy						

					22G	CL1	12 -				on to								JRA ⁻	Ol	ΥY	II							
Program Branch	me&		All B	E/B1	ech	bra	ınc	•			OII to	o an		_,_	1001	i Dio	111011	T	em.		Cat	ego	ry	L	Т		Р	(Credi
Prerequis	sites		Nil																1 /2			ES		0	0		6		3
Preamble)		This on the																	eng	ine	erin	g wi	ith h	ands	6-0	n ex	pei	rience
LIST OF	EXPER	RIME	NTS	/EX	ERC	ISE	S:																						
							PA	ART	ГΑ	– E	Elect	trica	al lı	nsta	alla	ion	(30	Но	urs)										
1.	Develop	o wir	ing di	agra	ms ι	ising	g so	oftw	vare	e to	ols.																		
2. lo	dentify a	and	selec	t sui	table	e cor	mp	one	ents	s for	r Ene	ergy	/ M	eas	ure	men	t an	d Ci	rcuit	Pro	ote	ction							
3. С	Design a	a wii	ring c	rcuit	inte	grat	ing	j En	nerg	gy N	/lete	er, M	ICB	3 an	d R	CCE	3												
4. C	Develop	o a w	/iring	circu	it for	r inc	and	des	cer	nt la	amp a	and	l flu	ore	sce	nt la	mp												
5. C	Develop	o and	d Inve	stiga	ite S	imp	le a	and	l Sta	airc	ase	Wiri	ing	for	Re	sider	ntial	Apı	olicat	ion	s								
6. E	Design th	the \	Viring	Cir	cuits	for	Cal	lling	g Be	ell S	Syste	em a	and	d Di	mm	able	Lig	ht											
7. C	Create w	wirin	g circ	uits	ior p	owe	er Ic	oads	S																				
8. N	Measure	eme	nt of	Earth	ı Re	sista	anc	e a	nd i	its c	conn	necti	ion	s.															
							F	PAF	RT	В –	- Inte	erne	et o	of T	hing	gs (3	80 H	lour	s)										
1. C	Design a	a Sir	ngle la	ayer	PCE	3 lay	out	t de	esig	ning	g																		
2. F	abricate	te Si	ngle	ayer	PCI	3 pri	intii	ng																					
3. A	Assembl	oling,	sold	ering	and	des	solo	deri	ing	pra	ectice	e on	ı sir	ngle	lay	er P	СВ												
4.	GPIO pro	rogra	ammi	ng in	ESF	- 282€	66																						
5. S	Sensor a	and	actua	tor i	nterf	acin	g v	vith	inte	erne	et er	nabl	led	mic	roc	ontro	oller	dev	vice										
6. S	Sensor a	and	actua	tor o	alibr	ratio	n																						
7. lı	ntegratio	ion c	of mic	roco	ntrol	ler b	as	ed :	sys	stem	n witl	th Cl	lou	d pl	atfo	rm													
							F	PAR	RT (c –	Wel	b Te	ech	no	logi	es (3	30 F	lou	rs)										
1. [Design a	a we	bsite	for a	ın ap	plic	atio	on เ	usir	ng H	ΗТМ	IL an	nd (CSS	3.														
2.	Convert	t the	desig	ned	web	site	int	o re	espo	ons	sive v	web	site	e us	ing	Boo	tstra	ap.											
3. A	Add dyna	nami	sm to	the	web	site	by	usi	ing .	Jav	/aSc	ript a	and	d er	nbe	d the	e Sc	ocial	Med	lia (cor	npor	nent	s to	the v	we	ebsite	е.	
4. lı	ncorpora	rate	datab	ase	inter	acti	on	to t	the	web	bsite	Э.																	
5. C	Deploy th	the o	devel	ped	web	site	in	the	se	erve	r.																		
																												To	otal:9
REFERE					FTV	VAR	RE:																						
-	₋aborato Eric T.Fr				eth	Roh	າຣດເ	n. "l	Hea	ad F	First	Jav	/aS	crin	t Pr	ogra	mm	nina	A Br	ain	-Fr	endl	lv G	iuide	" _. 1s	st F	Editio	on	
^{2.} C	O'Reilly	, 20	14.																						, 13	- · · L			
	Eric T.Fr															SS",2	2nd	Edi	ion,	O'F	Reil	ly , 2	2012	2					
4. L	ynn Bei	eighl	ey,"H	ead	First	SQ	L",'	1st	Edi	itin,	O'R	Reilly	y,20	007															

		UTCO tion of	MES: the co	urse, th	e stude	ents wi	ll be ab	le to						BT Map _l lighest L	
CO1	des	sign ele	ctrical v	viring ci	rcuits fo	r buildir	ngs bas	ed on th	neir requ	uiremer	nt			Applying(Precision	
CO2	dev	velop Ic	T base	d solutio	ons and	PCB fc	r real w	orld use	e cases					Applying Precision	
CO3	des	sign an	d host a	ın intera	ctive dy	/namic v	website	•						Applying(Precision	
						Марр	ing of C	Os wit	h POs	and PS	Os				
COs/P	Os	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO	1	3	2	2	1					1					
CO2	2	3	2	2	1					1					
COS	3	3	2	2	1					1					
1 – Sli	ght, 2	2 – Mod	lerate, 3	– Subs	stantial,	BT- Blo	om's T	axonom	ıy	ı	1		1	ı	

	(Common to All Engineering and Technology	Branche	s)				
Programme & Branch	All B.E./B.Tech. Branches	Sem.	Category	L	Т	Р	Cr
Prerequisites	Communication Skills I	2	HS	3	0	0	
Preamble	This course is designed to equip students with the necessary develop their linguistic and communicative competencies.	skills to li	sten, read, w	rite a	ınd sı	peak s	o as t
Unit – I	Grammar, Vocabulary, Listening, Speaking, Reading & Wi	riting					9
substitution - Lis	ence Patterns - Simple, Compound & Complex sentences - Vestening: Speeches from company CEOs - TV debates Spealing for Gist - Writing: Job application letter with resume - Transco	king: Jus					
Unit – II	Grammar, Vocabulary, Listening, Speaking, Reading & Wi	riting					9
Talking about co	ord - Vocabulary: Phrasal verbs - Idioms & Phrases - Liste elebrities - Practicing Pronunciation through web tools - Renciples of a machine - Writing: Description: Person, Place, Proce	eading:	Company c	orres			
Unit – III	Grammar, Vocabulary, Listening, Speaking, Reading & W	riting					9
company profiles Unit – IV	t lectures - Speaking: Technical & Non-technical presentations, Business Plans - Writing: a dream job/company - Letter to the Grammar, Vocabulary, Listening, Speaking, Reading & Wites of Comparison - Punctuations - Fragments & run-ons - Vocabulary	Editor – E riting	Biography & A	utok	oiogra	aphy - (Checl
Unit – IV Grammar: Degratistening: Lister commentaries – I	Grammar, Vocabulary, Listening, Speaking, Reading & Wieses of Comparison - Punctuations - Fragments & run-ons - Vocabulary to global accents - listening to motivational speeches - Spewovie Enactment - Reading: Narrative passages - Writing: En	Editor – E riting Ibulary: E eaking: N	Biography & A British & Ame Narrating pers	utok ericai sona	n - Sp	pelling	Shec 9 & wo s - Sp
Unit – IV Grammar: Degratistening: Lister commentaries - Technical reports Unit – V	Grammar, Vocabulary, Listening, Speaking, Reading & Wieses of Comparison - Punctuations - Fragments & run-ons - Vocabular to global accents - listening to motivational speeches - Spewovie Enactment - Reading: Narrative passages - Writing: Engrammar, Vocabulary, Listening, Speaking, Reading & Wieses of Comparison - Punctuations - Fragments & run-ons - Vocabulary to motivational speeches - Spewovie Enactment - Reading: Narrative passages - Writing: Engrammar, Vocabulary, Listening, Speaking, Reading & Wieses of Comparison - Punctuations - Fragments & run-ons - Vocabulary - Vocabulary - Punctuations - Fragments & run-ons - Vocabulary - Vocabulary - Punctuations - Fragments & run-ons - Vocabulary - Vocabulary - Punctuations - Fragments & run-ons - Vocabulary - Vocabulary - Punctuations - Fragments & run-ons - Vocabulary - Vocabulary - Vocabulary - Punctuations - Fragments & run-ons - Vocabulary - Vocabulary - Vocabulary - Vocabulary - Vocabulary - Punctuations - Fragments & run-ons - Vocabulary	Editor - E riting abulary: E eaking: N nail - Age	Biography & A British & Ame Narrating persenda & Minut	ricar sona es o	n - Sp Il mile f Mee	pelling estones	9 & wo s - Sp Spec
Company profiles Unit – IV Grammar: Degree Listening: Lister commentaries – I Technical reports Unit – V Grammar: Purport Listening to sam speeches/conver	Grammar, Vocabulary, Listening, Speaking, Reading & Wieses of Comparison - Punctuations - Fragments & run-ons - Vocabulary to global accents - listening to motivational speeches - Spewovie Enactment - Reading: Narrative passages - Writing: Engine	Editor – E riting bulary: E eaking: N nail - Age riting oding & E ess, rhyth hes - Ne	British & Ame Narrating persenda & Minut Decoding - Alm & Intonati wspaper repo	ericar sona es o	n - Sp Il mile f Mee	pelling estones eting - est - L	Spec 9 8 wo s - Spec 9 isten ungunical
Company profiles Unit – IV Grammar: Degree Listening: Lister commentaries – I Technical reports Unit – V Grammar: Purport Listening to sam speeches/conver	Grammar, Vocabulary, Listening, Speaking, Reading & Wiese of Comparison - Punctuations - Fragments & run-ons - Vocabulary to global accents - listening to motivational speeches - Spewovie Enactment - Reading: Narrative passages - Writing: English Grammar, Vocabulary, Listening, Speaking, Reading & Wiese and Function - If clause - Error detection - Vocabulary: Copple HR Interviews - Speaking: Introduction to phonetics - Stressations - Giving feedback - Debate - Reading: Key Note speece	Editor – E riting bulary: E eaking: N nail - Age riting oding & E ess, rhyth hes - Ne	British & Ame Narrating persenda & Minut Decoding - Alm & Intonati wspaper repo	ericar sona es o	n - Sp Il mile f Mee	pelling estones eting - est - L	9 & wo s - Sp Spec 9 isten
company profiles Unit – IV Grammar: Degretistening: Lister commentaries – Technical reports Unit – V Grammar: Purport Listening to sam speeches/convertistening to sam speeches/convertisten	Grammar, Vocabulary, Listening, Speaking, Reading & Wiese of Comparison - Punctuations - Fragments & run-ons - Vocabulary to global accents - listening to motivational speeches - Spewovie Enactment - Reading: Narrative passages - Writing: English Grammar, Vocabulary, Listening, Speaking, Reading & Wiese and Function - If clause - Error detection - Vocabulary: Copple HR Interviews - Speaking: Introduction to phonetics - Stressations - Giving feedback - Debate - Reading: Key Note speece	Editor – E riting Ibulary: E eaking: N nail - Age riting oding & E ess, rhyth hes - Ne nnical pro	British & Ame Narrating perenda & Minut Decoding - Alm & Intonati wspaper repoposals	ericai esona es o phal on -	n - Spil mile f Mee	pelling estones eting - Lest - Ledd & rt techr	Spec 9 8 wo s - Spec 9 isten ungunical
company profiles Unit – IV Grammar: Degretistening: Lister commentaries – Technical reports Unit – V Grammar: Purport Listening to sam speeches/convertistening to sam speeches/convertisten	Grammar, Vocabulary, Listening, Speaking, Reading & Wieses of Comparison - Punctuations - Fragments & run-ons - Vocabulary to global accents - listening to motivational speeches - Special Grammar, Vocabulary, Listening, Speaking, Reading & Wiese and Function - If clause - Error detection - Vocabulary: Cople HR Interviews - Speaking: Introduction to phonetics - Stresations - Giving feedback - Debate - Reading: Key Note speeciting: Circulars - Critical Appreciation of a non-detailed text - Tech	Editor – E riting Ibulary: E eaking: N nail - Age riting oding & E ess, rhyth hes - Ne nnical pro	British & Ame Narrating perenda & Minut Decoding - Alm & Intonati wspaper repoposals	ericai esona es o phal on -	n - Spil mile f Mee	pelling estones eting - Lest - Ledd & rt techr	Spec 9 8 wo s - Spec 9 isten ungunical
Company profiles Unit – IV Grammar: Degretistening: Lister Commentaries - Technical reports Unit – V Grammar: Purport Listening to sam speeches/converting from journals Wr TEXT BOOK: 1. Sanjay F REFERENCES: Meenaks	Grammar, Vocabulary, Listening, Speaking, Reading & Wieses of Comparison - Punctuations - Fragments & run-ons - Vocabulary to global accents - listening to motivational speeches - Special Grammar, Vocabulary, Listening, Speaking, Reading & Wiese and Function - If clause - Error detection - Vocabulary: Cople HR Interviews - Speaking: Introduction to phonetics - Stresations - Giving feedback - Debate - Reading: Key Note speeciting: Circulars - Critical Appreciation of a non-detailed text - Tech	Editor – E riting Ibulary: E eaking: N nail - Age riting oding & E ess, rhyth hes - Ne nnical pro	Biography & A British & Ame Narrating persenda & Minut Decoding - Al m & Intonati wspaper report posals y Press, New	erical sona es o	n - Sp I mile I mile I moet te - Guiu - shoo	pelling estones eting - Lest - Leded & rt technists	Shecing Shecign Shecing Shecing Shecing Shecing Shecing Shecing Shecing Shecin
Company profiles Unit – IV Grammar: Degretistening: Lister Commentaries – Technical reports Unit – V Grammar: Purport Listening to sam speeches/convert from journals Wr TEXT BOOK: 1. Sanjay F REFERENCES: Meenaks Universit	Grammar, Vocabulary, Listening, Speaking, Reading & Wieses of Comparison - Punctuations - Fragments & run-ons - Vocabulary to global accents - listening to motivational speeches - Specific Enactment - Reading: Narrative passages - Writing: Enactment - Reading: Narrative passages - Writing: Enactment - If clause - Error detection - Vocabulary: Cople HR Interviews - Speaking: Introduction to phonetics - Stresations - Giving feedback - Debate - Reading: Key Note speeciting: Circulars - Critical Appreciation of a non-detailed text - Technical Communication - Fragment - Reading - Letter to the Interview - Vocabulary - Vocabulary - Communication - Fragment - Vocabulary - Vocabulary - Cople HR Interviews - Speaking: Introduction to phonetics - Stresations - Giving feedback - Debate - Reading: Key Note speeciting: Circulars - Critical Appreciation of a non-detailed text - Technical Communication - Fragment - Vocabulary - V	Editor – E riting Ibulary: E eaking: N nail - Age riting oding & E ess, rhyth hes - Ne nnical pro University	British & Ame Narrating persenda & Minut Decoding - Alm & Intonati wspaper reposals y Press, New and Practice	uttob ricar sona es o phal on - Dell	n - Spin	pelling estones eting - Lest - Leded & rt technists	Spece 9 ister ungunical

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	use functional grammar for improving communication skills	Applying (K3)
CO2	listen and comprehend different accents and infer implied meanings	Applying (K3)
CO3	speak clearly, initiate and sustain a discussion and negotiate using appropriate communicative strategies	Creating (K6)
CO4	read different genres of texts, infer implied meanings and critically analyze and evaluate them	Understanding (K2)
CO5	produce different types of narrative, descriptive expository texts and understand creative, critical, analytical and evaluative writing	Creating (K6)
	Mapping of COs with POs and PSOs	

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12
CO1						2			1	3	1	1
CO2									2	3		1
CO3									2	3		2
CO4						1				3	1	1
CO5										3		2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		37	30			33	100
CAT2		7	50			43	100
CAT3		17	50			33	100
ESE		15	45			40	100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	(Common to CIVIL, MECH, MTS, ECE, EEE, E	IE & FT b	ranches)				
Programme & Branch	B.E & Civil, Mech, MTS, ECE, EEE, EIE & FT branches	Sem.	Category	L	Т	P	Credit
Prerequisites	Nil	2	BS	3	1*	2 *	4
Preamble	To impart the knowledge of partial derivatives, evaluated calculus and analytic functions to the students for solvir disciplines.						
Unit – I	Functions of Several Variables:						9
	o or more variables – Partial derivatives – Total differential Maxima and minima – Constrained maxima and minima – L Multiple Integrals:					f two	variables 9
	on in cartesian coordinates – Change of order of integrati	on – Appl	ication: Area	bet	weer	ı two	_
Triple integration	n in cartesian coordinates – Volume as triple integrals.						
Unit – III	Vector Calculus:						9
Solenoidal and	rative – Gradient of a scalar point function – Divergence of rrotational vectors – Vector Integration: Introduction – Green Verification of the above theorems and evaluation of integration	en's, Stok	e's and Gaus				
Unit – IV	Analytic Functions:						9
Riemann equate Construction of	complex variable – Analytic functions – Necessary and suf- ions (Statement only) – Properties of analytic functio analytic function – Applications: Fluid flow – Conform	n (Statem	ent only) -	- Ha	rmor	nic fu	unction –
transformation. Unit – V	Complex Integration						9
	Complex Integration: auchy's theorem (without proof) – Cauchy's integral formul	a – Taylor	's and I aure	nt se	eries	– Sir	
 Classification 	 Cauchy's residue theorem (without proof) – Applications 	u . u.j.o.				· · · ·	.94.4
		: Evaluatio	n of definite	inte	grals	invo	lving sine
	tions over the circular contour.	: Evaluatio	n of definite	inte	grals	invo	lving sine
and cosine func		: Evaluatio	n of definite	inte	grals	invo	lving sine
and cosine func	tions over the circular contour.	: Evaluatio	on of definite	inte	grals	invo	lving sine
LIST OF EXPERIMENT OF LIST OF EXPERIMENT OF	tions over the circular contour. RIMENTS / EXERCISES:	: Evaluatio	on of definite	inte	grals	invo	lving sine
LIST OF EXPERIMENT OF EXPERIME	RIMENTS / EXERCISES: ordinary and partial derivatives	: Evaluatio	on of definite	inte	grals	invo	lving sine
LIST OF EXPE1. Finding2. Comput3. Evaluati	RIMENTS / EXERCISES: ordinary and partial derivatives ng extreme values of function of two variables	: Evaluatio	on of definite	inte	grals	invo	lving sine
 LIST OF EXPE 1. Finding 2. Comput 3. Evaluati 4. Finding 	RIMENTS / EXERCISES: Ordinary and partial derivatives ng extreme values of function of two variables ng double and triple integrals	: Evaluatio	on of definite	inte	grals	invo	lving sine
 and cosine func LIST OF EXPEI 1. Finding 2. Comput 3. Evaluati 4. Finding 5. Comput 	RIMENTS / EXERCISES: Ordinary and partial derivatives Ing extreme values of function of two variables Ing double and triple integrals Ithe area between two curves	: Evaluatio	on of definite	inte	grals	invo	lving sine
 and cosine func LIST OF EXPEI 1. Finding 2. Comput 3. Evaluati 4. Finding 5. Comput 6. Applying 	RIMENTS / EXERCISES: Ordinary and partial derivatives Ing extreme values of function of two variables Ing double and triple integrals Ithe area between two curves Ing gradient, divergence and curl of point functions	: Evaluatio	on of definite	inte	grals	invo	lving sine
And cosine functions LIST OF EXPERMITE 1. Finding 2. Comput 3. Evaluati 4. Finding 5. Comput 6. Applying 7. Determite	RIMENTS / EXERCISES: Ordinary and partial derivatives Ing extreme values of function of two variables Ing double and triple integrals Ithe area between two curves Ing gradient, divergence and curl of point functions In Milne-Thomson method for constructing analytic function	: Evaluation	on of definite	inte	grals	invo	lving sine
And cosine functions LIST OF EXPERMINATION 1. Finding 2. Comput 3. Evaluati 4. Finding 5. Comput 6. Applying 7. Determination	RIMENTS / EXERCISES: Ordinary and partial derivatives Ing extreme values of function of two variables Ing double and triple integrals Ithe area between two curves Ing gradient, divergence and curl of point functions If Milne-Thomson method for constructing analytic function Ination of Mobius transformation for the given set of points Indicate the circular contour.		on of definite				
And cosine functions LIST OF EXPEI 1. Finding 2. Comput 3. Evaluati 4. Finding 5. Comput 6. Applying 7. Determi 8. Finding	RIMENTS / EXERCISES: Ordinary and partial derivatives Ing extreme values of function of two variables Ing double and triple integrals Ithe area between two curves Ing gradient, divergence and curl of point functions If Milne-Thomson method for constructing analytic function Ination of Mobius transformation for the given set of points Indicate the circular contour.		on of definite				
and cosine functions LIST OF EXPERMITE 1. Finding 2. Comput 3. Evaluati 4. Finding 5. Comput 6. Applying 7. Determi 8. Finding TEXT BOOK: 1. Ramana	RIMENTS / EXERCISES: Ordinary and partial derivatives Ing extreme values of function of two variables Ing double and triple integrals Ithe area between two curves Ing gradient, divergence and curl of point functions If Milne-Thomson method for constructing analytic function Ination of Mobius transformation for the given set of points Indicate the circular contour.	ture:45, T	utorials and	l Pra	ctica	al:15,	Total:60
And cosine functions and cosine functions. LIST OF EXPERATE 1. Finding 2. Comput 3. Evaluati 4. Finding 5. Comput 6. Applying 7. Determi 8. Finding TEXT BOOK: 1. Ramana New De	RIMENTS / EXERCISES: predinary and partial derivatives Ing extreme values of function of two variables Ing double and triple integrals Ithe area between two curves Ing gradient, divergence and curl of point functions If Milne-Thomson method for constructing analytic function Ination of Mobius transformation for the given set of points In poles and residues of an analytic function Lec B V, "Higher Engineering Mathematics", 1st Edition, Tail	ture:45, T	utorials and	l Pra	ctica	al:15,	Total:60
And cosine functions LIST OF EXPERMITE 1. Finding 2. Comput 3. Evaluati 4. Finding 5. Comput 6. Applying 7. Determi 8. Finding TEXT BOOK: 1. Ramana New Determine Text Represented the second representation of the seco	RIMENTS / EXERCISES: Ordinary and partial derivatives Ing extreme values of function of two variables Ing double and triple integrals Ithe area between two curves Ing gradient, divergence and curl of point functions If Milne-Thomson method for constructing analytic function Ination of Mobius transformation for the given set of points In poles and residues of an analytic function Lec B V, "Higher Engineering Mathematics", 1st Edition, Tarki, 2018.	ture:45, T	utorials and	l Pr a	Com	al:15,	Total:60
and cosine functions LIST OF EXPEI 1. Finding 2. Comput 3. Evaluati 4. Finding 5. Comput 6. Applying 7. Determi 8. Finding TEXT BOOK: 1. Ramana New De REFERENCES/ 1. Kreyszig 2. Kandasa Reprint	RIMENTS / EXERCISES: pordinary and partial derivatives Ing extreme values of function of two variables Ing double and triple integrals Ithe area between two curves Ing gradient, divergence and curl of point functions If Milne-Thomson method for constructing analytic function Ination of Mobius transformation for the given set of points In poles and residues of an analytic function Lec B V, "Higher Engineering Mathematics", 1st Edition, Tarki, 2018. In MANUAL / SOFTWARE: In E, "Advanced Engineering Mathematics ", 10th Edition, John Manual P., Thilagavathy K. and Gunavathy K., "Engineering Edition 2014, S.Chand and Co., New Delhi	ture:45, T ta McGrav nn Wiley, N	utorials and v-Hill Publish New Delhi, In	l Pra ning	Com 2016 Year	al:15,	Total:60 / Limited,
1. Finding 2. Comput 3. Evaluati 4. Finding 5. Comput 6. Applying 7. Determi 8. Finding TEXT BOOK: 1. Ramana New De REFERENCES/ 1. Kreyszig 2. Kandasa Reprint I 3. Duraisan	RIMENTS / EXERCISES: Ordinary and partial derivatives Ing extreme values of function of two variables Ing double and triple integrals Ithe area between two curves Ing gradient, divergence and curl of point functions I Milne-Thomson method for constructing analytic function I mation of Mobius transformation for the given set of points I pooles and residues of an analytic function Lec B V, "Higher Engineering Mathematics", 1st Edition, Tarki, 2018. I MANUAL / SOFTWARE: E, "Advanced Engineering Mathematics ", 10th Edition, John Manual P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics ", 10th Edition, John Manual P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics ", 10th Edition, John Manual P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics ", 10th Edition, John Manual P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics ", 10th Edition, John Manual P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics ", 10th Edition, John Manual P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics ", 10th Edition, John Manual P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics ", 10th Edition, John Manual P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics ", 10th Edition, John Manual P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics ", 10th Edition, John Manual P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics ", 10th Edition, John Manual P., Thilagavathy K., "Engineering Mathematics ", 10th Edition, John Manual P., "Engineering Mathematics ", 10th Edition, John Manual P., "Engineering Mathematics ", 10th Edition, John Manual P., "Engineering Mathematics ", 10th Edition, John Mathematics ", 10th Edition Mathematics ", 10th Edition Mathematics ", 10th Edition Mathematics ", 10th Edition Mathematics ", 10t	ture:45, T ta McGrav nn Wiley, N	utorials and v-Hill Publish New Delhi, In	l Pra ning	Com 2016 Year	al:15,	Total:60 / Limited,
And cosine functions LIST OF EXPEI 1. Finding 2. Comput 3. Evaluati 4. Finding 5. Comput 6. Applying 7. Determi 8. Finding TEXT BOOK: 1. Ramana New De REFERENCES/ 1. Kreyszig 2. Kandasa Reprint I 3. Duraisar Pearson	RIMENTS / EXERCISES: pordinary and partial derivatives Ing extreme values of function of two variables Ing double and triple integrals Ithe area between two curves Ing gradient, divergence and curl of point functions If Milne-Thomson method for constructing analytic function Ination of Mobius transformation for the given set of points In poles and residues of an analytic function Lec If MANUAL / SOFTWARE: If Ithe Higher Engineering Mathematics In 10th Edition, John Manual Properties If Ithe Higher Engineering Mathematics In 10th Edition, John Manual Properties Ithe Higher Engineering Mathematics In 10th Edition, John Manual Properties Ithe Higher Engineering Mathematics In 10th Edition, John Manual Properties Ithe Higher Engineering Mathematics In 10th Edition, John Manual Properties Ithe Higher Engineering Mathematics In 10th Edition, John Manual Properties Ithe Higher Engineering Mathematics In 10th Edition, John Manual Properties Ithe Higher Engineering Mathematics In 10th Edition, John Manual Properties Ithe Higher Engineering Mathematics In 10th Edition, John Manual Properties Ithe Higher Engineering Mathematics In 10th Edition, John Manual Properties Ithe Higher Engineering Mathematics In 10th Edition, John Manual Properties Ithe Higher Engineering Mathematics In 10th Edition, John Manual Properties Ithe Higher Engineering Mathematics In 10th Edition, John Manual Properties Ithe Higher Engineering Mathematics In 10th Edition, John Manual Properties Ithe Higher Engineering Mathematics In 10th Edition, John Manual Properties Ithe Higher Engineering Mathematics In 10th Edition, John Manual Properties Ithe Higher Engineering Mathematics In 10th Edition, John Manual Properties Ithe Higher Engineering Mathematics In 10th Edition, John Manual Properties Ithe Higher Engineering Mathematics In 10th Edition In 10t	ture:45, T ta McGrav nn Wiley, N ng Mathen	utorials and v-Hill Publish New Delhi, In natics For Feering Mathe	Praning idia, First	Com 2016 Year	al:15,	Total:60 / Limited,

	SE OUTCOMES: npletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	compute the total derivatives and extreme values of multivariable functions.	Applying (K3), Manipulation (S2)
CO2	evaluate multiple integrals and apply them to compute the area and volume of the regions.	Applying (K3), Manipulation (S2)
CO3	apply the concepts of derivatives and line integrals of vector functions in engineering problems.	Applying (K3), Manipulation (S2)
CO4	construct analytic functions and bilinear transformations and determine the image of given region under the given conformal mapping.	Applying (K3), Manipulation (S2)
CO5	apply the techniques of complex integration to evaluate real and complex integrals over suitable closed curves.	Applying (K3), Manipulation (S2)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2		3									
CO2	3	3	2		3									
CO3	3	3			3									
CO4	3	3			2									
CO5	3	3	3		2									

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

		/ COCLOCIIILITI	. ,				
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	30	60				100
CAT2	10	30	60				100
CAT3	10	30	60				100
ESE	10	30	60				100
* . 00/	-L/CAT 4 O 9 O 4	-0 de- 0	400				

^{* ±3%} may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

^{*}Alternate week

	22PHT23 – PHYSICS FOR F	FOOD TECHNOLOGY					
Programme & Branch	B.Tech- Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	2	BS	3	0	0	3
Preamble	This course aims to impart the knowledge or microwaves, nanomaterials, select crystal grow the applications of aforementioned topics in foo	th and materials charac					
Unit – I	Magnetic and Dielectric materials:						9
detector and ma	 Domain theory of ferromagnetism - Hysteresis gnetic inductive flow meter - Dielectric materials emperature dependence of polarization - dielectric Ultrasonic and Microwaves: 	- Dielectric constant -	- Types of p	olariz	zatior	n (qua	alitative)
Ultrasonics – Pro sing acoustic gra	perties – Magnetostrictive generator – Piezoelectric ting – Non-destructive testing – Flaw detection – crowaves into heat – Penetration depth – Application	Applications of ultraso	nics in food				in a liqui
Unit – III	Nanomaterials:	iis oi iiiiciowaves iii ioo	u iriuusiry.				9
Synthesis techni	face-to-volume ratio – Quantum confinement – Nan ques: Ball milling, physical vapour deposition, cl tures, properties and synthesis by laser ablation	hemical vapour depos	ition and sol	-gel	meth	nods	Carbo
Synthesis techni nanotubes: struc processing and p Unit – IV Nucleation – CI heterogeneous no	ques: Ball milling, physical vapour deposition, clures, properties and synthesis by laser ablation ackaging. Crystal growth: assical theory of nucleation – Critical radius a ucleation – Free energy formation of critical nucleus	hemical vapour depos method – Industrial a and critical free energ one Crystal growth techn	ition and sol applications of y (qualitative iques: Melt gr	-gel of na) – owth	meth anom Hom – Br	nods ateria nogen idgma	CarboIs in foo9eous an
Synthesis techni nanotubes: struc processing and p Unit – IV Nucleation – CI heterogeneous ni – Solution growth	ques: Ball milling, physical vapour deposition, clures, properties and synthesis by laser ablation ackaging. Crystal growth: assical theory of nucleation – Critical radius a ucleation – Free energy formation of critical nucleus – High temperature solution growth – Low tempera	hemical vapour depos method – Industrial a and critical free energ one Crystal growth techn	ition and sol applications of y (qualitative iques: Melt gr	-gel of na) – owth	meth anom Hom – Br	nods ateria nogen idgma	CarboIs in foo9eous an an metho
Synthesis techni nanotubes: struc processing and p Unit – IV Nucleation – CI heterogeneous n – Solution growth Unit – V Importance of m	ques: Ball milling, physical vapour deposition, clures, properties and synthesis by laser ablation ackaging. Crystal growth: assical theory of nucleation – Critical radius a ucleation – Free energy formation of critical nucleus	hemical vapour depos method – Industrial and critical free energ s – Crystal growth techn ture solution growth – E	ition and sol applications of y (qualitative iques: Melt gr examples in for electron mice	-gel of na) – owth ood p	Hom i – Br roces	nods ateria nogen idgma ssing.	- Carbo ls in foo 9 eous an an metho
Synthesis techni nanotubes: struc processing and p Unit – IV Nucleation – Cl heterogeneous n – Solution growth Unit – V Importance of m	ques: Ball milling, physical vapour deposition, clures, properties and synthesis by laser ablation ackaging. Crystal growth: assical theory of nucleation – Critical radius a ucleation – Free energy formation of critical nucleus – High temperature solution growth – Low tempera Materials characterization: aterials characterization – X-ray diffraction(powde	hemical vapour depos method – Industrial and critical free energ s – Crystal growth techn ture solution growth – E	ition and sol applications of y (qualitative iques: Melt gr examples in for electron mice	-gel of na) – owth ood p	Hom i – Br roces	nods ateria nogen idgma ssing.	 Carbo g eous an an metho g nsmissio
Synthesis techni nanotubes: struc processing and p Unit – IV Nucleation – Cl heterogeneous n – Solution growth Unit – V Importance of m	ques: Ball milling, physical vapour deposition, clures, properties and synthesis by laser ablation ackaging. Crystal growth: assical theory of nucleation – Critical radius a ucleation – Free energy formation of critical nucleus – High temperature solution growth – Low tempera Materials characterization: aterials characterization – X-ray diffraction(powde	hemical vapour depos method – Industrial and critical free energ s – Crystal growth techn ture solution growth – E	ition and sol applications of y (qualitative iques: Melt gr examples in for electron mice	-gel of na) – owth ood p	Hom i – Br roces	nods ateria nogen idgma ssing.	— Carbo Is in foo 9 eous an an metho 9 nsmissio
Synthesis techninanotubes: structure processing and punit – IV Nucleation – Cleater of the processing and punit – V Nucleation – Cleater of processing and punit – V Importance of melectron microscommic of the processing and punit – V TEXT BOOK: 1. Avadhan Company	ques: Ball milling, physical vapour deposition, clures, properties and synthesis by laser ablation ackaging. Crystal growth: assical theory of nucleation – Critical radius a ucleation – Free energy formation of critical nucleus – High temperature solution growth – Low tempera Materials characterization: aterials characterization – X-ray diffraction(powde upe (qualitative) – UV-visible spectroscopy – Ramar ulu M.N., Kshirsagar P.G. and Arun Murthy T.V.S., y Pvt. Ltd., New Delhi, 2019. (Units I,II,III,IV)	hemical vapour depose method – Industrial and critical free energy – Crystal growth techniture solution growth – Ear method) – Scanning in spectroscopy – Different – Crystal growth – Ear method) – Scanning in spectroscopy – Different – Crystal growth – Ear method) – Scanning in spectroscopy – Different – Crystal growth – Crysta	y (qualitative iques: Melt grexamples in for electron micential scanning ering Physics"	-gel of na	Hom - Br roces ope orime	nods ateria nogen idgma ssing. – Tra etry.	- Carbo Is in foo 9 eous an metho 9 nsmissio Total:4
Synthesis techninanotubes: structure processing and punit – IV Nucleation – Cleaterogeneous number of the policy of the punit – V Importance of multiple of the punit – V TEXT BOOK: 1. Avadhan Company Sam Zhan Zhan Zhan Company structure of the punit of the puni	ques: Ball milling, physical vapour deposition, clures, properties and synthesis by laser ablation ackaging. Crystal growth: assical theory of nucleation – Critical radius a ucleation – Free energy formation of critical nucleus – High temperature solution growth – Low tempera Materials characterization: aterials characterization – X-ray diffraction(powde upe (qualitative) – UV-visible spectroscopy – Ramar ulu M.N., Kshirsagar P.G. and Arun Murthy T.V.S.,	hemical vapour depose method – Industrial and critical free energy – Crystal growth techniture solution growth – Ear method) – Scanning in spectroscopy – Different – Crystal growth – Ear method) – Scanning in spectroscopy – Different – Crystal growth – Ear method) – Scanning in spectroscopy – Different – Crystal growth – Crysta	ition and solapplications of applications of a	-gel of na	Hom - Br roces ope orime	nods ateria nogen idgma ssing. – Tra etry.	- Carbo Is in foo 9 eous an metho 9 nsmissio Total:4
Synthesis techninanotubes: structor processing and positive processing proce	ques: Ball milling, physical vapour deposition, clures, properties and synthesis by laser ablation ackaging. Crystal growth: assical theory of nucleation – Critical radius a ucleation – Free energy formation of critical nucleus – High temperature solution growth – Low tempera Materials characterization: aterials characterization – X-ray diffraction(powde upe (qualitative) – UV-visible spectroscopy – Ramar ulu M.N., Kshirsagar P.G. and Arun Murthy T.V.S., y Pvt. Ltd., New Delhi, 2019. (Units I,II,III,IV)	hemical vapour depose method – Industrial and critical free energy – Crystal growth techniture solution growth – Ear method) – Scanning in spectroscopy – Different – Crystal growth – Ear method) – Scanning in spectroscopy – Different – Crystal growth – Ear method) – Scanning in spectroscopy – Different – Crystal growth – Crysta	ition and solapplications of applications of a	-gel of na	Hom - Br roces	nods ateria nogen idgma ssing. – Tra etry.	- Carbo Is in foo 9 eous an an metho 9 nsmissio Total:4
Synthesis techninanotubes: structor processing and postulation of the terogeneous notes and postulation of the terogeneous notes are solution growth the terogeneous notes are solution and the terogeneous notes are solutions are solutions. The terogeneous notes are solutions are solutions are solutions are solutions. The terogeneous notes are solutions are solutions are solutions are solutions are solutions. The terogeneous notes are solutions are solutions are solutions are solutions. The terogeneous notes are solutions are solutions are solutions are solutions are solutions. The terogeneous notes are solutions are solutions are solutions are solutions are solutions are solutions. The terogeneous notes are solutions are solutions are solutions are solutions are solutions. The terogeneous notes are solutions are solutions are solutions are solutions are solutions. The terogeneous notes are solutions are solutions are solved as a solution are solved are solved as a solution are solved as a	ques: Ball milling, physical vapour deposition, clures, properties and synthesis by laser ablation ackaging. Crystal growth: assical theory of nucleation – Critical radius a ucleation – Free energy formation of critical nucleus – High temperature solution growth – Low tempera Materials characterization: aterials characterization – X-ray diffraction(powde upe (qualitative) – UV-visible spectroscopy – Ramar ulu M.N., Kshirsagar P.G. and Arun Murthy T.V.S., y Pvt. Ltd., New Delhi, 2019. (Units I,II,III,IV)	hemical vapour depose method – Industrial and critical free energy — Crystal growth techniture solution growth – Ear method) – Scanning in spectroscopy – Different — "A Textbook of Engineer action Techniques", 1st Earli	y (qualitative iques: Melt greamples in for electron micential scanning ering Physics"	-gel of na) - owth od p crosc g cal , 11 ^{tt}	Homin - Britanom	nods ateria nogen idgmassing. – Traetry.	- Carbo Is in foo 9 eous an an metho 9 nsmissio Total:4
Synthesis techninanotubes: structor processing and postulation in the processing and processing in the process	ques: Ball milling, physical vapour deposition, clures, properties and synthesis by laser ablation ackaging. Crystal growth: assical theory of nucleation – Critical radius a ucleation – Free energy formation of critical nucleus – High temperature solution growth – Low tempera Materials characterization: asterials characterization – X-ray diffraction(powde ppe (qualitative) – UV-visible spectroscopy – Raman provided (ppe (qualitative) – UV-visible spectroscopy – UV-visible spectrosco	hemical vapour depose method – Industrial and critical free energy – Crystal growth techniture solution growth – Ever method) – Scanning in spectroscopy – Different eation Techniques", 1st Eval Properties – Measur	y (qualitative iques: Melt greamples in for electron micential scanning ering Physics"	-gel of na) - owth od p crosc g cal Press	Homin - Britanom	nods ateria nogen idgmassing. – Traetry.	— Carbo Is in foo 9 eous an an metho 9 nsmissio Total:4

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	apply the concepts of ferromagnetism to comprehend the working of metal detector, magnetic inductive flow meter and also to describe the phenomena related to dielectric polarization, dielectric loss and dielectric breakdown, and the application of dielectrics.	Applying (K3)
CO2	describe the production of ultrasonic wave, working of acoustic grating & non-destructive testing using ultrasonic waves and also to explain the uses of microwaves in food industry.	Applying (K3)
CO3	utilize appropriate techniques to prepare nanomaterials and carbon nanotubes, and to comprehend their features and applications.	Understanding (K2)
CO4	utilize appropriate theory and models of select crystal growth techniques to grow crystals.	Applying (K3)
CO5	apply the concepts of Raman effect, X-ray diffraction, matter waves and thermogram to describe the principle and working of select material characterization techniques.	Applying (K3)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2						2	2		2	2	2
CO2	3	2	2						2	2		2	3	3
CO3	3	2	2						2	2		2	3	3
CO4	3	2	2						2	2		2	3	3
CO5	3	2	2						2	2		2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Tota %
CAT1	15	55	30				100
CAT2	15	55	30				100
CAT3	15	55	30				100
ESE	10	55	35				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

D	OF FOOD MATE	INIALS				
Programme & B.Tech & Food Technology	Sem.	Category	L	T	Р	Credit
Prerequisites Physics for Food Technology	2/3	PC	3	0	0	3
Preamble To impart knowledge on physical, thermal, optical, el food materials and its measurement methods	ectromagnetic, rho	eological and	textu	ral pr	opert	ties of
Unit – I Physical Properties:						9
Importance of engineering properties, Physical properties of food materiarea – definitions and measurements, Frictional properties –coefficient or rolling resistance and angle of internal friction – definition, Aerodynamic application.	f friction, angle of	repose - typ	es a	nd its	dete	rmination
Unit – II Thermal Properties:						9
specific heat, thermal conductivity – steady state and unsteady state met value of food, Bomb calorimeter, Boiling point elevation and freezing properties.						
Unit – III Optical Properties:						9
dielectric properties - measurement methods, effect on moisture, temperapplications. Unit – IV Rheological Properties:	erature and comp	osition, micro	owav	e he	ating	and other
						1
	- Newtonian fluids	- Bingham ai	nd N	on Bi		9
Classification of rheology, Stress Strain behavior of Newtonian and Non- strain relationships in solids, liquids and visco elastic behavior- stress rela- stress-strain diagrams, Rheological models – Kelvin and Maxwell mode	cation test, creep t	est and dynar	nic te	est,	ingha	9 m. Stress
Classification of rheology, Stress Strain behavior of Newtonian and Non- strain relationships in solids, liquids and visco elastic behavior- stress relax stress-strain diagrams, Rheological models – Kelvin and Maxwell model methods - Capillary, Orifice, Falling and Rotational viscometers.	cation test, creep t	est and dynar	nic te	est,	ingha	9 m. Stress
Classification of rheology, Stress Strain behavior of Newtonian and Non- strain relationships in solids, liquids and visco elastic behavior- stress relax stress-strain diagrams, Rheological models – Kelvin and Maxwell mode methods - Capillary, Orifice, Falling and Rotational viscometers. Unit – V Textural Properties: Types of food textures, Texture measuring instruments- Compression, S TPA, Properties of food powders. Color: Interaction of object with	ration test, creep tel. Viscosity – Ty nap Bending, Cutlight, Measureme	est and dynar pes and its ting Shear, P nt methods	mic te defin uncti	est, itions ure, I	ingha , mea	9 m. Stress asuremen 9 cration and
Classification of rheology, Stress Strain behavior of Newtonian and Non- strain relationships in solids, liquids and visco elastic behavior- stress relax stress-strain diagrams, Rheological models – Kelvin and Maxwell mode methods - Capillary, Orifice, Falling and Rotational viscometers. Unit – V Textural Properties: Types of food textures, Texture measuring instruments- Compression, S TPA, Properties of food powders. Color: Interaction of object with	ration test, creep tel. Viscosity – Ty nap Bending, Cutlight, Measureme	est and dynar pes and its ting Shear, P nt methods	mic te defin uncti	est, itions ure, I	ingha , mea	9 m. Stress asuremen 9 ration and meter and
Classification of rheology, Stress Strain behavior of Newtonian and Non- strain relationships in solids, liquids and visco elastic behavior- stress relax stress-strain diagrams, Rheological models – Kelvin and Maxwell mode methods - Capillary, Orifice, Falling and Rotational viscometers. Unit – V Textural Properties: Types of food textures, Texture measuring instruments- Compression, S TPA, Properties of food powders. Color: Interaction of object with Colorimeter, Color order systems- Munsel color system, CIE color system,	ration test, creep tel. Viscosity – Ty nap Bending, Cutlight, Measureme	est and dynar pes and its ting Shear, P nt methods	mic te defin uncti	est, itions ure, I	ingha , mea	9 m. Stress asuremen 9 cration and
Classification of rheology, Stress Strain behavior of Newtonian and Nonstrain relationships in solids, liquids and visco elastic behavior- stress relaxionships in solids, liquids and visco elastic behavior- stress relaxionships in solids, liquids and visco elastic behavior- stress relaxionships in stress-strain diagrams, Rheological models — Kelvin and Maxwell mod	ration test, creep tel. Viscosity – Ty nap Bending, Cut light, Measureme Hunter lab color s	est and dynar pes and its ting Shear, P nt methods pace, Lovibo	mic te defin uncti -Spe nd sy	est, itions ure, I ectrop estem	engha Penet	9 m. Stress asuremen 9 ration and meter and
Classification of rheology, Stress Strain behavior of Newtonian and Non- strain relationships in solids, liquids and visco elastic behavior- stress relax stress-strain diagrams, Rheological models – Kelvin and Maxwell mode methods - Capillary, Orifice, Falling and Rotational viscometers. Unit – V Textural Properties: Types of food textures, Texture measuring instruments- Compression, S TPA, Properties of food powders. Color: Interaction of object with Colorimeter, Color order systems- Munsel color system, CIE color system, TEXT BOOK: 1. Serpil Sahin and Servet Gulum Sumnu, "Physical Properties of Foo	ration test, creep tel. Viscosity – Ty nap Bending, Cut light, Measureme Hunter lab color s	est and dynar pes and its ting Shear, P nt methods pace, Lovibo	mic te defin uncti -Spe nd sy	est, itions ure, I ectrop estem	engha Penet	9 m. Stress asuremen 9 ration and meter and
Classification of rheology, Stress Strain behavior of Newtonian and Non- strain relationships in solids, liquids and visco elastic behavior- stress relax stress-strain diagrams, Rheological models – Kelvin and Maxwell mode methods - Capillary, Orifice, Falling and Rotational viscometers. Unit – V	ration test, creep tel. Viscosity – Ty nap Bending, Cut light, Measureme Hunter lab color s ods", 1st Edition, S	est and dynar pes and its ting Shear, P nt methods pace, Lovibo	uncti -Spe nd sy	est, itions ure, I ectropystem	engha Penet	9 m. Stress asuremen 9 ration and meter and

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	apply the various physical properties in food process design	Applying (K3)
CO2	outline the thermal properties of foods and its measurement methods	Understanding (K2)
CO3	make use of optical and electromagnetic properties of food materials in food processes	Applying (K3)
CO4	explain various rheological behavior of solid, liquid and viscoelastic food materials	Understanding (K2)
CO5	choose suitable textural and color measurement techniques for food materials	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1					1		1	3	2
CO2	3	3	2	1	1					1		1	3	2
CO3	3	3	2	1	1					1		1	3	2
CO4	3	3	2	2	2					1		2	3	2
CO5	3	3	2	2	2					1		2	3	2

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	40	40				100
CAT3	20	40	40				
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22ITC23 - PYTHON F	PROGRAMMING					
Programme & Branch	BTech – Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	C Programming	2	OE	3	0	2	4
Preamble	This course deals with core python programming python constructs and libraries.	j. It gives a comprehe	nsive introduc	tion	to pro	oblem	solving using
Unit – I	Introduction:						9
identifiers - data	strategies – program design tools – Types of error types – input operation – comments – reserved word duction – conditional statement – iterative statement	ds - indentation - Ope	erators and E	xpres	ssions	s – De	cision Control
Unit – II	Lists, Tuples and Dictionary:	<u>.</u>					9
operations, assig	date, nested, cloning, operations, methods, comprel inments, returning multiple values, nested tuples, ir ort, looping, nested, built-in methods – list vs tuple vs	ndex and count method					
	Strings and Regular Expressions: nation, append, multiply on strings – Immutable – for tions – operators – comparing – iterating – string m – flag options.						
Unit – IV	Functions and Modules:						9
	uction – definition – call – variable scope and lifetim trings – programming practices recursive function- on.						
	Object Orientation: ts: Class and objects – class methods and self – cober. NumPy: NumPy Arrays – Computation on Numl						9 r – public and
LIST OF EXPER	IMENTS / EXERCISES:						
1. Program	s using conditional and looping statements						
2. Impleme	ntation of list and tuple operations						
3. Impleme	ntation of dictionary operations						
4. Perform	various string operations						
5. Use regu	ılar expressions for validating inputs						
6. Demonst	tration of different types of functions and parameter parameter	assing					
7. Develop	programs using classes and objects						
8. Perform	computation on Numpy arrays						
9. Draw diff	erent types of plots using Matplotlib						
			Lectu	ıre:4	5, Pr	actica	l:30, Total:75
TEXT BOOK:							
1. Reema T 2017.	hareja., "Python Programming using problem solving	approach", 3 rd impres	sion, Oxford	Univ	ersity	Press	., New Delhi,
REFERENCES/	MANUAL / SOFTWARE:						
1. Nageswa	ara Rao, "Core Python Programming", 2 nd Edition, Dre	eamTech Press, New I	Delhi, 2018.				

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	use basic python constructs to build simple programs	Applying (K3), Precision (S3)
CO2	apply list, tuple and dictionary to handle variety of data.	Applying (K3), Precision (S3)
СОЗ	apply strings and regular expression for searching and retrieval	Applying (K3), Precision (S3)
CO4	solve the problems using functions and modules.	Applying (K3), Precision (S3)
CO5	apply object oriented concepts and perform data science operations using python	Applying (K3), Precision (S3)

	•													
Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

	AGGEGOMENT ATTENNE THEORY											
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %					
CAT1	10	15	75				100					
CAT2	10	15	75				100					
CAT3	10	15	75				100					
ESE	10	15	75				100					

 $^{^*}$ ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22MET22 - BASICS OF MECH/									
Programme& Branch	BTech & Food Technology						Credit			
Prerequisites	Nil	2	ES	3	0	0	3			
Preamble	To impart knowledge on basic concepts of boile	er, steam properties, IC	Engine and m	nanu	factu	ring te	chnology			
Unit – I	Boilers:						9			
	tion – Fire tube and Water tube boilers - Cochran Boil Bed Boiler. Boiler mountings and Accessories - Perfo and blow down.									
Unit – II	Steam Properties:						9			
	am - steam table usage and h-s chart - Dryness fract trating and throttling . Steam distribution systems - Ap					pe, th	rottling,			
Unit – III Internal Combustion Engines:										
							_			
Classification of compression ign	IC Engines - Parts of IC Engine and their materials - ition engines - Two and Four stroke Engines – Coolin Methods of controlling emission from SI and CI engine	ng and Lubrication syste								
Classification of compression ign Diesel vehicles -	IC Engines - Parts of IC Engine and their materials - ition engines - Two and Four stroke Engines – Coolin	ng and Lubrication systences.								
Classification of compression ign Diesel vehicles - Unit – IV Basic principle a	IC Engines - Parts of IC Engine and their materials - ition engines - Two and Four stroke Engines - Coolin Methods of controlling emission from SI and CI engine	ng and Lubrication systences. ons:	em - Emissior	n nor	ms fo	r Peti	ol and			
Classification of compression ign Diesel vehicles - Unit – IV Basic principle a	IC Engines - Parts of IC Engine and their materials - ition engines - Two and Four stroke Engines - Coolin Methods of controlling emission from SI and CI engine Mechanical Components and their Application applications of power transmission systems such a	ng and Lubrication systences. ons:	em - Emissior	n nor	ms fo	r Peti	ol and			
Classification of compression ign Diesel vehicles - Unit – IV Basic principle a principle of Coupunit – V Basic principle a	IC Engines - Parts of IC Engine and their materials - ition engines - Two and Four stroke Engines - Coolin Methods of controlling emission from SI and CI engine Mechanical Components and their Application applications of power transmission systems such soling, Clutch, Brake and Flywheel.	ng and Lubrication systenes. ons: as Belt, Rope, Chain ar Extrusion, Sheet metal	em - Emission nd Gear drive . Basic princi	n nor	ms fo	or Peti	ol and 9 d working			
Classification of compression ign Diesel vehicles - Unit – IV Basic principle a principle of Coupunit – V Basic principle a	IC Engines - Parts of IC Engine and their materials - ition engines - Two and Four stroke Engines – Coolin Methods of controlling emission from SI and CI engine Mechanical Components and their Application applications of power transmission systems such a bling, Clutch, Brake and Flywheel. Manufacturing Technology manufacturing Technology manufacturing Metal forming processes, Forging,	ng and Lubrication systenes. ons: as Belt, Rope, Chain ar Extrusion, Sheet metal	em - Emission nd Gear drive . Basic princi	n nor	ms fo	or Peti	ol and 9 d working			
Classification of compression ign Diesel vehicles - Unit – IV Basic principle a principle of Coupuit – V Basic principle a Metal Joining pro	IC Engines - Parts of IC Engine and their materials - ition engines - Two and Four stroke Engines – Coolin Methods of controlling emission from SI and CI engine Mechanical Components and their Application applications of power transmission systems such a bling, Clutch, Brake and Flywheel. Manufacturing Technology manufacturing Technology manufacturing Metal forming processes, Forging,	ng and Lubrication systenes. ons: as Belt, Rope, Chain ar Extrusion, Sheet metal	em - Emission nd Gear drive . Basic princi	n nor	ms fo	or Peti	9 d working 9 cions of			
Classification of compression ign Diesel vehicles - Unit – IV Basic principle a principle of Coup Unit – V Basic principle a Metal Joining pro	IC Engines - Parts of IC Engine and their materials - ition engines - Two and Four stroke Engines – Coolin Methods of controlling emission from SI and CI engine Mechanical Components and their Application applications of power transmission systems such a bling, Clutch, Brake and Flywheel. Manufacturing Technology manufacturing Technology manufacturing Metal forming processes, Forging,	ng and Lubrication systenes. ons: as Belt, Rope, Chain and Extrusion, Sheet metal is 3D printing and CAD/C	em - Emission nd Gear drive . Basic princip :AM/CIM .	s - F	unction	or Peti	9 d working 9 cions of			
Classification of compression ign Diesel vehicles - Unit – IV Basic principle a principle of Coup Unit – V Basic principle a Metal Joining pro TEXT BOOKS: 1. R.K.Raji	IC Engines - Parts of IC Engine and their materials - ition engines - Two and Four stroke Engines – Coolin Methods of controlling emission from SI and CI engin Mechanical Components and their Application applications of power transmission systems such soling, Clutch, Brake and Flywheel. Manufacturing Technology Ind applications of Metal forming processes, Forging, pocesses – Welding, Soldering and Brazing. Basics of	ng and Lubrication systemes. ons: as Belt, Rope, Chain an Extrusion, Sheet metal 3D printing and CAD/C	em - Emission nd Gear drive . Basic princip AM/CIM .	s - F	unction	on an	9 working 9 ions of Total:4			
Classification of compression ign Diesel vehicles - Unit – IV Basic principle a principle of Coup Unit – V Basic principle a Metal Joining pro TEXT BOOKS: 1. R.K.Rajı 2. Venugol & V	IC Engines - Parts of IC Engine and their materials - ition engines - Two and Four stroke Engines - Cooling Methods of controlling emission from SI and CI enging Mechanical Components and their Application applications of power transmission systems such soling, Clutch, Brake and Flywheel. Manufacturing Technology Indications of Metal forming processes, Forging, processes - Welding, Soldering and Brazing. Basics of pour , "Thermal Engineering", 11th Edition, Laxmi Publication, "Thermal Engineering", "Therma	ng and Lubrication systemes. ons: as Belt, Rope, Chain an Extrusion, Sheet metal 3D printing and CAD/C	em - Emission nd Gear drive . Basic princip AM/CIM .	s - F	unction	on an	9 working 9 ions of Total:4			
Classification of compression ign Diesel vehicles - Unit – IV Basic principle a principle of Coup Unit – V Basic principle a Metal Joining pro TEXT BOOKS: 1. R.K.Raji 2. Venugo & V REFERENCES:	IC Engines - Parts of IC Engine and their materials - ition engines - Two and Four stroke Engines - Cooling Methods of controlling emission from SI and CI enging Mechanical Components and their Application applications of power transmission systems such soling, Clutch, Brake and Flywheel. Manufacturing Technology Indications of Metal forming processes, Forging, processes - Welding, Soldering and Brazing. Basics of pour , "Thermal Engineering", 11th Edition, Laxmi Publication, "Thermal Engineering", "Therma	ng and Lubrication systemes. ons: as Belt, Rope, Chain and Extrusion, Sheet metal and CAD/Control of the control of the contr	em - Emission nd Gear drive . Basic princip AM/CIM . 23, for Units I, shers, Kumba	s - F	unction	on an	9 working 9 ions of Total:4			
Classification of compression ign Diesel vehicles - Unit – IV Basic principle a principle of Coupunit – V Basic principle a Metal Joining pro TEXT BOOKS: 1. R.K.Raji 2. Venugo & V REFERENCES: 1. Pravin K	IC Engines - Parts of IC Engine and their materials - ition engines - Two and Four stroke Engines – Coolin Methods of controlling emission from SI and CI engine Mechanical Components and their Application applications of power transmission systems such soling, Clutch, Brake and Flywheel. Manufacturing Technology India applications of Metal forming processes, Forging, pocesses – Welding, Soldering and Brazing. Basics of pour , "Thermal Engineering", 11th Edition, Laxmi Public pal K and Prabhu Raja V, "Basic Mechanical Engineering"	ng and Lubrication systemes. ons: as Belt, Rope, Chain and Extrusion, Sheet metal 3D printing and CAD/Control of the control	em - Emission nd Gear drive . Basic princip AM/CIM . 23, for Units I, shers, Kumba	s - F	unction	on an	9 working 9 ions of Total:4			

	COURSE OUTCOMES: On completion of the course, the students will be able to					
CO1	identify suitable boilers and their components to various appplications	Applying (K3)				
CO2	interpret the properties of steam and infer the quality of steam using calorimeters	Understanding (K2)				
CO3	explain the working principle of an internal combustion engine with its subsystems	Understanding (K2)				
CO4	explain the basic principles of various mechanical components	Understanding (K2)				
CO5	infer the fundamental concepts of manufacturing processes and CAD/CAM/CIM	Understanding (K2)				

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2			2						2		3
CO2	3	3	2			2						2		3
CO3	3	3	2			2						2		3
CO4	3	3	2			2						2		3
CO5	3	3	2			2						2		3

^{1 –} Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	70	10				100
CAT2	20	80					100
CAT 3	20	80					100
ESE	20	70	10				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Progra Branci	amme a h	&	B.Tec	h - Foc	d Tech	nology	,				Sem.	Category	L	Т	Р	Credit
Prerec	quisites	S	Nil								2	BS	0	0	2	1
Pream		PERIN	loss, modu	velocity lus, spe t skills c	of ultra ecific re on writin	sonic v sistance	vaves, o e, therr	compre nal con	ssibility ductivity	of a liq y, visco	luid, part sity, and	on of param ticle size, \ I thickness I to societal	oung of thi	's mo	odulus n, and	, rigidity
1.			ition of h			in a ferr	omagne	etic mat	erial.							
2.		rmina	tion of t	-						I the co	mpressib	oility of the li	quid u	sing	ultras	onic
3.	Deter	rmina	ition of t	he parti	cle size	of the	given po	owder u	sing se	micond	uctor las	er.				
4.	Deter	rmina	ition of t	he You	ng's mo	dulus o	f the ma	aterial o	f the giv	/en bea	m using	uniform ber	iding r	netho	od.	
5.	Deter	rmina	ition of t	he rigid	ity mod	ulus of t	he met	allic wire	e using	torsion	al pendul	lum.				
6.	Deter	rmina	ition of t	he spec	ific resi	stance (of the g	iven me	etallic wi	ire usin	g Carey-	Foster's brid	dge.			
7.	Deter	rmina	ition of t	he therr	mal con	ductivity	of a ba	ad cond	uctor us	sing Le	e's disc.					
8.	Deter	rmina	ition of t	he coef	ficient o	f viscos	ity of lic	quid usi	ng Poise	euille's	method.					
9.	Deter	rmina	ition of t	hicknes	s of a th	nin film	using a	ir-wedg	e arranç	gement.						
10.	Writir	ng co	ding for	any one	e of the	above e	experim	nents / d	levelopi	ng a pr	oject / a	product.				
	"															Total:30
REFE	RENCE	S/ M	ANUAL	/SOFT	WARE:											
1.	Phys	ics La	aborator	y Manu	al / Rec	ord, De	partme	nt of Ph	ysics, 1	st Editio	on, 2020.					
	SE OU		MES: the cou	urse, th	e stude	ents wil	l be ab	le to							Γ Map hest l	ped _evel)
CO1			the hys						ials, the	e veloci	ty of ulti	rasound in	а		olying cision	
CO2	deter	mine		ung's m	odulus	of a m	aterial,	the rigi				, the specifi	С	App	olying cision	(K3),
CO3	deter	mine		efficient	of visco							d develop	а	App	olying ecision	(K3),
			ı		1	Маррі	ing of C	Cos wit	h POs a	and PS	Os	,				
COs/P		PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	2 F	SO1	PSO2
CO1		3	2	2	3					2	2		2		2	2
UUZ	<u>-</u>	J			၂	l	1	1	1						_	

			2	2MEL2	1 - BAS	ICS OF	MECH	IANICA	L ENGI	NEERII	NG LAB	ORATORY				
Progra Branc		&	B.Tec	h & Fo	od Tecl	nnology	<i>y</i>				Sem.	Category	L	т	Р	Credit
Prerec		s	Nil								2	BS	0	0	2	1
Pream	ble		To pro	ovide pr	actical e	exposur	e on va	rious m	anufact	uring pr	ocesses	in Mechani	cal E	ngine	ering.	
LIST C	F EXI	PERIN	MENTS A	EXER	CISES:											
1.	Stud	ly on S	Steam b	oiler and	d its cor	nponen	ts.									
2.	Stud	ly on v	/arious p	oarts of	IC engir	nes.										
3.	Drav	v the v	/alve tim	ning and	port tin	ning dia	gram fo	or four s	troke ar	nd two s	stroke en	gines.				
4.	Dism	nantlin	g and a	ssembli	ng of au	utomotiv	e trans	mission	system	1						
5.	Тор	repare	e a sanc	l mold u	sing Fo	undry to	ools									
6.	Perf	orm fa	icing, tu	rning an	d knurli	ng oper	ations i	n centre	e lathe							
7.	Perf	orm e	xternal t	hread c	utting o	peration	s in cei	ntre lath	е							
8.	To fo	orm a	compon	ent usir	g hot fo	orging a	nd injed	ction mo	ulding p	orocess						
9.	To fo	orm a	compon	ent usir	g shee	t metal o	operatio	on								
10.	Тор	repare	e differe	nt weld	joints lik	ke T / L	/ Lap w	eld joint	ts using	TIG / N	/IG weld	ing				
11.	Тор	repare	e differe	nt weld	joints us	sing Ga	s weldii	ng and s	Spot we	lding e	quipmen	ts				
12.	To m	nodel	a simple	compo	nent us	ing CAI) softwa	are								
																Total:30
REFE	RENCI	ES/ M	ANUAL	/SOFT\	WARE:											
1.			/ Manua													
2.	Prav	in Kur	mar, "Ba	sic Med	hanical	Engine	ering, F	Pearson	Publish	ners", N	ew Delh	i, 2013.				
00110	0E 0I	ITOO	MEG												T 14	
COUR On co			the cou	urse, th	e stude	nts wil	l be ab	le to						(Hiç		Level)
CO1	find	out va	rious co	mponer	nts of Bo	oilers ar	nd IC er	ngines							plying ipulati	(K3), on (S2)
CO2	perfo	orm th	e metal	forming	and joi	ning pro	cess								plying ecisior	
СОЗ			ifferent p delling u				oy mac	hining o	peration	ns using	lathe, a	nd perform		Ар	plying	. ,
						Маррі	ng of C	os with	n POs a	nd PS0	Os					
COs/P		PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO1	2 I	PSO1	PSO2
CO1		3			2					3			1	\perp		3
CO2		3			2					3			1	+		3
			lerate, 3	– Subs		BT- Blo	om's Ta	axonom	V	J			- 1			

	22FTT31 - PROCESS FLUID I	MECHANICS					
Programme & Branch	B.Tech & Food Technology	Sem.	Category	L	т	Р	Credit
Prerequisites	Nil	3	PC	3	0	0	3
Preamble	This course provides an introduction to the properties analysis and equations of Fluid flow and enables the						
Unit – I	Fluid Statics and Flow phenomena:						9
continuous gravit	Physical properties of fluids. Fluid statics -Hydrostatic y decanter- storage Tank. Types of fluids: Compress Flow of Fluids: Concept of flow rates, velocity and type of	sible and incomp					
Unit – II	Equations of Fluid Flow:						9
Application of Be through closed co and contraction-	on - Reynolds number - Fluid flow regimes. Bernoulli extraoulli equation for pump work. Shear stress and skin induits - Velocity profiles and friction factor for smooth a friction loss in fittings, valves and coils.	friction in pipes	- Laminar ar	nd tu	rbule	nt flo	w of fluid nlargemen
Unit – III	Flow Past Immersed Bodies: flow of liquids through porous media. Motion of particle						9
Flow pattern in ag and Bukingham's Unit – IV	through fluid, terminal velocity, Hindered settling. Agita gitated vessel - Estimation of Power consumption in agiπ method. Transportation of Fluids: Pumps. Positive displacement pumps: operation, capac	itated vessels. Dir	nensional an	alysis	s -Ra	yleigh	n's method
losses and charac Screw pumps, di	cteristics. Calculation of power and discharge. Working aphragm pumps, progressive cavity pumps, vacuum pressors – Selection, types and applications. Pipelines	principle and app pumps, metering	lications of G pumps and	ear ı peri	pump staltic	s, Lol	be pumps nps. Fans
Unit – V	Metering of Fluids:						9
of Doppler Ultras	ters: Orifice meter, Venturimeter, Pitot tube. Variable are onic flow meters, Transit time flow meters, Magnetic f ment flow meters, Coriolis flowmeter and Surface Aco	flow meters, Tubi	ne flow mete	rs, T	Therm	nal flo	w meters
						L	_ecture:4
TEXT BOOK:							
1. McCabe \ 2005.	W.L., Smith J.C. and Harriot P., "Unit Operations of Cher	mical Engineering"	, 7th Edition,	McG	iraw I	Hill, N	ew York,
REFERENCES:							
1. Romeo T	. Toledo, "Fundamentals of Food Process Engineering",	4th Edition, Spring	ger, New York	, 201	18.		
2. Paul Sing	h R., Dennis R. Heldman, "Introduction to Food Enginee	ring", 5th Edition,	Academic Pu	blish	er, 20	013.	

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	classify fluids and apply hydrostatic equilibrium	Applying (K3)
CO2	derive and apply basic equations of fluid flow	Applying (K3)
CO3	analyze fluid flow through porous media and select suitable mixing equipment	Analyzing (K4)
CO4	select and examine the performance of pumps	Analyzing (K4)
CO5	explain the working principle and choose flow measuring devices and valves	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	1					1		1	2	1
CO2	3	2	2	2	1					1		1	2	1
CO3	3	3	2	2	1					1		1	3	2
CO4	3	3	2	2	1	1		1		1		2	3	2
CO5	3	2	2	1	1					1		2	3	2

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

				•			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	30	45	5			100
CAT2	20	30	40	5			100
CAT3	25	30	40	5			100
ESE	20	30	40	5			100

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

	22FTT32 - FOOD CHEMISTRY					
Programme & Branch	B.Tech &Food Technology Sem. Cat	tegory	L	т	Р	Credit
Prerequisites	Nil 3	PC	3	0	0	3
Preamble	This course deals about the importance of micronutrients, food additives, mochemistry of muscle tissue.	odification	of	biom	olecu	les and
Jnit – I	Minerals and Vitamins:					9
	inerals - Calcium, Potassium, Sodium, Phosphorus. Minor minerals - Iron, d deficiency. Vitamins: Definition, water soluble and fat soluble vitamins, so					
Unit – II	Changes during Processing:					9
n carbohydrates -	s - methods – moist heat, dry heat and combination. Loss of nutrients and problem in problems and retrogradation of starch - proteins and lipids. Parboiling of rewing reactions - caramelization, Maillard reaction					
Unit – III	Modification of Biomolecules:					9
Biochemical chang	matic methods. Modification of fats - Hydrogenation - cis and trans isomers es during processing of foods – malting and baking.	s, intereste	eriti	catio	n, wir	nterization
	Food Additives, Food colours and Flavours:	iore leave	200	ro o	alours	9
Food additives: cla agents, flour impro Natural and synth perception of flavo Substances, Veget	Food Additives, Food colours and Flavours: assification and purpose - Role of thickeners, stabilizers, sweeteners, emulsification and purpose - Role of thickeners, stabilizers, sweeteners, emulsification and purpose - Role of thickeners, stabilizers, sweeteners, emulsifications, anticaking agents, sequestrants, humectants, preservatives - example etic colourants - chlorophyll, carotenoids, betalains, anthocyanins and others, Molecular Mechanisms of Flavour Perception, specific and synthetic flavours, Flavours from Lactic Acid—Ethanol Fermentation	les. Food er pheno ours, Tas	l co ls. te a	lours Flavo and (and ours Other	s, flavoring Flavours – sensor Saporous
Food additives: cla agents, flour impro Natural and synth perception of flavo Substances, Veget and Oils.	assification and purpose - Role of thickeners, stabilizers, sweeteners, emulsification and purpose - Role of thickeners, stabilizers, sweeteners, emulsifications, anticaking agents, sequestrants, humectants, preservatives - exampletic colourants - chlorophyll, carotenoids, betalains, anthocyanins and others, Molecular Mechanisms of Flavour Perception, specific and synthetic flavour	les. Food er pheno ours, Tas	l co ls. te a	lours Flavo and (and ours Other	s, flavoring Flavours – sensor Saporou
Food additives: cla agents, flour impro Natural and synth perception of flavo Substances, Veget and Oils. Jnit – V Structure of muscle	assification and purpose - Role of thickeners, stabilizers, sweeteners, emulsification and purpose - Role of thickeners, stabilizers, sweeteners, emulsifications, anticaking agents, sequestrants, humectants, preservatives - exampletic colourants - chlorophyll, carotenoids, betalains, anthocyanins and others, Molecular Mechanisms of Flavour Perception, specific and synthetic flavours, Flavours from Lactic Acid—Ethanol Fermentation	les. Food her pheno ours, Tas ons, Flavo al change	l co ls. te a ur \	Flavo Flavo and (olati	and ours Other les fr	s, flavorin Flavours - sensor Saporou om Fats 9 eat quality
Food additives: cla agents, flour impro Natural and synth perception of flavo Substances, Veget and Oils. Unit – V Structure of muscle	assification and purpose - Role of thickeners, stabilizers, sweeteners, emulsification and purpose - Role of thickeners, stabilizers, sweeteners, emulsification and purpose - Role of thickeners, stabilizers, sweeteners, emulsification and agents, sequestrants, humectants, preservatives - example etic colourants - chlorophyll, carotenoids, betalains, anthocyanins and others, Molecular Mechanisms of Flavour Perception, specific and synthetic flavouable, Fruit, and Spice Flavours, Flavours from Lactic Acid—Ethanol Fermentation Chemistry of edible muscle Tissues: e-conversion of muscle to meat — natural and induced postmortem biochemical	les. Food her pheno ours, Tas ons, Flavo al change	l co ls. te a ur \	Flavo Flavo and (olati	and ours Other les fr	s, flavorin Flavours – sensor Saporou om Fats 9 eat quality oilization
Food additives: cla agents, flour impro Natural and synth perception of flavo Substances, Veget and Oils. Unit – V Structure of muscle Chemistry of proce	assification and purpose - Role of thickeners, stabilizers, sweeteners, emulsification and purpose - Role of thickeners, stabilizers, sweeteners, emulsification and purpose - Role of thickeners, stabilizers, sweeteners, emulsification and agents, sequestrants, humectants, preservatives - example etic colourants - chlorophyll, carotenoids, betalains, anthocyanins and others, Molecular Mechanisms of Flavour Perception, specific and synthetic flavouable, Fruit, and Spice Flavours, Flavours from Lactic Acid—Ethanol Fermentation Chemistry of edible muscle Tissues: e-conversion of muscle to meat — natural and induced postmortem biochemical	les. Food her pheno ours, Tas ons, Flavo al change	l co ls. te a ur \	Flavo Flavo and (olati	and ours Other les fr	s, flavorin Flavours - sensor Saporou om Fats 9 eat quality
Food additives: cla agents, flour impro Natural and synth perception of flavo Substances, Veget and Oils. Unit – V Structure of muscle Chemistry of proce	assification and purpose - Role of thickeners, stabilizers, sweeteners, emulsification and purpose - Role of thickeners, stabilizers, sweeteners, emulsification and purpose - Role of thickeners, stabilizers, sweeteners, emulsification and agents, sequestrants, humectants, preservatives - example etic colourants - chlorophyll, carotenoids, betalains, anthocyanins and others, Molecular Mechanisms of Flavour Perception, specific and synthetic flavouable, Fruit, and Spice Flavours, Flavours from Lactic Acid—Ethanol Fermentation Chemistry of edible muscle Tissues: e-conversion of muscle to meat — natural and induced postmortem biochemical	les. Food ler pheno ours, Tas ons, Flavo al change immobiliz	l co ls. te a ur \	Flavo Flavo and (/olati ffection an	s and ours Other les fr ng me d stal	s, flavorin Flavours – sensor Saporou om Fats 9 eat quality bilization Total:4
Food additives: cla agents, flour impro Natural and synth perception of flavo Substances, Veget and Oils. Unit – V Structure of muscle Chemistry of proce TEXT BOOK: 1. Srinivasan	assification and purpose - Role of thickeners, stabilizers, sweeteners, emulsification and purpose - Role of thickeners, stabilizers, sweeteners, emulsification and purpose - Role of thickeners, stabilizers, sweeteners, emulsification and agents, sequestrants, humectants, preservatives - example etic colourants - chlorophyll, carotenoids, betalains, anthocyanins and others, Molecular Mechanisms of Flavour Perception, specific and synthetic flavouable, Fruit, and Spice Flavours, Flavours from Lactic Acid—Ethanol Fermentation Chemistry of edible muscle Tissues: e-conversion of muscle to meat – natural and induced postmortem biochemical seed meats – curing, hydration and water retention, formation of gel matrix, fat	les. Food ler pheno ours, Tas ons, Flavo al change immobiliz	l co ls. te a ur \	Flavo Flavo and (/olati ffection an	s and ours Other les fr ng me d stal	s, flavorin Flavours – sensor Saporou om Fats 9 eat quality bilization
agents, flour impro Natural and synth perception of flavo Substances, Veget and Oils. Unit – V Structure of muscle Chemistry of proce TEXT BOOK: 1. Srinivasan REFERENCES:	assification and purpose - Role of thickeners, stabilizers, sweeteners, emulsification and purpose - Role of thickeners, stabilizers, sweeteners, emulsification and purpose - Role of thickeners, stabilizers, sweeteners, emulsification and agents, sequestrants, humectants, preservatives - example etic colourants - chlorophyll, carotenoids, betalains, anthocyanins and others, Molecular Mechanisms of Flavour Perception, specific and synthetic flavouable, Fruit, and Spice Flavours, Flavours from Lactic Acid—Ethanol Fermentation Chemistry of edible muscle Tissues: e-conversion of muscle to meat – natural and induced postmortem biochemical seed meats – curing, hydration and water retention, formation of gel matrix, fat	les. Food er pheno ours, Tas ons, Flavo al change immobiliz	l cc ls. te a ur \	lours Flavo Flavo Jolati ffectin n an	s and ours Other les from ng me d stal	s, flavorin Flavour – senso Saporou om Fats 9 eat qualit politization Total:4

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	summarize the nutritional importance of vitamins and minerals	Understanding (K2)
CO2	recognize the changes in food components during cooking, processing and storage	Understanding (K2)
CO3	select the carbohydrates, proteins and fats based on its role in processing	Applying (K3))
CO4	identify the role of food additive, colours and flavors in food processing	Applying (K3)
CO5	infer the biochemical changes in meat during processing	Understanding (K2)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			1				1		1	2	1
CO2	3	2	1	1	1	1				1	1	2	2	2
CO3	3	3	2	1	1	2				1	1	2	3	2
CO4	3	3	2	1	1	2		1		1	1	2	3	3
CO5	3	3	1	1				1		1	1	1	3	2

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	25	50	15	10			100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22FTT33 - FOOD PROCESS C	ALCULATIONS					
Programme & Branch	B.Tech & Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	3	PC	3	1	0	4
Preamble	The course helps the student to understand fundam energy balance associated with unit operations.	ental and the stoic	hiometric calc	ulati	ons, i	materi	ial and
Unit – I	Units and Dimensions, Fundamental Calculation	s:					9+3
	d real gas laws – gas constant - calculations of pressure artial pressure and pure component volume in gas mixtomaterial Balance Calculation:		perature using	gidea	al and	d van	der Waals
Stoichiometric prin	nciples, material balance without chemical reaction - appallization, drying, blending of food ingredients and extraction.	plication of materia	l balance to u	nit o	perat	ions: (
							0.0
~	Recycle Operations and Humidity and Saturation le Operations: Bypass operation, recycle operations - b		ing operation	s. pu	ırae r	atio, r	9+3 ecvcle
Bypass and Recycratio and purge strong humidity, wet and control of the strong	cle Operations: Bypass operation, recycle operations - be eam. Humidity and Saturation: Calculation of absolute a dry bulb temperature, dew point - Humidity chart usage.	olock diagram, purg numidity, molal hun					ecycle ercentage
Bypass and Recyclatio and purge stronumidity, wet and continumidity, wet and continumidity.	cle Operations: Bypass operation, recycle operations - beam. Humidity and Saturation: Calculation of absolute and bulb temperature, dew point - Humidity chart usage. Energy Balance Calculation:	olock diagram, purg numidity, molal hun	nidity, relative	hum	nidity	and p	ecycle ercentage
Bypass and Recycratio and purge structure in the structur	cle Operations: Bypass operation, recycle operations - be eam. Humidity and Saturation: Calculation of absolute a dry bulb temperature, dew point - Humidity chart usage.	olock diagram, purg numidity, molal hun pacity in heat calcu on, heats of forma	nidity, relative	hum	invol	and p	ecycle ercentage 9+3 ensible
Bypass and Recycratio and purge structure in the structur	cle Operations: Bypass operation, recycle operations - beam. Humidity and Saturation: Calculation of absolute hear. Humidity and Saturation: Calculation of absolute hear bulb temperature, dew point - Humidity chart usage. Energy Balance Calculation: Didds, liquids, gases and solutions, use of mean heat capats, enthalpy changes in food. Standard heat of reaction dard heat of reaction - Effect of pressure and temperature. Combustion and Process Flow Sheet Calculation Combustion Calculation C	olock diagram, purg numidity, molal hun pacity in heat calcu on, heats of forma ure on heat of react	nidity, relative	ems	invol soluti	ving s	ecycle ercentage 9+3 ensible nixing etc.
Bypass and Recycratio and purge stream to and purge stream to a purge stream to a purge stream to a purge. The arcapacity of some the arcapacity of scale and latent he calculation of stand to a purge to a purg	cle Operations: Bypass operation, recycle operations - beam. Humidity and Saturation: Calculation of absolute hear. Humidity and Saturation: Calculation of absolute hear bulb temperature, dew point - Humidity chart usage. Energy Balance Calculation:	plock diagram, purg numidity, molal hun pacity in heat calcu on, heats of forma are on heat of react n: and GHV. Determir	ridity, relative	ems ion,	involusoluti	ving soon, m	ecycle ercentage 9+3 ensible nixing etc. 9+3
Bypass and Recycratio and purge stream to an and purge stream to a	cle Operations: Bypass operation, recycle operations - beam. Humidity and Saturation: Calculation of absolute hear. Humidity and Saturation: Calculation of absolute hear bulb temperature, dew point - Humidity chart usage. Energy Balance Calculation:	plock diagram, purg numidity, molal hun pacity in heat calcu on, heats of forma are on heat of react n: and GHV. Determir	ridity, relative	ems ion, positi	involusolution by	ving s ion, m	9+3 ensible hixing etc. 9+3 y+3
Bypass and Recycratio and purge strational purge strational purge strational purge strational purge. Text Book:	cle Operations: Bypass operation, recycle operations - bream. Humidity and Saturation: Calculation of absolute hear. Humidity and Saturation: Calculation of absolute hear bulb temperature, dew point - Humidity chart usage. Energy Balance Calculation:	plock diagram, purg humidity, molal hun pacity in heat calcu on, heats of forma ure on heat of react n: and GHV. Determir ess Flow Sheet Ca	relative relative relative relations, probletion, combustion. Ination of compliculation: Mat	ems ion,	involusion by and	ving soon, my OrsaEnerg	9+3 ensible hixing etc. 9+3 at by Balance 6, Total:60
Bypass and Recycratio and purge structuration and purge structuration and purge structuration and commit — IV Heat capacity of some and latent he calculation of stand Unit — V Combustion: Combustion: Combustion: Combustion of stand analysis - Calculate for selected food P	cle Operations: Bypass operation, recycle operations - bream. Humidity and Saturation: Calculation of absolute hear. Humidity and Saturation: Calculation of absolute hear bulb temperature, dew point - Humidity chart usage Energy Balance Calculation: Dolids, liquids, gases and solutions, use of mean heat calculates, enthalpy changes in food. Standard heat of reaction and heat of reaction of pressure and temperature. Combustion and Process Flow Sheet Calculation bustion of solids, liquid and gas, determination of NHV action of excess air, theoretical oxygen requirement. Process Process.	plock diagram, purg humidity, molal hun pacity in heat calcu on, heats of forma ure on heat of react n: and GHV. Determir ess Flow Sheet Ca	relative relative relative relations, probletion, combustion. Ination of compliculation: Mat	ems ion,	involusion by and	ving soon, my OrsaEnerg	9+3 ensible hixing etc. 9+3 at by Balance 6, Total:60
Bypass and Recycratio and purge stream to and purge stream to an and purge stream to an analysis - Calculation of standard selected food P TEXT BOOK: 1. Himmelbla Delhi, 201	cle Operations: Bypass operation, recycle operations - bream. Humidity and Saturation: Calculation of absolute hear. Humidity and Saturation: Calculation of absolute hear bulb temperature, dew point - Humidity chart usage Energy Balance Calculation: Dolids, liquids, gases and solutions, use of mean heat calculates, enthalpy changes in food. Standard heat of reaction and heat of reaction of pressure and temperature. Combustion and Process Flow Sheet Calculation bustion of solids, liquid and gas, determination of NHV action of excess air, theoretical oxygen requirement. Process Process.	plock diagram, purg humidity, molal hun pacity in heat calcu on, heats of forma ure on heat of react n: and GHV. Determir ess Flow Sheet Ca	relative relative relative relations, probletion, combustion. Ination of compliculation: Mat	ems ion,	involusion by and	ving soon, my OrsaEnerg	9+3 ensible hixing etc. 9+3 at by Balance 6, Total:60
ratio and purge stranding through the strand of the stranding through the stranding thro	cle Operations: Bypass operation, recycle operations - bream. Humidity and Saturation: Calculation of absolute hear. Humidity and Saturation: Calculation of absolute hear bulb temperature, dew point - Humidity chart usage Energy Balance Calculation: Dolids, liquids, gases and solutions, use of mean heat calculates, enthalpy changes in food. Standard heat of reaction and heat of reaction of pressure and temperature. Combustion and Process Flow Sheet Calculation bustion of solids, liquid and gas, determination of NHV action of excess air, theoretical oxygen requirement. Process Process.	plock diagram, purg humidity, molal hun pacity in heat calcu on, heats of forma are on heat of react n: and GHV. Determiness Flow Sheet Ca	ulations, problition, combustion. nation of compliculation: Mat Lecture: Edition, Prent	ems ion,	involusion by and	ving soon, my OrsaEnerg	9+3 ensible hixing etc. 9+3 at by Balance 6, Total:60

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	make use of different systems of units and dimensions, calculate compositions of mixtures and solutions	Applying (K3)
CO2	outline the stoichiometry principles and apply material balance for different unit operations	Applying (K3)
CO3	apply material balance for bypass, recycle operations and perform humidification calculations	Applying (K3)
CO4	make use of energy balance for system without chemical reactions	Applying (K3)
CO5	make use of material and energy balance in various process and determine the GHV, NHV and composition of fuels	Analyzing (K4)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	1							1	1	1
CO2	3	3	2	2	1							1	3	3
CO3	3	3	2	2	1	1						1	3	3
CO4	3	3	2	2	1							1	2	1
CO5	3	3	2	2	2	1	1	1	1	1	1	1	3	2

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

		,	—	•			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	10	80				100
CAT2	10	10	80				100
CAT3	10	10	60	20			100
ESE	5	5	75	15			100

^{*} $\pm 3\%$ may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

	22FTT34- REFRIGERATION AND COLD (SHAIN WANAGI	-141E14 (
Programme & Branch	B.Tech & Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	3	PC	3	0	0	3
Preamble	The course imparts the basic concepts of thermodynal systems and theoretical knowledge on cold chain man		n systems, lo	w ter	npera	ature	storage
Unit – I	Introduction to Thermodynamics:						9
Thermodynamics. Second Law of the	epts of thermodynamics- systems, properties, process, fu Statement of first law for flow and non - flow process. Ir rmodynamics: Kelvin-Plank, Clausius statements, Carnot	nternal energy, e	nthalpy, heat	сар	acitie	s (CV	/ and CP)
Unit – II	Refrigeration Components:						9
depletion potentia cooling evaporate	rigeration, unit of refrigeration capacity, Refrigerants - l, Reversed Carnot cycle, Limitations of reversed Carnor. Condenser- water cooled, air cooled and evaporansion valve - thermostatic expansion valve.	ot systems. Eva	aporator- dry	and	floo	ded ty	ype, liqui
Unit – III	Refrigeration Systems:						9
	- simple vapour compression and absorption system. p-l						
system – reversed	•	ycle and effect o	of operating co	ondit	ions.	Air re	
system – reversed Jnit – IV	Brayton cycle. Low Temperature Storage Systems:	-					9
system – reversed Unit – IV Pre-cooling systen oad in cold store.	Brayton cycle. Low Temperature Storage Systems: ns, Cold storage- construction, insulation and operation. D Prefabricated systems, walk-in-coolers. Frozen storage,	Design of cold sto	orage unit. Ca	Icula	tion o	of refri	9 igeration
system – reversed Unit – IV Pre-cooling systen load in cold store. for liquefaction of a	Brayton cycle. Low Temperature Storage Systems: ns, Cold storage- construction, insulation and operation. D Prefabricated systems, walk-in-coolers. Frozen storage,	Design of cold sto	orage unit. Ca	Icula	tion o	of refri	9 igeration
system – reversed Unit – IV Pre-cooling systen load in cold store. for liquefaction of a Unit – V Introduction, Comp Time temperature	Brayton cycle. Low Temperature Storage Systems: ns, Cold storage- construction, insulation and operation. D Prefabricated systems, walk-in-coolers. Frozen storage, air.	Design of cold sto Freezer types, Co port systems, Co n in candy man	orage unit. Ca Cryogenics – I	Icula Linde	tion of and	of refri Clau natior	geration de system 9 n systems
System – reversed Unit – IV Pre-cooling system oad in cold store. for liquefaction of a Unit – V Introduction, Comp	Brayton cycle. Low Temperature Storage Systems: ns, Cold storage- construction, insulation and operation. D Prefabricated systems, walk-in-coolers. Frozen storage, air. Cold Chain: conents of cold chain. Refrigerated distribution and transponents of cold chain. Refrigerated distribution and transponent – Application of RFID. Role of refrigeration	Design of cold sto Freezer types, Co port systems, Co n in candy man	orage unit. Ca Cryogenics – I	Icula Linde	tion of and	of refri Clau natior	geration de system g n systems ng, baker
system – reversed Unit – IV Pre-cooling systen load in cold store. for liquefaction of a Unit – V Introduction, Comp Time temperature products, meat pro	Brayton cycle. Low Temperature Storage Systems: ns, Cold storage- construction, insulation and operation. D Prefabricated systems, walk-in-coolers. Frozen storage, air. Cold Chain: conents of cold chain. Refrigerated distribution and transponents of cold chain. Refrigerated distribution and transponent – Application of RFID. Role of refrigeration	Design of cold sto Freezer types, Co port systems, Co n in candy man	orage unit. Ca Cryogenics – I	Icula Linde	tion of and	of refri Clau natior	geration de system 9 n systems
System – reversed Unit – IV Pre-cooling system oad in cold store. for liquefaction of a Unit – V Introduction, Compare temperature products, meat products, meat products.	Brayton cycle. Low Temperature Storage Systems: ns, Cold storage- construction, insulation and operation. D Prefabricated systems, walk-in-coolers. Frozen storage, air. Cold Chain: conents of cold chain. Refrigerated distribution and transponents of cold chain. Refrigerated distribution and transponent – Application of RFID. Role of refrigeration	Design of cold sto Freezer types, Co port systems, Co n in candy man and dairy products	orage unit. Ca Cryogenics – I old chain in re ufacture, beve	Icula Linde	tion of and	of refri Clau natior	geration de systen g systems ng, baker
system – reversed Unit – IV Pre-cooling system load in cold store. for liquefaction of a Unit – V Introduction, Comp Time temperature products, meat pro	Brayton cycle. Low Temperature Storage Systems: ns, Cold storage- construction, insulation and operation. Description of Prefabricated systems, walk-in-coolers. Frozen storage, air. Cold Chain: Conents of cold chain. Refrigerated distribution and transponding management — Application of RFID. Role of refrigeration ducts, poultry products, fish products, fruit /vegetables and	Design of cold sto Freezer types, Co port systems, Co n in candy man and dairy products	orage unit. Ca Cryogenics – I old chain in re ufacture, beve	Icula Linde	tion of and	of refri Clau natior	geration de system g n systems ng, baker
system – reversed Unit – IV Pre-cooling system load in cold store. for liquefaction of a Unit – V Introduction, Comp Time temperature products, meat pro TEXT BOOK: 1. Rajput R.F. REFERENCES:	Brayton cycle. Low Temperature Storage Systems: ns, Cold storage- construction, insulation and operation. Description of Prefabricated systems, walk-in-coolers. Frozen storage, air. Cold Chain: Conents of cold chain. Refrigerated distribution and transponding management — Application of RFID. Role of refrigeration ducts, poultry products, fish products, fruit /vegetables and	Design of cold sto Freezer types, Co port systems, Co n in candy man and dairy products ataria and Sons,	orage unit. Ca Cryogenics – I old chain in re ufacture, beve	Icula Linde	tion of and	of refri Clau natior	geration de systen g systems ng, baker

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	apply the concepts of thermodynamics	Applying(K3)
CO2	outline the components of refrigeration system	Understanding(K2)
CO3	explain various refrigeration system and make use of refrigeration calculations	Applying(K3)
CO4	select appropriate low temperature storage systems	Applying(K3)
CO5	apply the concept of cold chain for storage and distribution of various food products	Applying(K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1						1		1	1	1
CO2	3	3	2	1		1	1			1		1	1	1
CO3	3	3	3	2						1		1	1	2
CO4	3	3	3	2	1					1		2	2	2
CO5	3	3	3	2	2					1		2	2	2

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	30	40				100
CAT2	30	30	40				100
CAT3	30	30	40				100
ESE	25	25	50				100

* $\pm 3\%$ may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22FTT35 - FOOD PACKAG	ING TECHNOLOGY					
Programme & Branch	B.Tech & Food Technology	Sem.	Category	L	Т	P	Credit
Prerequisites	Nil	3	PC	3	0	0	3
Preamble	To impart knowledge about basics and recent advar labelling.	ncements in food packag	ing materials,	meth	ods	and fo	ood
Unit – I	Basics of Food Packaging						9
regulation. Labeling		ds, predicting the shelf	life of foods.	. Pac	kage	star	
Unit – II	Paper and Paperboard Packaging	anasta Daskana ti		. منام			9
	pard- manufacture, properties analysis and packaging a g tapes, cap liners and diaphragm.	ispects. Package types -	– poucnes, sa	CKS, (cartor	ns, bc	ixes, tubes,
Unit – III	Plastic Packaging						9
	ised in packaging – PE, PP, PET, PVC, EVOH, PVA. g of plastic films and rigid plastic containers. Natura lity and closure.						
Unit – IV	Metal cans and Glass Containers:						9
processes, coating	can making –steel, aluminum. Can making processor, film laminates and inks, corrosion and sulphur stocontainer manufacture – melting, forming, surface treat	aining. Flash 18 proce	ss, retorting	equip	ment	t. Def	inition and
Unit – V	Trends in Food Packaging:						9
	pent packaging, modified atmosphere packaging - packaging, self-heating and cooling cans. Recycling of				grad	able	and edible
							Total:45
TEXT BOOK:							
	Coles and Mark J. Kirwan, "Food and Beverage Packages, USA, 2011.	ing Technology", 2nd Ed	ition, Blackwe	II Puk	olishir	ng As	ia Pvt Ltd,
REFERENCES:							
1. Han Jung	H, "Innovations in Food Packaging", 2nd Edition, Acad	lemic Press, USA, 2014.					

	SE OUTCOMES: upletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	infer basic concepts in food packaging	Understanding (K2)
CO2	make use of paper and paperboards for various food applications	Applying (K3)
CO3	identify suitable plastic for packaging based on their properties	Applying (K3)
CO4	choose appropriate metal and glass containers for food packaging	Applying (K3)
CO5	select and adapt recent trends in food packaging	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1			2				1	2	2
CO2	3	3	2	1								1	1	3
CO3	3	3	2	1				1				1	1	3
CO4	3	3	2	1								1	1	3
CO5	3	3	2	1	1			1				2	1	3

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

		7 (00 Z 00 III Z 1 1	,	20:11			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3)	Analyzing (K4) %	Evaluating (K5) %	Creating (K6)	Total %
CAT 1	20	64	16				100
CAT 2	20	64	16				100
CAT 3	20	64	16				100
ESE	16	52	32		·		100

 $^{^{*}}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

					2	22FTL3	1 - FLU	IID FLO	W LAB	ORATO	RY					
Progra Branc		&	B.Tec	h & Fo	od Tecl	nnology	y				Sem.	Category	L	Т	Р	Credit
Prerec	= =	es	Nil								3	PC	0	0	2	1
Pream	ble		To im	part pra	ctical kr	nowledg	je requi	red for I	nandling	y Newto	nian Flu	ids.				
LIST C	F EXI	PERIM	IENTS /	EXER	CISES:											
1.	Dete	ermina	tion of c	lischarg	e coeffi	cient of	Venturi	meter								
2.	Dete	ermina	tion of c	lischarg	e coeffi	cient of	Orificer	meter								
3.	Verit	fying r	elations	hip betw	een fric	tion fac	tor and	Reyno	lds num	ber for f	low thro	ugh square	ducts	3		
4.	Verit	fying D	arcy's e	equation	for flov	v throug	gh circu	lar pipe	S							
5.	Dete	ermina	tion of c	ritical R	eynolds	numbe	er for flo	w throu	gh helio	al coils						
6.	Dete	ermina	tion of c	lischarg	e coeffi	cient of	V- noto	:h								
7.	Verit	fying r	elations	hip betw	een fric	tion fac	tor and	Reyno	lds num	ber for f	low thro	ugh annula	r pipe	:S		
8.	Dete	ermina	tion of lo	oss coef	ficient o	of valves	s and p	ipe fittin	gs							
9.	Estir	mation	of perfo	ormance	charac	teristics	s of cen	trifugal	pump							
10.	Estir	mation	of perfo	ormance	charac	teristics	s of reci	iprocatir	ng pum)						
11.										fficient c	of Ventur	imeter				
	b. D	emons	stration	and dete	erminati	on of er	nergy lo	ss in pi	pe							Total:30
DEEE	DENIC	EQ/M	ANIIAI	/SOFT\	MADE.											
1.	_		Manua		WARE.											
2.	McC	abe W	/.L., Sm		and Ha	arriot P.	, "Unit C	Operation	ons of C	hemical	Engine	ering", 7th E	ditio	ո, Mo	Graw	Hill,
3.		York,		rni'a Chi	omical E	Enginoo	ro Hone	d book"	0th E4	ition Ma	Crow L	ill Now Yor	k 20	07		
3. 4				-								ill, New Yor		07.		
				iii Oper	alions –	- I , Z/ II	1 Edition	n, Miran	Piakas	nan Pul	Dilcations	s, Pune, 20 ²	10.	_	T 14	
COUR On co				urse, th	e stude	nts wil	l be ab	le to							BT Map ghest	ppea Level)
CO1	estin	nate th	ne disch	arge co	efficient	for vari	iable ar	ea and	head flo	w mete	rs				aluatin ecisio	g (K5),
CO2	mea	sure a	nd anal	yze the	flow of	fluids th	rough o	closed o	onduits	, valves	and pip	e fittings		Eva	aluatin	g (K5),
CO3				rmance										Eva		g (K5),
	Cvai	aaie ii	io perio	mance	or puili									Pr	ecisio	า (S3)
COs/P	Os I	PO1	PO2	PO3	PO4	Mappi PO5	ng of C	PO7	POs a	nd PSC PO9	PO10	PO11	PO1	2	PSO1	PSO2
COS/F		3	3	3	3	2	1 00	1.01	1	3	2	2	2	-	3	2
CO2		3	3	3	3	2	1		1	3	2	2	2		3	2
COS		3	3	3	3	1	1		1	3	2	2	2		3	2
1 – Sli	ght, 2	– Mod	erate, 3	– Subs	tantial,	BT- Blo	om's Ta	axonom	У	1		1				_1

					22F	TL32 -	FOOD (CHEMIS	STRY L	ABORA	TORY					
Progra Branc		&	B.Tec	h & Fo	od Tecl	nnology	y				Sem.	Category	L	Т	Р	Credit
Prerec		es	Nil								3	PC	0	0	2	1
Pream	ble		To de	al abou	t analys	is and e	estimatio	on of bio	omolecu	ıles.						
LIST C	OF EX	PERIN	IENTS /	/ EXER	CISES:											
1.	Qua	litative	tests fo	or mono	sacchar	ide, dis	acchari	des, po	lysacch	arides						
2.	Estir	mation	of total	carboh	ydrate ii	n food p	roduct									
3.	Extra	action	and ana	alysis of	oil (iod	ine num	ber, sa	ponifica	ition nur	mber, ad	cid numb	per)				
4.	Estir	mation	of prote	ein by L	owry's r	nethod										
5.	Dete	ermina	tion of c	lextrose	equiva	lent in n	nodified	starche	es							
6.	Extra	action	and est	imation	of caro	tenoids	and lyc	opene i	n fruits/	vegetab	les					
7.	Estir	mation	of poly	phenols	in fruits	/vegeta	bles									
8.	Estir	mation	of flava	anoids ir	n fruits/v	egetabl	les									
9.	Estir	mation	of Vitar	min C in	fruits/v	egetabl	es									
10.	Estir	mation	of Iron	in food	samples	3										
11.	Virtu	ual Lal	ooratory	Experii	ments:											
11.	a. Is	oelect	ric preci	pitation	of prote	ein from	milk									Total:30
DEEE	DENC	EC/M	A NII I A I	/COET	MADE.											Total.50
1.			Manua Manua		WAKE:											
					of Anal	ysis and	d Quality	y Contr	ol for Fr	uit and `	Vegetab	le Products	", 2nd	Edit	ion, Ta	ıta
2.			ill, New			"D: I			" 0 1 5	re k				_		40
3.										aition, N	New Age	Internation	aı, Ne	W De	eini, 20	18.
4				eau/?sui	b=3&bro	n=63&	SIM=150	S&CHT=								
COUR On co				urse, th	e stude	nts wil	l be abl	e to							T Map ghest l	
CO1	anal	lyze ar	nd estim	ate mad	cro and	micronu	utrients	in food	product	s					aluating ecision	
CO2	extra	act oil	and ana	alyze its	propert	ies								Eva	luating	(K5),
CO3	extra	act and	d estima	ate phyto	ochemic	als in fo	ood prod	ducts						Eva	luating	(K5),
	5,111						•		- DO-	d DOC				Pro	ecision	(83)
COs/P	POs	PO1	PO2	PO3	PO4	маррі РО5	ng of C	PO7	POs a	PO9	PO10	PO11	PO1	2	PSO1	PSO2
		3	3	3	3	2	1		1	3	2	1	1	+	2	3
CO				_	3	2	1		1	3	2	1	1		2	3
CO	2	3	3	3	3		•				_		•		_	3

	22GET31- UNIVERSAL HU		-\				
Programme &	(Common to All Engineering and T	<u> </u>		_		_	
Branch	All BE/BTech Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	3/6	HS	2	0	0	2
Preamble	To make the student to know what they 'really meaning of happiness and prosperity for a huma harmony at all the levels of human living, and live a	n being. Also to faci					tanding c
Unit – I	Introduction:						6
Exploration – Con Aspirations – Con	Guidelines of Value Education – Content and Proces neent and Process of Self exploration – Natural Acceptationus Happiness and Prosperity – Exploring Happines – Relationships – Physical Facilities – Right Under Harmony in the Self and Body:	eptance – Realization ness and Prosperity	on and Under	stand	ding	– Bas	sic Humai
	·	alf ((U) and Dade N		- I£		l A	_
the Self and Body,	I Body – Understanding Myself as Co–existence of S , Self ('I') as the Conscious Entity, the Body as the Manderstanding Myself – Harmony with Body.						
	Harmony in the Family and Society:						•
Unit – III	narmony in the Family and Society.						6
	amily – Justice – Feelings (Values) in Human Relation Five dimensions of Human Endeavour.	nships – Relationship	from Family	to So	ociety	/ – Ide	
Harmony in the Fa of Human Goal – F	amily – Justice – Feelings (Values) in Human Relation	nships – Relationship	from Family	to So	ociety	/ – Ide	
Harmony in the Fa of Human Goal – I Unit – IV Order of Nature –	amily – Justice – Feelings (Values) in Human Relation Five dimensions of Human Endeavour. Harmony in Nature and Existence: Interconnectedness – Understanding the Four ordentroduction to Space – Co–existence of units of Space	er – Innateness – N	atural Charac	terist	ic –	Basic	entification 6 Activity -
Harmony in the Fa of Human Goal – I Unit – IV Order of Nature – Conformance – Ir	amily – Justice – Feelings (Values) in Human Relation Five dimensions of Human Endeavour. Harmony in Nature and Existence: Interconnectedness – Understanding the Four ordentroduction to Space – Co–existence of units of Space	er – Innateness – Napace – Limited and	atural Charac unlimited –	terist Activ	ic – e an	Basic	entification 6 Activity -
Harmony in the Fa of Human Goal – I Unit – IV Order of Nature – Conformance – Ir Existence is Co–e: Unit – V Values in different	amily – Justice – Feelings (Values) in Human Relation Five dimensions of Human Endeavour. Harmony in Nature and Existence: Interconnectedness – Understanding the Four ordentroduction to Space – Co–existence of units of Space in Implications of the above Holistic Understanding to dimensions of Human Living – Definitiveness of Etheomprehensive Human Goal – Humanistic Education	er – Innateness – No pace – Limited and ng of Harmony on I ical Human Conduct	atural Charac unlimited – Professional	terist Activ Ethic	ic – e an cs:	Basic d No-	6 Activity - activity - 6 ed Living - Issues ir
Harmony in the Fa of Human Goal – If Unit – IV Order of Nature – Conformance – Ir Existence is Co–ex Unit – V Values in different Identification of C Professional Ethics	amily – Justice – Feelings (Values) in Human Relation Five dimensions of Human Endeavour. Harmony in Nature and Existence: Interconnectedness – Understanding the Four ordentroduction to Space – Co–existence of units of Space in Implications of the above Holistic Understanding to dimensions of Human Living – Definitiveness of Etheomprehensive Human Goal – Humanistic Education	er – Innateness – No pace – Limited and ng of Harmony on I ical Human Conduct	atural Charac unlimited – Professional	terist Activ Ethic	ic – e an cs:	Basic d No-	6 Activity - activity - 6 ed Living -
Harmony in the Fa of Human Goal – I Unit – IV Order of Nature – Conformance – Ir Existence is Co–e: Unit – V Values in different Identification of C Professional Ethic:	amily – Justice – Feelings (Values) in Human Relation Five dimensions of Human Endeavour. Harmony in Nature and Existence: Interconnectedness – Understanding the Four ordentroduction to Space – Co–existence of units of Space in Implications of the above Holistic Understanding the Implications of Human Living – Definitiveness of Etheomprehensive Human Goal – Humanistic Educations.	er – Innateness – Nace – Limited and ng of Harmony on I ical Human Conduct n – Universal Huma	atural Charac unlimited – Professional : –Implications n Order – Co	terist Activ Ethic s of \	ic – e an cs: /alue	Basic d No- e base e and	Activityactivity - 6 ed Living - Issues ir
Harmony in the Fa of Human Goal – f Unit – IV Order of Nature – Conformance – Ir Existence is Co–e. Unit – V Values in different Identification of C Professional Ethic: TEXT BOOK: 1. Gaur R.R. Books Pvi	amily – Justice – Feelings (Values) in Human Relation Five dimensions of Human Endeavour. Harmony in Nature and Existence: Interconnectedness – Understanding the Four ordentroduction to Space – Co–existence of units of Space in Implications of the above Holistic Understanding to dimensions of Human Living – Definitiveness of Etheomprehensive Human Goal – Humanistic Education	er – Innateness – Nace – Limited and ng of Harmony on I ical Human Conduct n – Universal Huma	atural Charac unlimited – Professional : –Implications n Order – Co	terist Activ Ethic s of \	ic – e an cs: /alue	Basic d No- e base e and	Activityactivity - 6 ed Living - Issues in
Harmony in the Fa of Human Goal – F Unit – IV Order of Nature – Conformance – Ir Existence is Co–e: Unit – V Values in different Identification of C Professional Ethic: TEXT BOOK: 1. Gaur R.R. Books Pvt REFERENCES:	amily – Justice – Feelings (Values) in Human Relation Five dimensions of Human Endeavour. Harmony in Nature and Existence: Interconnectedness – Understanding the Four order not not not not not on the space – Co-existence of units of Space – Implications of the above Holistic Understanding to dimensions of Human Living – Definitiveness of Etheomorehensive Human Goal – Humanistic Educations. "Sangal R., Bagaria G.P., "A Foundation Course in Hat. Ltd., New Delhi, 2016.	er – Innateness – Nace – Limited and ng of Harmony on I ical Human Conduct n – Universal Huma	atural Charac unlimited – Professional : –Implications n Order – Co	terist Activ Ethic s of \	ic – e an cs: /alue	Basic d No- e base e and	Activityactivity - 6 ed Living - Issues in
Harmony in the Fa of Human Goal – Funit – IV Order of Nature – Conformance – Ir Existence is Co–e: Unit – V Values in different Identification of C Professional Ethics TEXT BOOK: 1. Gaur R.R. Books Pvt REFERENCES: 1. Ivan Illich,	amily – Justice – Feelings (Values) in Human Relation Five dimensions of Human Endeavour. Harmony in Nature and Existence: Interconnectedness – Understanding the Four ordentroduction to Space – Co–existence of units of Space in Implications of the above Holistic Understanding the Implications of Human Living – Definitiveness of Etheomorehensive Human Goal – Humanistic Educations. "Sangal R., Bagaria G.P., "A Foundation Course in Human Fixed Programment Pr	er – Innateness – Nace – Limited and ng of Harmony on I ical Human Conduct – Universal Huma	atural Charac unlimited – Professional : –Implications n Order – Co	terist Activ Ethic s of \	ic – e an cs: /alue	Basic d No- e base e and	Activityactivity - 6 ed Living - Issues in

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	restate the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society	Applying (K3)
CO2	distinguish between the Self and the Body, understand the meaning of Harmony in the Self, the Co–existence of Self and Body	Applying (K3)
СОЗ	infer the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human–human relationships and explore their role in ensuring a harmonious society	Applying (K3)
CO4	transform themselves to co-exist with nature by realising interconnectedness and four order of nature	Applying (K3)
CO5	distinguish between ethical and unethical practices, and extend ethical and moral practices for a better living	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	75					100
CAT2	25	75					100
ESE	NA						100

 $^{^{\}ast}$ ±3% may be varied (CAT 1 & 2 – 50 marks & ESE – 100 marks)

		22MAT41- NUMERICAL METHODS FOR E						
		ommon to Civil, Mechanical, Mechatronics, Automobile an	d Food T	echnology B	rancl	nes)		
Program Branch		BE - Civil, Mechanical, Mechatronics, Automobile and BTech - Food Technology Branches	Sem.	Category	L	Т	Р	Credit
Prerequ	uisites	Nil	4	BS	3	1	0	4
Preamb	ole	To impart knowledge in interpolation, numerical differentiation numerical algorithms to identify roots of algebraic and transcequations, ordinary and partial differential equations.						
Unit – I		Solution to Algebraic and Transcendental Equations:						9+3
		Method of false position – Newton-Raphson method – Solution nethod and Gauss – Jordan method – Iterative methods: Gauss						ethods:
Unit - II	I	Interpolation:						9+3
Gauss f	forward and	ual intervals: Newton's forward and backward difference formu backward interpolation formulae – Interpolation with unequal in fference formula.						
Unit - II	II	Numerical Differentiation and Integration:						9+3
		Newton's forward, backward and divided difference formulae - Simpsons 3/8 th rule – Double integrals using Trapezoidal and			Trap	ezoid	lal rule) —
Unit – ľ	V	Numerical Solution of First order Ordinary Differential Ed	quations:					9+3
		s: Taylor series method – Euler method – Modified Euler metho edictor corrector method – Adam's Bashforth method.	od – Fourt	h order Runge	e-Kutt	a me	thod -	- Multi step
Unit – V	/	Solutions of Boundary Value Problems in PDE:						9+3
		ensional heat equation – Bender –Schmidt recurrence relation			hod –	- One	dime	nsional
wave ed	quation – So	lution of two dimensional Laplace equations – Solution of Poiss	son equat	ion.				
				Lecture	e:45,	Tuto	rial:1	5, Total:60
TEXT B	BOOK:							
TEXT B		T, Ramachandran T., "Numerical Methods", 1 st Edition, McGra	aw Hill Edu	ucation, Chenr	nai, 2	019.		
1.		T, Ramachandran T., "Numerical Methods", 1 st Edition, McGra	aw Hill Edu	ucation, Cheni	nai, 2	019.		
1.	Veerarajan	T, Ramachandran T., "Numerical Methods", 1 st Edition, McGra ao. K., "Numerical Methods for Scientists and Engineers", 3 rd					Ltd, I	New Delhi
1. REFER	Veerarajan ENCES: Sankara R. 2007.		Edition, P	rentice Hall of	f India	a Pvt.		
1. REFER	Veerarajan ENCES: Sankara R. 2007. Steven C. (ao. K., "Numerical Methods for Scientists and Engineers", 3 rd	Edition, Pers", 7 th Ed	rentice Hall of	India -Hill I	a Pvt.		

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	apply various numerical techniques to solve algebraic and transcendental equations.	Applying (K3)
CO2	perform interpolation on given data using standard numerical techniques.	Applying (K3)
CO3	understand the concepts of numerical differentiation and integration	Applying (K3)
CO4	compute the solution of first order ordinary differential equations by numerical techniques	Applying (K3)
CO5	apply various numerical techniques for solving partial differential equations.	Applying (K3)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	2	2											
CO3	3	3	2											
CO4	3	2	1											
CO5	3	3	3											

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	10	80	-	-	-	100
CAT2	10	10	80	-	-	-	100
CAT3	10	10	80	-	-	-	100
ESE	10	10	80	-	-	-	100

^{*} $\pm 3\%$ may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22FTT41 - HEAT TRANSF	LI OI LIATIONS					
Programme & Branch	B.Tech & Food Technology	Sem.	Category	L	Т	P	Credit
Prerequisites	Nil	4	ES	3	1	0	4
Preamble	The course enable the students to study the phe evaporators and its application in food processin		eat transfer, h	neat	excha	anger	6,
Unit – I	Heat transfer Operations and conductions:						9+3
Unit – II Natural and forced under laminar, tra	er, composite cylinder, Thermal Conductivity - effect Convection: d convection— Application of dimensional analysis for ansition and turbulent conditions. Individual and overtate heat transfer. Introduction to Fins.	r convection - Equation	ns for forced a	and n	atura	l con	9+3 rection
Unit – III	Radiation:						9+3
• · · · · · · · · · · · · · · · · · · ·							
Black body conce	pt - Radiation Properties-Stefan Boltzmann's law, e	emissivity and absorpti	ivity. Concept	of g	rey b	ody -	- radiatio
	pt - Radiation Properties-Stefan Boltzmann's law, є k surfaces -parallel planes, radiation shields.	emissivity and absorpti	ivity. Concept	of g	rey b	ody –	- radiatio
between non-blac		emissivity and absorpti	vity. Concept	of g	rey b	ody –	- radiatio
Unit – IV Parallel and coun factor charts - Fou	k surfaces –parallel planes, radiation shields.	ers effectiveness; numb	per of transfe	r uni	t – us	se of	9+3
Unit – IV Parallel and coun factor charts - Fou	k surfaces –parallel planes, radiation shields. Heat Exchangers: ter flow heat exchangers - LMTD - Heat exchanger sling factor. Types of heat exchanger- working princip	ers effectiveness; numb	per of transfe	r uni	t – us	se of	9+3
Unit – IV Parallel and coun factor charts - Fou exchangers, shell Unit – V Types of evaporat feed backward op	Heat Exchangers: ter flow heat exchangers - LMTD - Heat exchanger lling factor. Types of heat exchanger- working princip and tube heat exchanger, plate heat exchangers. Evaporators: cors – working principle and applications: Single effecterations, Open pan evaporator, horizontal tube evap	ers effectiveness; numb ples and applications: s	per of transfe Single pass, r	r unimulti	t – us pass rs -Fe	se of heat	9+3 correctio 9+3 rward an
Unit – IV Parallel and coun factor charts - Fou exchangers, shell Unit – V Types of evaporat feed backward op	Heat Exchangers: ter flow heat exchangers - LMTD - Heat exchanger lling factor. Types of heat exchanger- working princip and tube heat exchanger, plate heat exchangers. Evaporators: cors – working principle and applications: Single effecterations, Open pan evaporator, horizontal tube evap	ers effectiveness; numb ples and applications: s	per of transfe Single pass, r	r unimulti multi pratoi g tub	t – us pass rs -Fe e eva	se of heat	9+3 correctio 9+3 rward anor,
Unit – IV Parallel and coun factor charts - Fou exchangers, shell Unit – V Types of evaporat feed backward op forced circulation	Heat Exchangers: ter flow heat exchangers - LMTD - Heat exchanger lling factor. Types of heat exchanger- working princip and tube heat exchanger, plate heat exchangers. Evaporators: cors – working principle and applications: Single effecterations, Open pan evaporator, horizontal tube evap	ers effectiveness; numb ples and applications: s	per of transfe Single pass, r e effect evapo aporator, long	r unimulti multi pratoi g tub	t – us pass rs -Fe e eva	se of heat	9+3 correctio 9+3 rward anor,
between non-blac Unit – IV Parallel and coun factor charts - Fou exchangers, shell Unit – V Types of evaporat feed backward op forced circulation of the country of the	Heat Exchangers: ter flow heat exchangers - LMTD - Heat exchanger lling factor. Types of heat exchanger- working princip and tube heat exchanger, plate heat exchangers. Evaporators: cors – working principle and applications: Single effecterations, Open pan evaporator, horizontal tube evap	ers effectiveness; numbiples and applications: some ct evaporators, multiple porator, vertical tube ev	per of transfe Single pass, r e effect evapo aporator, long	r unimulti multi pratoi g tub	t – us pass rs -Fe e eva	se of heat	9+3 correctio 9+3 rward anor,
Unit – IV Parallel and coun factor charts - Fou exchangers, shell Unit – V Types of evaporat feed backward op forced circulation of	Heat Exchangers: ter flow heat exchangers - LMTD - Heat exchanger lling factor. Types of heat exchanger- working princip and tube heat exchanger, plate heat exchangers. Evaporators: fors – working principle and applications: Single effect erations, Open pan evaporator, horizontal tube evap evaporator.	ers effectiveness; numbiples and applications: some ct evaporators, multiple porator, vertical tube ev	per of transfe Single pass, r e effect evapo aporator, long	r unimulti multi pratoi g tub	t – us pass rs -Fe e eva	se of heat	9+3 correctio 9+3 rward anor,
Unit – IV Parallel and coun factor charts - Fou exchangers, shell Unit – V Types of evaporat feed backward op forced circulation of the country of the count	Heat Exchangers: ter flow heat exchangers - LMTD - Heat exchanger lling factor. Types of heat exchanger- working princip and tube heat exchanger, plate heat exchangers. Evaporators: fors – working principle and applications: Single effect erations, Open pan evaporator, horizontal tube evap evaporator.	ers effectiveness; numbiples and applications: sect evaporators, multiple porator, vertical tube evaporator, vertical tube, evaporator, ev	per of transfe Single pass, r e effect evapo aporator, long Lecture	r unimulti	t – us pass rs -Fe e eva	se of heat eed fo porat	9+3 correctio 9+3 rward anor,

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	outline the concept of heat conduction	Understanding(K2)
CO2	make use of equations for calculating convective heat transfer coefficients	Applying(K3)
CO3	apply the concepts of radiation to solve heat transfer problems	Applying(K3)
CO4	select a suitable heat exchanger and analyze the performance	Analyzing (K4)
CO5	choose evaporators and infer its performance	Applying(K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	1					1		1	2	1
CO2	3	3	1	2	2					1		1	2	1
CO3	3	3	1	2	1					1		1	1	1
CO4	3	3	2	2	2	1	1	1	1	1	1	1	3	2
CO5	3	3	2	2	2	1	1	1	1	1	1	1	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %					
CAT1	10	45	45				100					
CAT2	10	30	60				100					
CAT3	10	20	50	20			100					
ESE	10	30	50	10			100					

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

	22FTT42 – FOOD MIC	CROBIOLOGY					
Programme & Branch	B.Tech &Food Technology	Sem.	Category	L	т	Р	Credit
Prerequisites	Nil	4	PC	3	0	0	3
Preamble	To get in depth knowledge in microbiology basi diseases and its control.	cs, identification and inc	cidence of mic	robe	es in 1	food, s	spoilage,
Unit – I	Introduction:						9
	n and Scope of Microbiology- History-Contribution tion of Microorganisms- Prokaryotes and Eukaryot foods.						
Unit – II	Classification and Identification:						9
Differential stainin	Identification: Classification of microbes based on ag, Special Staining. Culture media- types of media. Growth curve.						
Unit – III	Incidence of Microorganisms:						9
	nsic. Microbial Load assessment: SPC, MPN, Di uorescent Antibody, ELISA.	ivic, bye Reduction te	si, Air illea	Suie	mem		iui iuiugica
Unit – IV Microbial spoilage	Microbial spoilage and its control: and its control: Types of food spoilage, Microbia						
Unit – IV Microbial spoilage meat and meat pro	Microbial spoilage and its control:	foods and canned food					egetables
Unit – IV Microbial spoilage meat and meat pro	Microbial spoilage and its control: and its control: Types of food spoilage, Microbia oducts, bakery products, dairy products, fermented	foods and canned food					egetables
Unit – IV Microbial spoilage meat and meat pro agents, Chemical a Unit – V Food Borne Disea	Microbial spoilage and its control: and its control: Types of food spoilage, Microbia oducts, bakery products, dairy products, fermented agents and their mode of action. Role of antibiotics Food Borne Diseases and Quality Control: ases and Quality Control: Gastroenteritis, Listerios toxin, Ochratoxin, Patulin, Botulin. Indicators of food	foods and canned food . sis, Salmonellosis, Shig	s. Control of	micro	Cam	nisms	egetabless: Physica
Unit – IV Microbial spoilage meat and meat pro agents, Chemical a Unit – V Food Borne Disea Food toxins – Afla	Microbial spoilage and its control: and its control: Types of food spoilage, Microbia oducts, bakery products, dairy products, fermented agents and their mode of action. Role of antibiotics Food Borne Diseases and Quality Control: ases and Quality Control: Gastroenteritis, Listerios toxin, Ochratoxin, Patulin, Botulin. Indicators of food	foods and canned food . sis, Salmonellosis, Shig	s. Control of	micro	Cam	nisms	egetabless: Physica
Unit – IV Microbial spoilage meat and meat pro agents, Chemical a Unit – V Food Borne Disea Food toxins – Afla	Microbial spoilage and its control: and its control: Types of food spoilage, Microbia oducts, bakery products, dairy products, fermented agents and their mode of action. Role of antibiotics Food Borne Diseases and Quality Control: ases and Quality Control: Gastroenteritis, Listerios toxin, Ochratoxin, Patulin, Botulin. Indicators of food	foods and canned food . sis, Salmonellosis, Shig	s. Control of	micro	Cam	nisms	egetables s: Physica 9 acteriosis ood safety
Microbial spoilage meat and meat proagents, Chemical a Unit – V Food Borne Disea Food toxins – Afla Microbiological crit TEXT BOOK: 1. James M. 2012. Unit	Microbial spoilage and its control: and its control: Types of food spoilage, Microbial oducts, bakery products, dairy products, fermented agents and their mode of action. Role of antibiotics Food Borne Diseases and Quality Control: asses and Quality Control: Gastroenteritis, Listerios toxin, Ochratoxin, Patulin, Botulin. Indicators of footeria for foods. Jay, Martin J. Loessner, David A. Golden, "Modernit 1-2	foods and canned food . sis, Salmonellosis, Shig od product quality- Colif n Food Microbiology", 4	s. Control of dellosis, Vibricorm bacteria-	osis, Indi	Cam cator	npylob s of fo	egetables: Physical sectors of safety Total:4
Microbial spoilage meat and meat proagents, Chemical a Unit – V Food Borne Disea Food toxins – Afla Microbiological crit TEXT BOOK: 1. James M. 2012. Uni	Microbial spoilage and its control: and its control: Types of food spoilage, Microbial oducts, bakery products, dairy products, fermented agents and their mode of action. Role of antibiotics Food Borne Diseases and Quality Control: asses and Quality Control: Gastroenteritis, Listerios toxin, Ochratoxin, Patulin, Botulin. Indicators of footeria for foods. Jay, Martin J. Loessner, David A. Golden, "Modern	foods and canned food . sis, Salmonellosis, Shig od product quality- Colif n Food Microbiology", 4	s. Control of dellosis, Vibricorm bacteria-	osis, Indi	Cam cator	npylob s of fo	egetables: Physical sectors of safety Total:4
Microbial spoilage meat and meat proagents, Chemical a Unit – V Food Borne Disea Food toxins – Afla Microbiological crit TEXT BOOK: 1. James M. 2012. Unit 2 Frazier W	Microbial spoilage and its control: and its control: Types of food spoilage, Microbial oducts, bakery products, dairy products, fermented agents and their mode of action. Role of antibiotics Food Borne Diseases and Quality Control: asses and Quality Control: Gastroenteritis, Listerios toxin, Ochratoxin, Patulin, Botulin. Indicators of footeria for foods. Jay, Martin J. Loessner, David A. Golden, "Modernit 1-2	foods and canned food . sis, Salmonellosis, Shig od product quality- Colif n Food Microbiology", 4	s. Control of dellosis, Vibricorm bacteria-	osis, Indi	Cam cator	npylob s of fo	egetable s: Physic 9 acteriosi pod safet Total:4

	SE OUTCOMES: uppletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	recall the historical developments in microbiology and classify microorganisms	Remembering (K1)
CO2	outline appropriate techniques to identify and cultivate microorganisms	Understanding(K2)
CO3	summarize the importance of microorganisms in foods and quantify microbial load	Understanding(K2)
CO4	identify microbial spoilage in different foods and choose suitable control measures	Applying (K3)
CO5	infer the food borne diseases and quality control of foods	Understanding(K2)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1										1	1
CO2	3	2	2		2	2				1			1	2
CO3	3	2	3		2	1				1		1	1	3
CO4	3	3	3		1	2		1		1		1	1	3
CO5	3	2	2			2	1	1		1		1	1	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	50					100
CAT2	40	60					100
CAT3	20	40	40				100
ESE	40	40	20				100

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

	22FTT43 - MASS TRANSFER IN FOOD P	ROCESSING OPER	RATIONS				
Programme & Branch	B.Tech & Food Technology	Sem.	Category	L	т	Р	Credit
Prerequisites	Food Process Calculations	4	PC	3	1	0	4
Preamble	This course provides an insight to the diffusion pro-						
	Mass Transfer Operations and Diffusion: ss Transfer Operations: Introduction, Classification v of diffusion. Steady state molecular and eddy diffu						
diffusivity of gas ar efficients. Unit – II	Theories of Mass Transfer and Analogies, Hum	•		over	all m	ass ti	ansfer co-
Theories of Mass Theat, mass and m Crystallization: Adia	Transfer and Analogies: Theories of mass transfer: nomentum transfer: Reynolds, Chilton -Colburn, Talabatic saturation process and theory of wet bulb tempers. Principles of crystallization. Crystallizers - Types -	Two Film, penetration ylor- Prandtl, Von-k Perature - Measurem	on- surface re Carman Analo	gies	. Hu	midifi	y between cation and
Unit – III	Distillation:	, tppiloationo.					9+3
unit – IV Equilibrium in terna current and counter	n- steam distillation- vacuum distillation. Tray and Pacabe-Thiele method Liquid-Liquid Extraction: Tray systems - Solvent selection criteria- equilibrium start current operations. Extractors - working principle and prated plate towers- rotating disc contactors - pulsed contactors -	age wise contact. Sir	ngle stage ext	racti ked t	on- N	Multi st	9+3 tage cross
Unit – V	Leaching:						9+3
Leaching equipmen	ium - Factors affecting rate of leaching. Single and Monts – working principle and applications: Stationary bous immersion type leaching equipments.						
			Lecture	45,	Tuto	rial:15	, Total:60
TEXT BOOK:							
1. Anantharar Delhi, 2011	man N., Meera Sheriffa Begam K.M., "Mass Transfer 1.	Theory and Practice	e", 1st Edition	ı, PH	II Puk	olicatio	ons, New
REFERENCES:							
1. Treybal R.E	E., "Mass Transfer Operations", 3rd Edition, McGraw	Hill, New York, 2012					
- Smith P.G.	, "Introduction to Food Process Engineering", 2nd Ed	ition Springer New	Vork 2011				
2. Smilli P.G.	, introduction to 1 dod 1 100033 Engineering , 2nd Ed	illori, opringer, new	10IK, 2011.				

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	classify, explain and model the diffusion in gas, liquid and solid	Understanding(K2)
CO2	explain and make use of the concepts of humidification and crystallization	Applying (K3)
CO3	summarize various distillation processes and determine equilibrium stages in distillation tower	Evaluating (K5)
CO4	select suitable solvent and extraction equipments and perform extraction calculations	Applying (K3)
CO5	illustrate the principle and operation of leaching equipments and make use of leaching calculations	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1					1			1	1
CO2	3	3	2	2	1					1		1	3	2
CO3	3	3	3	3	3					1		1	3	2
CO4	3	3	3	3	2		1	1		1		1	3	2
CO5	3	3	3	3	2		1	1		1		1	3	2

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	35	45				100
CAT3	15	35	50				100
ESE	15	35	50				100

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

Programme & Branch	B.Tech & Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	4/5	PC	3	1	0	4
Preamble	The course provides knowledge on basic unit of mechanical separation, mixing and extrusion in		harvest proce	ssin	g, siz	e redu	uction,
Unit – I	Pre-Processing Operations:						9+3
	s in field crops – Cleaning - Peeling - Grading and ound and unbound moisture. Equilibrium moisture						
Unit – II	Size Reduction:						9+3
and Cutting equipn	r foods and Liquid foods – Calculation of Energy t ment's - Crushers, Hammer mills, Fixed head mills, and Pulper. Size reduction in liquids						
	Mark suited Commettees						9+3
	Mechanical Separation: liquids - Gravitational sedimentation – Floatation	-Sedimentation of parti	icles in gas.	Cen	trifug	al sep	
Sedimentation in I Velocity of particles filtration – Area cal Unit – IV Characteristics of I	liquids - Gravitational sedimentation – Floatation s – Radius of neutral zone – Measurement- Equipr culation- Equipment's, Sieving effectiveness and A Mixing: mixtures. Measurement of mixing - sample size, sample	ment's. Filtration – Cons Applications ample composition. Part	tant rate and	Con nd Li	stant	press	paration - sure 9+3 g - mixing
Sedimentation in I Velocity of particles filtration – Area cal Unit – IV Characteristics of rindex. Mixing of dif	liquids - Gravitational sedimentation – Floatation s – Radius of neutral zone – Measurement- Equipr lculation- Equipment's, Sieving effectiveness and A	ment's. Filtration – Cons Applications ample composition. Part	tant rate and	Con nd Li	stant	press	paration - sure 9+3 g - mixing
Sedimentation in I Velocity of particles filtration – Area cal Unit – IV Characteristics of I index. Mixing of dif Particle Mixers, Do	liquids - Gravitational sedimentation – Floatation s – Radius of neutral zone – Measurement- Equipment legistriction - Equipment's, Sieving effectiveness and A Mixing: mixtures. Measurement of mixing - sample size, saferent quantities. Rate of Mixing and Energy Input	ment's. Filtration – Cons Applications ample composition. Part	tant rate and	Con nd Li	stant	press	paration - sure 9+3 g - mixing
Velocity of particles filtration – Area cal Unit – IV Characteristics of sindex. Mixing of dif Particle Mixers, Do Unit – V Theory - Rheologic Applications and E	iquids - Gravitational sedimentation - Floatation s - Radius of neutral zone - Measurement- Equipment iculation- Equipment's, Sieving effectiveness and A Mixing: mixtures. Measurement of mixing - sample size, saferent quantities. Rate of Mixing and Energy Input bugh and Paste Mixers.	ment's. Filtration – Cons Applications ample composition. Part in Mixing. Mixing equipr lle and Twin screw extru	ticle mixing a ment's - Liqui	nd Li d Mix	iquid kers,	Mixing Powd	9+3 g - mixing er and 9+3
Sedimentation in I Velocity of particles filtration – Area cal Unit – IV Characteristics of r index. Mixing of dif Particle Mixers, Do Unit – V Theory - Rheologic Applications and E	iquids - Gravitational sedimentation - Floatation s - Radius of neutral zone - Measurement- Equipment legistration - Equipment's, Sieving effectiveness and A Mixing: mixtures. Measurement of mixing - sample size, saferent quantities. Rate of Mixing and Energy Input ough and Paste Mixers. Extrusion and Material Handling: cal properties and Operating Characteristics. Sing iffects on Foods. Types of handling and conveying	ment's. Filtration – Cons Applications ample composition. Part in Mixing. Mixing equipr lle and Twin screw extru	ticle mixing a ment's - Liqui uders - Ancilla ts - Belt conve	nd Li d Mix ary E eyor,	quid kers,	Mixing Powd	9+3 g - mixing er and 9+3 s. eveyor,
Sedimentation in I Velocity of particles filtration – Area cal Unit – IV Characteristics of r index. Mixing of dif Particle Mixers, Do Unit – V Theory - Rheologic Applications and E bucket elevator and	iquids - Gravitational sedimentation - Floatation s - Radius of neutral zone - Measurement- Equipment legistration - Equipment's, Sieving effectiveness and A Mixing: mixtures. Measurement of mixing - sample size, saferent quantities. Rate of Mixing and Energy Input ough and Paste Mixers. Extrusion and Material Handling: cal properties and Operating Characteristics. Sing iffects on Foods. Types of handling and conveying	ment's. Filtration – Cons Applications ample composition. Part in Mixing. Mixing equipr lle and Twin screw extru	ticle mixing a ment's - Liqui uders - Ancilla ts - Belt conve	nd Li d Mix ary E eyor,	quid kers,	Mixing Powd	9+3 g - mixing er and 9+3
Sedimentation in I Velocity of particles filtration – Area cal Unit – IV Characteristics of r index. Mixing of dif Particle Mixers, Do Unit – V Theory - Rheologic Applications and E bucket elevator and TEXT BOOK: Fellows P.	iquids - Gravitational sedimentation - Floatation s - Radius of neutral zone - Measurement- Equipment legistration - Equipment's, Sieving effectiveness and A Mixing: mixtures. Measurement of mixing - sample size, saferent quantities. Rate of Mixing and Energy Input ough and Paste Mixers. Extrusion and Material Handling: cal properties and Operating Characteristics. Sing iffects on Foods. Types of handling and conveying	ment's. Filtration – Cons Applications ample composition. Part in Mixing. Mixing equipr le and Twin screw extru system for food product	ticle mixing a ment's - Liqui iders - Ancilla ts - Belt conve	nd Li d Mix ary E eyor,	quid cers, quipi scre	Mixing Powd	9+3 g - mixing er and 9+3 s. iveyor,
Sedimentation in I Velocity of particles filtration – Area cal Unit – IV Characteristics of r index. Mixing of dif Particle Mixers, Do Unit – V Theory - Rheologic Applications and E bucket elevator and TEXT BOOK: Fellows P.	iquids - Gravitational sedimentation — Floatation s — Radius of neutral zone — Measurement- Equipment legistration - Equipment's, Sieving effectiveness and A Mixing: mixtures. Measurement of mixing - sample size, saferent quantities. Rate of Mixing and Energy Input legistration and Paste Mixers. Extrusion and Material Handling: cal properties and Operating Characteristics. Sing effects on Foods. Types of handling and conveying depneumatic conveyor	ment's. Filtration – Cons Applications ample composition. Part in Mixing. Mixing equipr le and Twin screw extru system for food product	ticle mixing a ment's - Liqui iders - Ancilla ts - Belt conve	nd Li d Mix ary E eyor,	quid cers, quipi scre	Mixing Powd	9+3 g - mixing er and 9+3 s. iveyor,
Sedimentation in I Velocity of particles filtration – Area cal Unit – IV Characteristics of r index. Mixing of dif Particle Mixers, Do Unit – V Theory - Rheologic Applications and E bucket elevator and TEXT BOOK: 1. Fellows P. 2016 REFERENCES:	iquids - Gravitational sedimentation — Floatation s — Radius of neutral zone — Measurement- Equipment legistration - Equipment's, Sieving effectiveness and A Mixing: mixtures. Measurement of mixing - sample size, saferent quantities. Rate of Mixing and Energy Input legistration and Paste Mixers. Extrusion and Material Handling: cal properties and Operating Characteristics. Sing effects on Foods. Types of handling and conveying depneumatic conveyor	ment's. Filtration – Cons Applications ample composition. Part in Mixing. Mixing equipred le and Twin screw extrusystem for food product	ticle mixing a ment's - Liqui	nd Li d Mix ary E eyor,	quid cers, quipi scre	Mixing Powd	9+3 g - mixing er and 9+3 s. iveyor,

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	identify appropriate pre-processing operations and calculate moisture characteristics of food products	Applying (K3)
CO2	select suitable size reduction equipment for food materials	Applying (K3)
CO3	examine the role of mechanical separation operations in food processing	Applying (K3)
CO4	Identify the characteristics of the mixtures and select appropriate mixing equipment	Applying (K3)
CO5	explain the process of extrusion and select suitable material handling systems	Understanding(K2)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2						1		1	3	2
CO2	3	3	2	2						1		1	3	2
CO3	3	3	2	3	1					1		1	3	2
CO4	3	3	2	3	1					1		1	3	2
CO5	3	3	2	2						1		1	3	2

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creatin g(K6) %	Total %
CAT1	20	40	40				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

* $\pm 3\%$ may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

				22	PFTL41	- HEAT	AND N	MASS T	RANSF	ER LA	BORATO	ORY				
	amme &		B.Tec	h & Fo	od Tecl	nology	,				Sem.	Category	L	Т	Р	Credit
Branc	n quisites		Nil								4	PC	0	0	2	1
Pream	-		To im	part pra	ctical kr	nowledg	e on he	at and	mass tra	ansfer tl	hat is red	quired for pr	ocess	indı	ustries.	
	OF EXPE	RIM														
1.	Estima	tion	of indiv	idual he	at trans	fer coe	fficient ι	ınder N	atural/F	orced c	onvectio	n heat trans	sfer			
2.	Determ	ninat	ion of S	Stefan B	oltzmar	consta	nt for ra	diation	heat tra	ansfer						
3.	Estima	ition	of indiv	idual an	d overa	ıll heat t	ransfer	coeffici	ent for h	neat trai	nsfer in s	shell and tub	e heat	exe	change	er
4.	Estima	ition	of indiv	ridual an	d overa	ıll heat t	ransfer	coeffici	ent for h	neat trai	nsfer in a	gitated ves	sel			
5.	Estima	ition	of indiv	idual he	at trans	fer coe	fficient f	or heat	transfe	r throug	h bare tu	ıbe heat ex	change	er		
6.	Verifyir	ng th	e Ralei	igh's eq	uation f	or the g	iven sys	stem us	ing simp	ole distil	lation se	tup				
7.	Determ setup	ninat	ion of v	aporiza [.]	tion effi	ciency (Ev) and	I therma	al efficie	ncy (Et)) of the g	jiven systen	n using	ste	am dis	stillation
8.	Determ	ninat	ion of t	he diffus	sivity of	given li	quid to a	air								
9.	Studyir	ng th	e theor	etical a	nd actua	al recov	ery of s	olvent u	ising lea	aching a	ınd Estin	nation of oil	recove	ery ι	ısing E	xpeller
10.				very of t Distillat		head a	nd botto	m prod	ucts of	methan	ol water	system und	er tota	l ref	lux cor	ditions
11.	Virtual	Lab	: Demo	nstratio	n of the	rmal Co	nductivi	ity of a r	material							
																Total:30
REFEI	RENCES	6/ M <i>A</i>	ANUAL	/SOFT\	WARE:											
1.	Labora	tory	Manua	ıl												
2.	McCab York, 2			ith J.C.,	and Ha	arriot P.	"Unit O	peratio	ns of Ch	nemical	Enginee	ring". 7th E	dition,	Mc(Graw H	ill, New
3.				ry's Che	emical E	nginee	rs Hanc	l book".	8th Edi	tion, Mo	Graw Hi	II, New Yor	k, 2007	7.		
4	Treyba	ıl. R.	E. "Mas	ss Trans	fer Ope	erations	.3rd Ed	lition, M	cGraw-	Hill, Ne	w York,	1981.				
5.	Amirth	a vir	tual lab	tool :htt	ps://vla	b.amrita	a.edu/									
COUR	SE OUT	CON	/IES:												Т Мар	
	mpletion			-											ghest I	
CO1	estima	te he	eat tran	sfer coe	fficient	for heat	exchar	ngers						Pr	ecision	(S3)
CO2	determ	ine :	Stefan I	Boltzma	nn cons	stant an	d diffusi	vity coe	efficient					Pr	luating ecision	(S3)
CO3	evalua	te th	e proce	ess/perfo	ormance	e param	eters fo	r distilla	ation, ex	traction	, and lea	aching			luating ecision	
						Маррі	ng of C	os with	POs a	nd PSC	Os					
COs/P			PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	! 1	PSO1	PSO2
CO	•	3	3	3	3	2				3	2	2 2	1		3	2
CO	_	3	3	3	3	2	1	1	1	3	2	2	1		3	2
CO:	ght, $2 - N$						-	-				_				

					22FTL	.42 - FC	OOD MI	CROBI	OLOGY	LABO	RATOR	Y				
Progra Branc		&	B.Tec	ch & Fo	od Tecl	nnology	y				Sem.	Category	L	Т	Р	Credit
Prerec	quisite	es	Nil								4	PC	0	0	2	1
Pream	ıble		To ide	entify an	d chara	cterize	microbe	es asso	ciated w	ith food	ls and to	enumerate	it.			
LIST C	OF EX	PERIM	IENTS	/ EXER	CISES:											
1.	Stud	dy expe	eriments	s on mic	robiolog	gy lab e	quipme	nts and	safety p	oractice	S					
2.	Ider	ntification	on of mi	icroorga	nisms b	y Simpl	e staini	ng tech	nique							
3.	Ider	ntification	on of mi	icroorga	nisms b	y Gram	stainin	g techn	ique							
4.	Pre	paratio	n of diff	erent cu	lture me	edia and	d microb	oial isola	ation us	ing seria	al dilutio	n technique				
5.	Cult	tivation	and en	umerati	on of mi	icroorga	ınisms ı	using di	fferent p	olating n	nethod(F	Pour/Spread	d/Strea	ık)		
6.	Enu	merati	on of m	icroorga	nisms i	n spoile	d baker	y and c	onfectio	nery pro	oducts					
7.	Mici	robial e	examina	ition of b	olanche	d / paste	eurized	/ steriliz	ed/refri	gerated	/ frozen	foods				
8.	Ass	essing	the load	d of coli	form ba	cteria as	s an ind	icator n	nicroorg	anism u	ising MP	'N method				
9.	Biod	chemic	al chara	acteristic	s of mid	croorgai	nisms u	sing IM	ViC test	t						
10.	Anti	biotic s	ensitivi	ty for mi	croorga	nisms										
11.	Virtu	ual lab:	simple	staining	, gram	staining	, serial	dilution	plating	technic	ues, IM	/iC test				
															•	Total:30
REFEI	RENC	ES/ M	ANUAL	/SOFT	WARE:											
1.	Lab	oratory	Manua	ıl												
2.	Jam	nes G.	Cappuc	cino, Na	atalie Sh	nerman,	" Micro	biology	A Labo	ratory N	/lanual",	12, illustrate	ed, Pe	arsc	n, 2019	€.
3.	McL	andsb	orough	L., "Foo	d Micro	biology	Labora	tory", Ta	aylor & I	Francis	Group, 2	2017.				
4	http	://www	.amrita.	edu/cre	ate											
		UTCO													Т Мар	
	1			urse, th											ghest l plying	
CO1	ider	ntify the	morph	ology of	microo	rganism	s by dif	ferent s	taining	techniq	ue			Pr	ecision	(S3)
CO2	isola	ate the	microo	rganism	s from o	different	food st	uffs						Man	-	on (S2)
CO3	cha	racteriz	ze the m	nicroorg	anisms	using di	fferent	method	S						alyzing ecision	
						Mappi	ng of C	os with	n POs a	ınd PSC)s					
COs/P	POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	2	PSO1	PSO
CO.	1	3	3	2	2	1	2			3	2		1		1	3
CO		3	3	2	2	1	2			3	2		1		1	3
	3	3	3	2	2	2	2	1		3	2		2		1	3

	22GEL41 - PROFESSIONAL SKILLS TRA	AINING -	1				
	(Common to All BE/ BTech Engineering and Tech	nology b	ranches)				
Programme & Branch	All BE/ BTech Engineering and Technology branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	4	EC	0	0	2	2
Preamble	This subject is to enhance the employability skills and to deve	elop care	er competend	CV			
Unit – I	Soft Skills – I:	•	•	•			20
knowledge upg etiquette- Basic etiquette- Body		sics of co	orporate cultu	re-K	ey pill	ars of b	usiness Felephone
Unit – II	Quantitative Aptitude and Logical Reasoning – I:				.		30
variation-Partne	g level I: Number System-LCM &HCF-Divisibility test-Surds ership-Time speed and distance-Data interpretation-data rep pical connectives-Binary logic Linear arrangements- Circular and co	oresentat	ion. Logical				
Unit – III	Written Communication & Verbal Aptitude						30
Professional e- (Transcoding) Phrases Paired Spotting Errors	Vriting strategies and formats Importance of Résumés Writing a mail Writing Responding to e-mails and business letters Technica Writing One-page Essays. Verbal Aptitude Synonyms Antonyms I words Analogies Spelling test Cloze test using suitable verb fo Sentence Correction and Formation Grammar Based questions (Tembled Sentences & Jumbled paragraphs, Identifying Facts, Inferences	al Reports Homon orms usir Transform	t writing Inter yms One wo ng appropriat nation : Active	preta ord s e art e-Pas	ition oubstiticles	of Techi ution Id and pre & Direct	nical Data lioms and epositions; -Indirect);
							Total:45
TEXT BOOK:							
	Thorpe and Showick Thorpe, "Objective English for Competitive Executed States and Showick Thorpe, "Objective English for Competitive Executed States and Showick Thorpe,"	aminatio	n", 6th Editior	n, Pe	arson	India E	ducation
REFERENCES	:						
1. Stephe	n Bailey, "Academic Writing: A practical guide for students", Routle	dge, Nev	v York, 2011.				

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	develop the soft skills of learners to support them work efficiently in an organization as an individualand as a team	Applying (K3), Precision (S3)
CO2	solve real time problems using numerical ability and logical reasoning	Applying (K3), Precision (S3)
CO3	Apply communication skills effectively to understand and deliver information in various written discourses grammatically with accuracy	Applying (K3), Precision (S3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2				3	3		3		3	2		
CO2	3	2				3	3		3		3	2		
CO3		2				3	3		3	3	3	2		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2		50	50				100
CAT3		50	50				100
ESE			N	IA			100

* $\pm 3\%$ may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

			22EGL31 -							[
Drogram	ma P		(C	common to	All Engin	eering and	Technolog	y Branche	es)				
Program Branch	iiie &	All B.E.	/B.Tech Bi	ranches			Se	em.	Category	L	Т	Р	Credit
Prerequi	isites	Nil					3	/ 4	HS	0	0	2	1
Preamble	Э		urse is desi ional comm			ssary skills	to listen, s	peak, reac	I and write	in order	to obt	ain bet	ter
LIST OF	EXPERIM	IENTS / E	XERCISES	:									
1.	Self	Introductio	n & Mock Ir	nterview									
2.	Job	Application	n letter with	Resume									
3.	Pres	entation: A	Technical	topic / Pro	ject report	& a Case	study						
4.	Situa	tional Dial	ogues / Tel	ephonic C	onversatio	ns							
5.	Grou	p Discussi	ion										
6.	Read	ding Aloud											
7.	Liste	ning Comp	orehension										
8.	Writi	ng Compa	ny Profiles										
9.	Prep	aring revie	ews of a bo	ok/product	t/movie								
40	Pron	unciation 7	Foot										
10.													Total: 3
	NCES/ M		OFTWARE	i:									Total: 3
REFERE	ENCES/ M	ANUAL /S	OFTWARE		e								Total: 3
REFERE 1. 2. COURSE	Lab Ore	ANUAL /S poratory Ma	OFTWARE anual	ab Softwar								apped	
REFERE 1. 2. COURSE	Lab Ore	ANUAL /S coratory Ma ell Digital L MES: the cours	OFTWARE anual anguage La	ab Softwar	be able to					(H Und	l ighes erstar	apped	l) (2),
REFERE 1. 2. COURSE On comp	Lab Ore E OUTCO pletion of	ANUAL /S poratory Ma ell Digital Le MES: the cours unce effecti	OFTWARE anual anguage La	ab Softwar lents will and readi	be able to		education			Und Und	lighes erstar mitation pplyir	apped st Leve	I) (2),
REFERE 1. 2. COURSE On comp	Lab Ore E OUTCO oletion of enha	ANUAL /S poratory Ma ell Digital La MES: the cours unce effecti	OFTWARE anual anguage La se, the stud	ab Softwar lents will and readi	be able to ing skills or workplad	ce/higher e				Und Und I Nat	erstar erstar mitatio applyir uraliza applyir	apped it Leve ading (k on (S1)	(2),
1. 2. COURSE On comp	Lab Ore E OUTCO oletion of enha	ANUAL /S poratory Ma ell Digital La MES: the cours unce effecti	opportunction of the students	lents will and readi	be able to ing skills or workplace	ce/higher e		60s		Und Und I Nat	erstar erstar mitatio applyir uraliza applyir	apped st Leve nding (K on (S1) ng (K3) ation (S	(2),
REFERE 1. 2. COURSE On comp CO1 CO2	Lab Ore E OUTCO oletion of enha	ANUAL /S poratory Ma ell Digital La MES: the cours unce effecti	opportunction of the students	lents will and readi	be able to ing skills or workplace	ce/higher e	s	SOs PO8	PO9	Und Und I Nat	erstar mitation applyin curaliza applyin ticulat	apped st Leve nding (K on (S1) ng (K3) ation (S	(2),
COS/	ENCES/ M Lab Ore E OUTCO bletion of enha acqu use I	ANUAL /S coratory Ma ell Digital Le MES: the cours ince effecti ire profess English lan	coffware anual anguage La se, the stud ive listening sional skills aguage skills	lents will and reading required for seffectivel	be able to ing skills or workplace by in variou	ce/higher e	s POs and P S		PO9 2	Und I A Nat A	erstar mitation applyin curaliza applyin ticulat	apped at Leve nding (Kon (S1) ng (K3), ation (S4) tion (S4)	(2), (55)
COS/POS	ENCES/ M Lab Ore E OUTCO bletion of enha acqu use I	ANUAL /S coratory Ma ell Digital Le MES: the cours ince effecti ire profess English lan	coffware anual anguage La se, the stud ive listening sional skills aguage skills	lents will and reading required for seffectivel	be able to ing skills or workplace by in variou	ce/higher e	s POs and P S			(H Und I A Nat A Ar	erstar mitation applyin curaliza applyin ticulat	apped at Leve nding (Kon (S1) ng (K3), ation (S4) tion (S4)	(2), (55)

	22FTT51-FOOD PROCE	200 ENGINEEKING - II					
Programme & Branch	BTech Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Heat Transfer Operations	5	PC	3	0	0	3
Preamble	To impart knowledge of drying, heating and coo	oling as preservation techn	iques in food p	roces	ssing.		
Unit – I	Drying:						9
	hanism of drying - Drying characteristics of mater of drying agricultural materials - batch and continu t.						
Unit – II	Types of Dryers:						9
	elt Dryer, Drum Dryer, Spray Dryer, Fluidized B Freeze Drying, IR drying and Micro wave drying.	Bed Dryer, Spouted bed	dryer, Pneuma	atic D	ryer,	Rota	ry Dryer
Unit – III	Preservation by Heating:						9
Process calculati	ions: General method, Ball's formula method. Ste		ne relationship I equipments.				
processing Unit – IV Chilling - Equipm	Preservation by Cooling: nents, Cold storage. Freezing - Thermodynamics of	erilization – methods and	equipments.	UHT	steril	izatio	n. Retor
processing Unit – IV Chilling - Equipm Properties of froz	Preservation by Cooling: nents, Cold storage. Freezing - Thermodynamics of the foods. Freezing time calculations, Freezing equ	erilization – methods and	equipments.	UHT	steril	izatio	n. Retori
processing Unit – IV Chilling - Equipm Properties of froz Unit – V . High Pressure Fundamentals, P	Preservation by Cooling: nents, Cold storage. Freezing - Thermodynamics of	of food freezing, Phase dia uipments. Freeze concenti	grams, Ice cry ration.	UHT rstals	forma	ation, Ultra	9 gasound -
processing Unit – IV Chilling - Equipm Properties of froz Unit – V . High Pressure Fundamentals, P	Preservation by Cooling: nents, Cold storage. Freezing - Thermodynamics of the foods. Freezing time calculations, Freezing equal Non thermal Preservation: Processing - Principles & Equipments. Pulsed Expreservation and processing tool. Irradiation - Fundaments.	of food freezing, Phase dia uipments. Freeze concenti	grams, Ice cry ration.	UHT rstals	forma	ation, Ultra	9 9 asound -
processing Unit – IV Chilling - Equipm Properties of froz Unit – V . High Pressure Fundamentals, P Heating – Fundar	Preservation by Cooling: nents, Cold storage. Freezing - Thermodynamics of the foods. Freezing time calculations, Freezing equal Non thermal Preservation: Processing - Principles & Equipments. Pulsed Expreservation and processing tool. Irradiation - Fundaments.	of food freezing, Phase dia uipments. Freeze concenti	grams, Ice cry ration.	UHT rstals	forma	ation, Ultra	9 9 asound -
processing Unit – IV Chilling - Equipm Properties of froz Unit – V High Pressure Fundamentals, P Heating – Fundar	Preservation by Cooling: nents, Cold storage. Freezing - Thermodynamics of the foods. Freezing time calculations, Freezing equal Non thermal Preservation: Processing - Principles & Equipments. Pulsed Expreservation and processing tool. Irradiation - Fundaments.	erilization – methods and of food freezing, Phase dia uipments. Freeze concenticlectric Fields – Mechanist damentals and Biological e	equipments. Ingrams, Ice cry ration.	vstals ent sy Techr	forma forma	ation, Ultray. Oh	9 9 asound - mic Total:4
Drocessing Unit – IV Chilling - Equipm Properties of froz Unit – V . High Pressure Fundamentals, Pheating – Fundar TEXT BOOK: 1 Fellows	Preservation by Cooling: nents, Cold storage. Freezing - Thermodynamics of the foods. Freezing time calculations, Freezing equal Non thermal Preservation: Processing - Principles & Equipments. Pulsed Expreservation and processing tool. Irradiation - Fundamentals and Generic configurations.	erilization – methods and of food freezing, Phase dia uipments. Freeze concenticlectric Fields – Mechanist damentals and Biological e	equipments. Ingrams, Ice cry ration.	vstals ent sy Techr	forma forma	ation, Ultray. Oh	9 9 asound - mic Total:4
Drocessing Unit – IV Chilling - Equipm Properties of frozen Properties	Preservation by Cooling: nents, Cold storage. Freezing - Thermodynamics of the foods. Freezing time calculations, Freezing equal Non thermal Preservation: Processing - Principles & Equipments. Pulsed Expreservation and processing tool. Irradiation - Fundamentals and Generic configurations.	erilization – methods and of food freezing, Phase dia uipments. Freeze concentricities of Freeze concentricities of the food freezing and Biological end Practice", 4th Edition, World Practice", 4th Edition, World Practice", 4th Edition, World Practice", 4th Edition, World Practice (Control of the food freezing and Practice (equipments. Igrams, Ice cryration. Improvements and treatments. Igrams, Ice cryration. In and treatments. In and treatments. In and treatments. In and treatments.	vstals ent sy Techr	steril forma	izatio	9 9 asound mic Total:4

		TCOME n of the	S: course,	the stud	ents will	be able	to						(H	BT Mapp lighest Le	
CO1	sumi	marize t	he dryin	g mecha	anism of	food ma	aterials						Und	derstandin	g (K2)
CO2	class	sify and	explain :	suitable	dryers f	or food r	naterial	ls					Und	derstandin	g (K2)
CO3	iden	tify appr	opriate t	hermal p	oreserva	ition tecl	nniques	for food	materia	lls				Applying (K3)
CO4	mak	e use of	low tem	perature	proces	sing as	a prese	ervation te	chnique	es				Applying (K3)
CO5	outli	ne the p	rinciples	and sel	ect suita	able non	therma	ıl preserv	ation te	chniques	for food	materials		Applying (K3)
						Мар	ping o	f COs wi	th POs	and PSC	Os				
COs/	POs	PO1	PO2	PO3	PO4	PO5	P06	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CC)1	3	3	2	2						1		1	2	2
CC)2	3	3	2							1		1	2	2
CC)3	3	3	3	2		2				1		1	2	3
CO)4	3	3	3	2		2				1		1	2	3
CO)5	3	3	3			2				1		2	3	3
– Slig	ht, 2 –	Modera	ate, 3 –	Substar	ntial, BT										
								NT PAT							
	/ Blood tegory	-		mbering 1) %	J Und	derstan (K2) %		Applyin (K3) %		nalyzing (K4) %		uating 5) %	Creat (K6)		Total %
(CAT1		2	25		75									100
(CAT2		2	25		50		25							100
(CAT3		2	20		50		30							100
	ESE		2	20		50		30							100
* ±3% r	may be	varied	(CAT 1,	2 & 3 -	50 mark	s & ESE	= 100	marks)				•			

	22FTT52 - FRUIT AND VEG TECHNO						
Programme &Branch	B.TECH. – Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	5	P C	3	0	0	3
Preamble	To help the students to learn about the physiolog of fruitsand vegetables	gy, pre-processing, pos	stharvest storage	e and v	ariou	s pro	ducts
Unit - I	Physiology and Pre-processing of fruits and	vegetables:					9
Factors leading vegetables: Pred	ables. Composition and nutrition aspects. Pre hat to deterioration of fruits and vegetables. Method cooling, ag, sorting, grading peeling, blanching. Post-harvest storage methods and Preservat	ls to reduce post-harv					
	ons. Application of refrigeration and freezing cor	•	otorogo Fronz	ina ma	th a d	م ۸:۰	
Freezer, Immersion Freez Inertand Vacuum	er, Cryogenic Freezer. Hypobaric Storage, CAS. Irin Packaging. Concentration-freeze drying –osmotic	radiation, Waxing. Tre dehydration, brining, s	nds in Packag	ing fre			e-MAP,
Unit - III	Processing Technology of fruits and fruit bev						9
Hydraulic Press,	nvolved in Juice preparation-equipments-screw to Filters, clarification and concentration by membra am, Jelly, marmalade, candied preserves.						
Unit - IV	Processing Technology of vegetable product	ts:					9
Preparation of v	processing parameters of vegetable wafers, soup arious types of pickles. Dehydrated vegetable and d fruit, glazed fruit, fruit toffee, fruit powders, fruit lea	leafy products. Proces					
Unit - V	Hurdle Technology, Minimally Processed Fru	iits and Vegetables, E	dible Coating:				9
and the quality of	aspects of hurdle technology, stress- effect on free of the minimally processed fruits and vegetables, ph lity parameters and biochemical changes in the final	ysiology and biochemi	stry of the fresh	tors affo cut frui	ecting ts an	g the d veg	shelf life getables.
				T	otal:	45	
TEXT BOOK:							
	va R.P & Sanjeev Kumar, "Fruit and Vegetable Prs &Distributors, New Delhi, 2014.	reservation: Principles	and Practices"	, 3rd E	ditior	n, CB	S
REFERENCES/	MANUAL / SOFTWARE:						
	athnam and R.S. Ramteke. "Advances in Preserva	ation and Processing 1	Technologies of	Fruits	and '	Veaet	tables",
1	on, New India Publishing Agency, New Delhi, 2011.						

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	interpret physiological and biochemical changes in fruits and vegetables	Understanding (K2)
CO2	select suitable storage and preservation techniques for fruits and vegetables	Applying (K3)
CO3	apply different technology to process fruits into different fruit products	Applying (K3)
CO4	make use of techniques to process different vegetable products and other speciality products	Applying (K3)
CO5	interpret techniques involved in hurdle technology and minimal processing	Understanding (K2)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1								1			3	1
CO2	3	2	2			2				1			3	2
CO3	3	2	1	1						1			3	1
CO4	3	2	1	1						1			3	1
CO5	3	1	3			2				1			3	2
CO6	3	1								1			3	1

^{1 –} Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN -

			ITIEURI				
Test / Bloom's Category*	Rememberin g(K1) %	Understandin g(K2) %	Applyin g(K3) %	Analyzin g(K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	10	50	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Programme &	B.TECH. – FOOD TECHNOLOGY	Sem.	Catagory	L	т	Р	Credit
Branch Prerequisites	Food Chemistry	5 Seili.	Category	3	0	0	3
Frerequisites	rood Chemistry	3	PC	3	U	U	3
Preamble	To provide insight knowledge about the different ray sectors.	w materials, equipmen	nt and products	of bal	kery a	ndconfed	ctionery
Unit - I	Science Behind Baking:						9
Classification of b coloring agents, f	pakery products. Bakery Ingredients-Testing of raw mater flavoring agents, milk, milk powder, emulsifiers, leaveners	rials and functions - flo s, antioxidants and imp	ur, yeast, suga provers.	ar, fat	, egg	, water,	salt,
Unit - II	Equipments in Bakery Industry and Rheology of	dough:					9
	edients- dough mixers, dividers, rounder, sheeter, lams. Farinograph, Amylograph, Alveograph, Extensograph.a		ermentation en	closu	res ar	nd brew	equipment
Unit - III	Bread Making Process and Cake making:						9
	horleywood bread process, No time process. Charac d remedies. Spoilage of bread. Cake making ingredient						
manufacture. Unit - IV Ingredients and batters. Biscuit m	d remedies. Spoilage of bread. Cake making ingredient Biscuit making and Confectionery: their functions. Types of biscuit dough — Developed nanufacturing process, Wafers, puff pastry, chemically leading to the conference of the	ts and their function. dough, short doughteavened bakery produ	Methods for dif	ferent enzy	types me m	of cake	s 9 dough and
manufacture. Unit - IV Ingredients and batters. Biscuit m	d remedies. Spoilage of bread. Cake making ingredient Biscuit making and Confectionery: their functions. Types of biscuit dough — Developed	ts and their function. dough, short doughteavened bakery produ	Methods for dif	ferent enzy	types me m	of cake	s 9 dough and
manufacture. Unit - IV Ingredients and batters. Biscuit m Ingredients-Basi Unit - V Composition and chewing gums. C	Biscuit making and Confectionery: their functions. Types of biscuit dough — Developed nanufacturing process, Wafers, puff pastry, chemically leic Technical considerations in sugar based confectione	dough, short dough eavened bakery productry	Methods for differences, semi-sweet, acts. Classification	enzy on of	me m confe	of cake	g goms and
manufacture. Unit - IV Ingredients and batters. Biscuit m Ingredients-Basi Unit - V Composition and chewing gums. C	Biscuit making and Confectionery: their functions. Types of biscuit dough — Developed nanufacturing process, Wafers, puff pastry, chemically le ic Technical considerations in sugar based confectione Confectionery Products: I manufacturing process- Sugar boiled products-Candy, Chocolate Processing —chocolate shells, candy bars. Fru	dough, short dough eavened bakery productry	Methods for differences, semi-sweet, acts. Classification	enzy on of	me m confe	of cake	g dough and Products g gums and , faults and
manufacture. Unit - IV Ingredients and batters. Biscuit manufacture. Unit - V Composition and chewing gums. Corrective measure. TEXT BOOK:	Biscuit making and Confectionery: their functions. Types of biscuit dough — Developed nanufacturing process, Wafers, puff pastry, chemically le ic Technical considerations in sugar based confectione Confectionery Products: I manufacturing process- Sugar boiled products-Candy, Chocolate Processing —chocolate shells, candy bars. Fru	dough, short dough eavened bakery productry Toffees, fudge, cara uit confections. Confec	Methods for different seed, acts. Classification mel, aerated continues productionery productionery productions.	enzy on of	me m confe	of cake	g dough an Products g g gums an , faults an
manufacture. Unit - IV Ingredients and batters. Biscuit manufacture. Unit - V Composition and chewing gums. Corrective measure. TEXT BOOK:	Biscuit making and Confectionery: their functions. Types of biscuit dough — Developed nanufacturing process, Wafers, puff pastry, chemically le ic Technical considerations in sugar based confectione Confectionery Products: I manufacturing process- Sugar boiled products-Candy, Chocolate Processing —chocolate shells, candy bars. Fruires. Spoilage of confectionery products.	dough, short dough eavened bakery productry Toffees, fudge, cara uit confections. Confec	Methods for different seed, acts. Classification mel, aerated continues productionery productionery productions.	enzy on of	me m confe	of cake	g dough an Products g g gums an , faults an
manufacture. Unit - IV Ingredients and batters. Biscuit m Ingredients-Basi Unit - V Composition and chewing gums. Corrective measu TEXT BOOK: 1. W. P. Ed REFERENCES:	Biscuit making and Confectionery: their functions. Types of biscuit dough — Developed nanufacturing process, Wafers, puff pastry, chemically le ic Technical considerations in sugar based confectione Confectionery Products: I manufacturing process- Sugar boiled products-Candy, Chocolate Processing —chocolate shells, candy bars. Fruires. Spoilage of confectionery products.	dough, short doughteavened bakery productry Toffees, fudge, carauit confections. Confections.	Methods for differences, semi-sweet, acts. Classification mel, aerated continuery productionery productionery productionery productionery.	enzy on of onfect t qual	rme m confe	of cake	g dough an Products g g gums an , faults an
manufacture. Unit - IV Ingredients and batters. Biscuit m Ingredients-Basi Unit - V Composition and chewing gums. Corrective measu TEXT BOOK: 1. W. P. Ed REFERENCES: 1. Weibiao	Biscuit making and Confectionery: their functions. Types of biscuit dough — Developed nanufacturing process, Wafers, puff pastry, chemically leter Technical considerations in sugar based confectionery. Confectionery Products: I manufacturing process- Sugar boiled products-Candy, Chocolate Processing —chocolate shells, candy bars. Fruites. Spoilage of confectionery products. Wards, "The Science of Bakery Products", United Kingdon	dough, short doughteavened bakery producty Toffees, fudge, carauit confections. Confections. Royal Society of Chanology", 2nd Edition, Nanology", 2nd Edition, Nanology	Methods for difference of the second of the	enzy on of onfect t qual	rme m confe	nodified ctionery Bubble	g dough an Products g g gums an faults an
manufacture. Unit - IV Ingredients and batters. Biscuit manufacture. Unit - V Composition and chewing gums. Corrective measure TEXT BOOK: 1. W. P. Ed REFERENCES: 1. Weibiao 2. Ferenc A	Biscuit making and Confectionery: their functions. Types of biscuit dough — Developed nanufacturing process, Wafers, puff pastry, chemically lete Technical considerations in sugar based confectione Confectionery Products: I manufacturing process- Sugar boiled products-Candy, Chocolate Processing —chocolate shells, candy bars. From Ires. Spoilage of confectionery products. Wards, "The Science of Bakery Products", United Kingdom Zhou and Y. H. Hui, "Bakery Products Science and Technical cand and Technic	dough, short doughteavened bakery productry Toffees, fudge, carauit confections. Confections. Confections. Toffees, fudge, carauit confections.	Methods for difference of the control of the contro	enzy on of onfect t qual	rme m confe	nodified ctionery Bubble	g dough an Products g g gums an faults an

	SE OUTCOMES: npletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	outline the role of ingredients in bakery industry	Understanding (K2)
CO2	select appropriate equipment for baking process and relate the rheological properties of dough	Applying (K3)
CO3	identify and apply processing techniques for bread and cake manufacturing process	Applying (K3)
CO4	illustrate the processing techniques for preparation of miscellaneous bakery products and summarize the role of confectionery ingredients	Understanding (K2)
CO5	apply the processing techniques to formulate different confectionery products	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1		2				1		1	2	1
CO2	3	2	1	1		1				1		2	3	2
CO3	3	3	3	3		2				1		2	3	2
CO4	3	3	3	3		2				1		2	3	2
CO5	3	3	3	3		2				1		2	3	2

^{1 –} Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	30	40				100
CAT2	30	40	30				100
CAT3	20	40	40				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22FTT54 - FOOD SCIENCE	E AND NUTRITIO	N				
Programme & Branch	BTech – Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Food Chemistry	5/4	PC	3	0	0	3
Preamble	This course will deal about the importance of n differentage groups	nutrients and its ass	imilation, ene	rgy bal	ance a	and nut	rition for
Unit – I	Food Groups and Nutrition:						9
nutrition and und digestive tract, m Unit – II	sses of nutrients, RDA, nutritional status and its as er nutrition. Balanced diet: Diet planning principles, echanical and chemical digestion, absorption and tr Carbohydrates - Sugars, Starch and Fiber:	dietary guidelines; fransport of nutrients	ood groups; A	natom	y and _l	physiol	ogy of the
	osorption of carbohydrates, lactose intolerance; Glynealth, health effects of fiber and starch intake, artific					ommen	dations o
Unit - III	Lipids and Proteins:						9
trans fatty acids Digestion and at Recommended ir	ipid digestion, absorption and transport; Functions of Medium Chain Triglycerides, phospholipids and obsorption of proteins; Functions of proteins; amino acid suppleme	d sterols; Health e b acids; Protein quants; Protein Energy	ffects and reality, methods	comme of as	ended sessin	intakes g prote	of lipic in quality shiorkor.
trans fatty acids Digestion and at Recommended in Unit - IV Calorific value of physiological ene	pipid digestion, absorption and transport; Functions of Medium Chain Triglycerides, phospholipids and particles of proteins; Functions of proteins; amino antakes of proteins; protein and amino acid suppleme Energy Value, Energy Balance and Body Confoods; basal metabolism, specific dynamic action of grey value of foods. Energy balance — components	d sterols; Health e o acids; Protein quants; Protein Energy mposition: of foods, Protein ed — energy intake, er	ffects and reality, methods Malnutrition - fficiency ratio nergy expendi	comme s of ass Marass , Net p	ended sessin mus ai rotein nergy	intakes g prote nd Kwa utilizati require	s of lipic in quality shiorkor. 9 on,
trans fatty acids Digestion and at Recommended in Unit - IV Calorific value of physiological ene	pipid digestion, absorption and transport; Functions of Medium Chain Triglycerides, phospholipids and pasorption of proteins; Functions of proteins; amino antakes of proteins; protein and amino acid suppleme Energy Value, Energy Balance and Body Confoods; basal metabolism, specific dynamic action of	d sterols; Health e o acids; Protein quants; Protein Energy mposition: of foods, Protein ed — energy intake, er	ffects and reality, methods Malnutrition - fficiency ratio nergy expendi	comme s of ass Marass , Net p	ended sessin mus ai rotein nergy	intakes g prote nd Kwa utilizati require	s of lipic in quality shiorkor. 9 on,
trans fatty acids Digestion and at Recommended ir Unit - IV Calorific value of physiological ene Body composition Unit - V Factors to be correquirements. Inf (Toddlers and Prirequirements, Im	pipid digestion, absorption and transport; Functions of Medium Chain Triglycerides, phospholipids and psorption of proteins; Functions of proteins; amino ntakes of proteins; protein and amino acid suppleme Energy Value, Energy Balance and Body Confoods; basal metabolism, specific dynamic action of gry value of foods. Energy balance — components in — Five levels of body composition — body composition.	d sterols; Health et acids; Protein quants; Protein Energy into protein et acids; Protein et acids; Protein et acids; Protein et acids; Protein et acids et	ffects and reality, methods Malnutrition - fficiency ratio hergy expenditesity- BMR are s and food stion of suppler Feeding Patte ds, food choice	commes of ass Marass , Net p iture, end BMI election mentary rn. Sche, eatin	rotein mus ar rotein nergy calcul n. Lacty foods nool ch g habi	intakes g prote nd Kwa utilizati require ations. tation - s. Early illdren - ts, facto	s of lipic in quality shiorkor. 9 on, ment. 9 nutrition childhood Nutritions
trans fatty acids Digestion and al Recommended in Unit - IV Calorific value of physiological ene Body composition Unit - V Factors to be co requirements. Inf (Toddlers and Pr requirements, Im influencing. Geria	pid digestion, absorption and transport; Functions of Medium Chain Triglycerides, phospholipids and pasorption of proteins; Functions of proteins; amino attakes of proteins; protein and amino acid suppleme Energy Value, Energy Balance and Body Confoods; basal metabolism, specific dynamic action of gray value of foods. Energy balance — components in — Five levels of body composition — of proteins	d sterols; Health et acids; Protein quants; Protein Energy into protein et acids; Protein et acids; Protein et acids; Protein et acids; Protein et acids et	ffects and reality, methods Malnutrition - fficiency ratio hergy expenditesity- BMR are s and food stion of suppler Feeding Patte ds, food choice	commes of ass Marass , Net p iture, end BMI election mentary rn. Sche, eatin	rotein mus ar rotein nergy calcul n. Lacty foods nool ch g habi	intakes g prote nd Kwa utilizati require ations. tation - s. Early illdren - ts, facto	s of lipic in quality shiorkor. 9 on, ment. 9 nutrition childhood Nutrition.
trans fatty acids Digestion and at Recommended ir Unit - IV Calorific value of physiological ene Body composition Unit - V Factors to be correquirements. Inf (Toddlers and Pr requirements, Im influencing. Geria	pid digestion, absorption and transport; Functions of Medium Chain Triglycerides, phospholipids and pasorption of proteins; Functions of proteins; amino attakes of proteins; protein and amino acid suppleme Energy Value, Energy Balance and Body Confoods; basal metabolism, specific dynamic action of gray value of foods. Energy balance — components in — Five levels of body composition — of proteins	d sterols; Health et acids; Protein quants; Protein Energy mposition: of foods, Protein et — energy intake, ention techniques. Obstation requirement formula. Introduct related problems, leaventh, Nutrient needlents use, needlents use, nutrient needlents use, nutrient needlents use, nutrient needlents use, needlen	ffects and reality, methods Malnutrition - fficiency ratio nergy expendinesity- BMR are sand food stion of suppler Feeding Patter ds, food choice eeds, nutrition	Net piture, end BMI electiormentary in. Schee, eatin	rotein mus ar rotein nergy calcul n. Lacty foods nool ch g habi	intakes g prote nd Kwa utilizati require ations. tation - s. Early illdren - ts, facto	s of lipic in quality shiorkor. 9 on, ment. 9 nutrition childhoor Nutrition ors
trans fatty acids Digestion and at Recommended ir Unit - IV Calorific value of physiological ene Body composition Unit - V Factors to be correquirements. Inf (Toddlers and Pr requirements, Im influencing. Geria	ipid digestion, absorption and transport; Functions of Medium Chain Triglycerides, phospholipids and pasorption of proteins; Functions of proteins; amino natakes of proteins; protein and amino acid suppleme Energy Value, Energy Balance and Body Confoods; basal metabolism, specific dynamic action of gry value of foods. Energy balance — components in — Five levels of body composition — body composition — body composition — brive levels of brive levels of body composition — brive levels of brive levels of body composition — brive levels of b	d sterols; Health et acids; Protein quants; Protein Energy mposition: of foods, Protein et — energy intake, ention techniques. Obstation requirement formula. Introduct related problems, leaventh, Nutrient needlents use, needlents use, nutrient needlents use, nutrient needlents use, nutrient needlents use, needlen	ffects and reality, methods Malnutrition - fficiency ratio nergy expendinesity- BMR are sand food stion of suppler Feeding Patter ds, food choice eeds, nutrition	Net piture, end BMI electiormentary in. Schee, eatin	rotein mus ar rotein nergy calcul n. Lacty foods nool ch g habi	intakes g prote nd Kwa utilizati require ations. tation - s. Early illdren - ts, facto	s of lipic in quality shiorkor. 9 on, ment. 9 nutrition childhood Nutritions
trans fatty acids Digestion and at Recommended ir Unit - IV Calorific value of physiological ene Body composition Unit - V Factors to be corequirements. Inf. (Toddlers and Pricequirements, Iminfluencing. Gerial TEXT BOOK: 1. Srilaks REFERENCES:	ipid digestion, absorption and transport; Functions of Medium Chain Triglycerides, phospholipids and posorption of proteins; Functions of proteins; amino proteins; protein and amino acid suppleme Energy Value, Energy Balance and Body Confoods; basal metabolism, specific dynamic action of the sergy value of foods. Energy balance — components of proteins — Five levels of body composition — body composition — body composition — body composition — for Different Age Groups: Onsidered in meal/menu planning. Pregnancy — nutritional requirements, breast feeding, infart eschoolers) — Growth and nutrient needs, nutritional portance of snacks, school lunch. Adolescence — Gratic Nutrition — Factors affecting food intake and nutries when it is not provided in the protection of the prot	d sterols; Health et acids; Protein quants; Protein Energy mposition: of foods, Protein et — energy intake, ention techniques. Obstantion requirement formula. Introduct related problems, lowth, Nutrient need tents use, nutrient need tents use, nutrient need tents use, nutrient need tents use.	ffects and reality, methods Malnutrition - fficiency rationergy expendinesity- BMR are so and food stion of suppler Feeding Patteds, food choice eeds, nutritioners, New Delhi,	ecommes of ass Marass , Net p iture, e end BMI election mentary ern. Sch e, eatin n related	rotein mus ar rotein nergy calcul n. Lacy foods lool ch g habi d prob	intakes g prote nd Kwa utilizati require ations. tation - s. Early ildren - ts, facto lems.	s of lipid in quality shiorkor. 9 on, ment. 9 nutrition childhoo Nutrition ors Total:

	OUTCOMES: pletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	interpret the physiological and metabolic functions of nutrients	Understanding (K2)
CO2	select appropriate carbohydrate diet based on their health effects	Applying (K3)
CO3	outline the lipids and proteins based on their nutritional value	Understanding (K2)
CO4	interpret the energy value of foods and body composition and explain the energy balance	Understanding (K2)
CO5	classify nutrition requirement based on different age groups	Understanding (K2)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO 12	PSO1	PSO 2
CO1	3	3	1	1		3				1		1	1	1

CO2	3	3	1	1	3		1	1	1	2
CO3	3	3	1	1	3		1	1	1	2
CO4	3	3	1	1	3		1	1	1	1
CO5	3	3	1	1	3		1	1	1	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	50	30				100
CAT3	25	75					100
ESE	20	60	20				100

^{* ±3%} may be varied (CAT 1,2,3 - 50 marks & ESE - 100 marks)

Programr Branch	ne &	В.	ГЕСН.	– Food	Techno	ology				Sem.	Category	L	T	Р	Credit
Prerequis	sites	Не	at Trar	nsfer O	peratio	ns				5	PC	0	0	2	1
Prea	mble	То	impart	knowle	dge on	various	propert	ties of fo	ood mate	erials invo	olved in food p	rocessing			
List of Ex	ercises	/ Exper	iments	:								-			
1.	Determin	ation of	f size, r	oundne	ss, sphe	ericity a	nd 1000	grain v	weight of	f food gra	ins.				
2.	Determin	nation of	f bulk d	ensity, 1	rue den	sity and	d porosi	ty.							
3.	Determin	ation of	fangle	of repo	se for gr	ain sam	nple.								
4.	Determin	ation of	f co effi	cient of	friction	for grain	n sampl	e.							
5.	Experime	ent on p	addy d	ehuske	r to dete	rmine t	he shell	ing effic	ciency.						
6.	Determin	nation of	fconve	ying eff	iciency a	and pow	ver requ	iiremen	t of diffe	rent conv	eyor.				
7.	Determin	nation of	fsepara	ation eff	iciency	of inclin	ed belt	separat	tor.						
8.	Experime	ent on a	nalysis	of parti	cle size	distribu	ıtion usi	ng ham	mer mill	and ball	mill.				
9.	Experime	ent on s	edimen	ntation											
10	Experime	ent on d	lrying cl	haracte	ristics of	f food m	naterial	using di	ifferent o	dryers.					
															Total:3
REFEREN	NCES/ M	ANUAL	/SOFT	WARE	:										
1.	Laborato	ory Man	ual												
	Margarid Business					iments	in Unit	Operati	ons and	Processi	ng of Foods",	1st Editior	Sprir	nger Sc	ience &
3.	Rao M. A	A. and R	Rizvi S.S	S.H., Er	ngineerir	ng Prop	erties o	f Foods	s, 4th ed	ition, CRO	C Press, New `	York, 2014	1.		
COURSE	OUTCO	MES:												Марре	
On comp														hest Le	
CO1	assess th	ne perro	rmance	e of agr	o proces	ssing ed	quipmer	nt				Evaiu	iating((K5),Pre	ecision(S3
	determin	e the ef	fectiver	ness of	size red	luction e	equipme	ent				Evalu	ıating	(K5),Pre	ecision(S3
CO2	interpret	the dryi	ng chai	racteris	tics of fo	ood mat	erials us	sing diff	erent dr	yers		Evalu	ating	(K5),Pre	ecision(S3
CO2	micipiet					Mannir	ng of Co	os with	POs ar	nd PSOs		1			
CO2	merpiet					wappii	ig oi o								
CO3	PO1	PO2	PO3	PO4	PO5	РО6	P07	PO8	PO9	PO10	PO11	PO12	ı	PSO1	PSO2
CO3		PO2 3	PO3 2	PO4	Г Т				PO9	PO10 2	PO11	PO12	ı	PSO1 2	PSO2 2
CO3 COs/POs	PO1				Г Т						PO11		ı		

Programi Branch	ne &	B.TE	CH. – F	ood Techn	ology			Sem.	Category	L	ТР	Credit
Prerequ	iisites				Nil			5	PC	0	0 2	1
Prean	nble	To im	npart kr agingma	nowledge a	bout the eable for diff	equipments proferent fruits an	ocessing d vegeta	parame	eters and evalua	ting the pa	arameters	of
List of Ex	ercises	/ Experi	iments	:								
1.	Study th	ne effect	of blan	ching treatr	ment on the	e fruits and veg	getables					
2.	Estimat	ion of ef	ficiency	of screw p	ress extrac	tor and pulper	-					
3.	Develop	ment a	nd analy	ysis of squa	sh and sau	ice						
4.	Prepara	ation of f	ruit bar	comparisor	n with comr	nercial produc	t.					
5.	Formula	ation of j	ams an	d comparis	on with cor	nmercial produ	ıct.					
6.	Formula	ation of j	ellies / r	marmalade	and compa	arison with con	nmercial	product.				
7.	Estimat	ion of bu	ursting s	strength of p	ackaging i	materials						
8.				esistance of								
9.						oackaging mat	erials					
10.								lity of diff	erent packaging	motoriala		
10.	LStimat	IOII OI W	alei abs	огриоп сар	acity and t	vater vapour p	emeabi	iity Oi uiii	erent packaging	materials		
												Total:3
REFERE				WARE:								
1.		tory Mar										
2.						ds Fruit and V						
	Gordon	I Doho						Guide". 1	st edition CRC P	ress, USA.	2009.	
3.		L. KODE	ertson,	Food Pack	aging and	Shelf Life: A P	ractical (
3. 4.	http://w			'Food Pack com/learnin			ractical (,		
4.	OUTCO	ww.rpau	ılsingh.d	com/learnin	g/virtual/vii	tual.htm	ractical (BT Mapp	
4. COURSE On comp	OUTCOI	ww.rpau MES: the cou	ılsingh.d	com/learnin	g/virtual/vii	tual.htm			o estimate the	(1	Highest Le	evel)
4. COURSE On comp	OUTCOI letion of assess	ww.rpau WES: the cou	ulsingh.c	com/learnin	g/virtual/vin will be ab	tual.htm			o estimate the	(l Evaluat	Highest Le	evel) ecision(S3
4.	OUTCOI letion of assess efficience	ww.rpau WES: the cou the char cy juice	urse, the	com/learnin e students curred duri	g/virtual/vir will be ab ng fruits an	tual.htm le to d vegetables b			o estimate the	(l Evaluat	Highest Le	evel) ecision(S3
4. COURSE On comp CO1 CO2	OUTCOI letion of assess efficience prepare	ww.rpau WES: the cou the char cy juice of	urse, thenges oc extraction	e students curred during on equipments ze fruit/vege	g/virtual/vir	tual.htm le to d vegetables b	olanchin	g and als	o estimate the	(l Evaluat	Highest Le	evel) ecision(S3 ecision(S3
4. COURSE On comp CO1 CO2	OUTCOI letion of assess efficience prepare	ww.rpau WES: the cou the char cy juice of	urse, thenges oc extraction	e students curred during on equipments ze fruit/vege	g/virtual/vir	tual.htm le to d vegetables to	olanching	g and als erials		(l Evaluat	Highest Le ing(K5),Pre ing(K5),Pre	evel) ecision(S3 ecision(S3
4. COURSE On comp CO1 CO2 CO3	OUTCOI letion of assess efficience prepare evaluate	ww.rpau WES: the cou the char cy juice of	urse, thenges oc extraction	e students curred during on equipments ze fruit/vege	g/virtual/vii will be ab ng fruits an ent. etable base rrier prope Mappir	le to d vegetables bed products	olanching	g and als erials		(l Evaluat	Highest Le ing(K5),Pre ing(K5),Pre	evel) ecision(S3 ecision(S3
4. COURSE On comp	OUTCOI letion of assess efficience prepare evaluate	ww.rpau MES: the cou the char cy juice and char e mecha	urse, the nges oc extraction aracterizanical an	e students curred during on equipment ze fruit/vegund water ba	g/virtual/vii will be ab ng fruits an ent. etable base rrier prope Mappir	le to d vegetables bed products rties of packag	olanching ling mate	g and als erials nd PSOs		Evaluat Evaluat Evaluat	Highest Le ing(K5),Pre ing(K5),Pre ing(K5),Pre	evel) ecision(S3 ecision(S3 ecision(S3
4. COURSE On comp CO1 CO2 CO3 COs/POs	OUTCOI letion of assess efficience prepare evaluate	ww.rpau WES: the cou the char cy juice of and char e mecha	urse, the nges oc extraction aracterizanical ar	e students curred during on equipment ze fruit/vegend water ba	g/virtual/vii will be ab ng fruits an ent. etable base rrier prope Mappir	le to d vegetables bed products rties of packag	olanching ing mate	g and als erials nd PSOs PO10		Evaluat Evaluat Evaluat	Highest Leting(K5),Preing(K5),Preing(K5),Preing(K5)	evel) ecision(S3 ecision(S3 ecision(S3 PSO2

			2	2FTL	53- BA	KING	AND C	ONFE	CTION	ERY TE	CHNOLOGY L	.ABOR	ATOR	RY	
Programr Branch	ne &	В.ТЕС	CH. – F	ood Te	chnolo	gy				Sem.	Category	L	Т	Р	Credi
Prerequ	isites	Food	Chemis	stry						6	PC	0	0	2	1
Prean	nble	To pro		nsight p	ractical	knowle	dge abo	out the	different	t raw mate	erials and produc	cts of bal	kery a	nd confe	ctionery
List of Ex	ercises	/ Experi	ments	:											
1.	Estimati	ion of qu	ality pa	aramete	ers of ba	kery in	gredien	ts.							
2.	Estimati	ion of we	et and o	dry glut	en conte	ent of w	heat flo	ur.							
3.	Determi	ination o	f dougl	n rising	capacit	y of lea	veners								
4.	Estimat	ion of dia	astatic	activity	and ma	ltose va	alue of f	lour							
5.	Estimat	ion of wa	ater abs	sorption	power,	alkalin	e water	retentio	on and s	sedimenta	ation value of floo	ur.			
6.	Prepara	ition and	l analys	sis of br	ead.										
7.	Prepara	ition and	l analys	sis of bi	scuits a	nd cool	kies.								
8.	<u> </u>	ition and													
9.	Prepara	ition of s	ugar bo	oiled an	d cocoa	a based	l confec	tionery.							
10.	Prepara	ition of to	offee ar	nd fudg	e.										
															Total:
REFEREN	ICES/ MA	ANUAL	/SOFT	WARE											
1.	Laborat	tory man	nual												
2.	Duncan 2001.	Manley	, "Biscι	uit, Crad	cker and	d Cooki	e Recip	es for th	ne Food	Industry'	', 1st Edition, Wo	odhead	Publis	shing, Er	ngland,
3.	Yogaml	oal Asho	kkuma	r, "Text	book o	f Baker	y and C	onfection	onery", 2	2nd Editio	on, PHI Learning	Pvt. Ltd.	New	Delhi, 2	012.
4.	http://w	ww.bch.	cuhk.ed	du.hk/vl	ab2/ani	mation	/fermen	tation/ir	ndex.htn	nl					
COURSE On compl			roo th	o otud	onto wi	ll bo ob	lo to							Mappe	
CO1								- d f - u		t h - l -				uating (I	-
	evaluate	e trie qua	anty or	ilour an	a otner	ingreai	ents us	за югр	гераган	on or bak	ery products			cision (S luating (
CO2	prepare	the bak	ery pro	duct an	d evalu	ate its p	oroperti	es					Mani	pulation	(S2)
CO3	formula	te confe	ctioner	y produ	cts and	perforn	n senso	ry prop	erties					luating (pulation	
						Mappi	ng of C	os with	POs a	nd PSOs			-		
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	I	PSO1	PSO
CO1	3	2	2	2		1		1	3	2		2		1	3
CO2	3	2	2	2		1		1	3	2		2		3	2
CO3	2 – Mod		_		BT- Blo		axonom	-	3					3	

		22GEL51 - PROFESSIONAL SKILLS TRAI	INING - II					
		(Common to All BE/ BTech Engineering and Techn	ology bra	anches)				
Progra Branci	ımme & n	All BE/ BTech Engineering and Technology branches	Sem.	Category	L	Т	Р	Credit
Prereq	uisites	Nil	5	EC	0	0	80	2
Pream	ble	This subject is to enhance the employability skills and to develo	op career	competency				
Unit –	I	Soft Skills – II :						20
intervie Unit –	ews. II	ills-Activities before Interview, upon entering interview room, dui Quantitative Aptitude and Logical Reasoning – II:						30
and portion of the probability o	olynomial e oility-Statistic ing: Conditi ing- Quant b	evel II: Money related problems-Mixtures-Symbol base problem equations-Special, equations-Inequalities-Sequence and series-Data sufficiency- Geometry-Trigonometry-Heights and distanonality and grouping-Sequencing and scheduling- Selections-Newscased reasoning-Flaw detection- Puzzles-Cryptarithms.	s-Set the	eory-Permuta ordinate geon	ations netry	and -Men	d comb suration	inations- . Logical n logical
Unit -		Reading & Speaking Skills						
		comprehension Effective Pending strategies Descriptive In	oforontial	2 Argumon	tativo	roor	dina na	30
compression of an and Readir Sharin Preser Speak	ehension / sargument – ng notices a g of Real ntation on V ing; Pair Dis	comprehension— Effective Reading strategies — Descriptive, Ir beating factual information within a text — global reading/ski scanning for specific information — detailed comprehension / integration in the identifying the writer's attitude and opinions — Reading news and book reviews—Interpreting graphic data & Advertisements. Time Experience; Conversational Practices—Role Play — Sharious Topics— Technical / Non-Technical Topics— Project Revicussion— Group Discussion—The process of Group Discussion readings & Skills—Negotiating Skills.	mming fansive rea articles in Speaking nort Talks view Pres	or general under ding – under in business rg: Mock Inters / TED Talentation – O	inder stand naga views ks – rator	rstand ding to zines s –Se Exter y and	ding – the deve s, news elf-Introd npore; Effectiv	ssages – selective elopment papers – duction – Giving a ve Public
compression of an and Readir Sharin Preser Speak	ehension / sargument – ng notices a g of Real ntation on V ing; Pair Dis	cating factual information within a text – global reading/ski scanning for specific information – detailed comprehension / interpreting graphic data & Advertisements. Time Experience; Conversational Practices –Role Play – Sharious Topics – Technical / Non-Technical Topics – Project Revicussion – Group Discussion – The process of Group Discussion	mming fansive rea articles in Speaking nort Talks view Pres	or general under ding – under in business rg: Mock Inters / TED Talentation – O	inder stand naga views ks – rator	rstand ding to zines s –Se Exter y and	ding – the deve s, news elf-Introd npore; Effectiv	ssages – selective elopment papers – duction – Giving a ve Public
compression of an and Readir Sharin Preser Speak	ehension / s argument – ng notices a g of Real ntation on V ing; Pair Dis ionic Conve	cating factual information within a text – global reading/ski scanning for specific information – detailed comprehension / interpreting graphic data & Advertisements. Time Experience; Conversational Practices –Role Play – Sharious Topics – Technical / Non-Technical Topics – Project Revicussion – Group Discussion – The process of Group Discussion	mming fansive rea articles in Speaking nort Talks view Pres	or general under ding – under in business rg: Mock Inters / TED Talentation – O	inder stand naga views ks – rator	rstand ding to zines s –Se Exter y and	ding – the deve s, news elf-Introd npore; Effectiv	ssages – selective elopment papers – duction – Giving a ve Public sessed –
compro of an a Readir Sharin Preser Speaki Teleph	ehension / sargument – ng notices a g of Real ntation on V ing; Pair Dis ionic Conve	cating factual information within a text – global reading/ski scanning for specific information – detailed comprehension / interpreting graphic data & Advertisements. Time Experience; Conversational Practices –Role Play – Sharious Topics – Technical / Non-Technical Topics – Project Revicussion – Group Discussion – The process of Group Discussion	mming finsive real articles in Speaking fort Talks view Preside — Strate	or general under in business rig: Mock Interes / TED Tallentation – Ogies to be ad	under rstand maga views ks – ratory opted	rstand ding the izines s –Se Exter y and d – S	ding – the devise, news elf-Introd npore; Effectiv kills Ass	ssages – selective elopment papers – duction – Giving a ve Public sessed –
comproduction of an analysis Readir Sharin Preser Speak Teleph	ehension / sargument – ng notices a g of Real ntation on V ing; Pair Dis ionic Conve	cating factual information within a text – global reading/ski canning for specific information – detailed comprehension / interest identifying the writer's attitude and opinions – Reading news and book reviews –Interpreting graphic data & Advertisements. Time Experience; Conversational Practices –Role Play – Sharious Topics – Technical / Non-Technical Topics – Project Revicussion – Group Discussion – The process of Group Discussion reations & Skills – Negotiating Skills.	mming finsive real articles in Speaking fort Talks view Preside — Strate	or general under in business rig: Mock Interes / TED Tallentation – Ogies to be ad	under rstand maga views ks – ratory opted	rstand ding the izines s –Se Exter y and d – S	ding – the devise, news elf-Introd npore; Effectiv kills Ass	ssages – selective elopment papers – duction – Giving a ve Public sessed –

Thorpe, Showick and Edgar Thorpe, "Winning at Interviews," 5th edition, Pearson Education, India, 2013.

Rizvi, Ashraf M, "Effective Technical Communication," 2nd Edition, McGraw Hill Education India, 2017.

2.

3.

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	develop the soft skills of learners to support them work efficiently in an organization as an individualand as a team	Applying (K3), Precision (S3)
CO2	solve real time problems using numerical ability and logical reasoning	Applying (K3), Precision (S3)
CO3	apply reading and speaking skills effectively for various academic and professional purposes	Applying (K3), Precision (S3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	0	0	0	3	3	0	3	0	3	2		
CO2	3	2	0	0	0	3	3	0	3	0	3	2		
CO3		2	0	0	0	3	3	0	3	3	3	3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6)	Total %
CAT1	20	40	40				100
CAT2		50	50				100
CAT3		50	50				100
ESE				NA			

* $\pm 3\%$ may be varied (CAT 1,2 & 3 – 50 marks)

_	T	LOGY			1	, ,	
Programme & Branch	B.TECH. – Food Technology	Sem	Category	L	т	Р	Credit
Prerequisites	Food Chemistry, Food Microbiology	6	PC	3	0	0	3
Preamble	To provide exposure to variety of technical operations in students discover their own professional directions for future			ing ind	ustry	and	help
Unit - I	Physical chemistry of milk:						9
	Types of market milk, Composition of milk, Factors affection, Freezing point, Acidity and pH, Viscosity	ng composition,	Properties of mi	lk: Col	our,	Flavo	ur, Specifi
Unit - II	Collection, reception and pre-processing of raw milk:						9
	ction of raw milk, Raw milk shelf life extension systems, Coonilk, Filtration and Clarification of raw milk, Bactofugation of ra				orm t	ests	of raw milk
Unit - III	Unit operations of milk processing:						9
Unit - IV	production operations.					I	
Adulterants in milk	Quality assurance of dairy products: and their detection, Defects in market milks, Defects in fat-ric						9 products
Adulterants in milk	Quality assurance of dairy products:						
Adulterants in milk in frozen dairy pround - V Aspects of cleaning of CIP system: Ce	Quality assurance of dairy products: and their detection, Defects in market milks, Defects in fat-ric oducts, Defects in coagulated products, Defects in fermen	ted products. Le	gal standards for methods, CIP flo	or milk w syste	and em, ty	milk ypes	products 9
Adulterants in milk in frozen dairy pround - V Aspects of cleaning of CIP system: Ce	Quality assurance of dairy products: and their detection, Defects in market milks, Defects in fat-ric oducts, Defects in coagulated products, Defects in fermen Cleaning and sanitization of dairy equipment: g: Trade obligations, moral obligations, legal obligations, Cleantralized CIP system, CIP cyc	ted products. Le	gal standards for methods, CIP flo	or milk w syste	and em, ty	milk ypes	products 9
Adulterants in milk in frozen dairy pround - V Aspects of cleaning of CIP system: Ce	Quality assurance of dairy products: and their detection, Defects in market milks, Defects in fat-ric oducts, Defects in coagulated products, Defects in fermen Cleaning and sanitization of dairy equipment: g: Trade obligations, moral obligations, legal obligations, Cleantralized CIP system, CIP cyc	ted products. Le	gal standards for methods, CIP flo	or milk w syste	and em, ty	milk ypes	products 9 ag agents
Adulterants in milk in frozen dairy pround of CIP system: Ce and methods, Asset	Quality assurance of dairy products: and their detection, Defects in market milks, Defects in fat-ric oducts, Defects in coagulated products, Defects in fermen Cleaning and sanitization of dairy equipment: g: Trade obligations, moral obligations, legal obligations, Cleantralized CIP system, CIP cyc	ted products. Le ning agents and le of equipments:	gal standards for methods, CIP flosilo, tanker, pas	or milk w syste steurize	and em, ty	milk ypes	products 9 ag agents
Adulterants in milk in frozen dairy pround to the Unit - V Aspects of cleaning of CIP system: Ce and methods, Asset TEXT BOOK:	Quality assurance of dairy products: and their detection, Defects in market milks, Defects in fat-ric oducts, Defects in coagulated products, Defects in fermen Cleaning and sanitization of dairy equipment: g: Trade obligations, moral obligations, legal obligations, Cleantralized CIP system and decentralized CIP system, CIP cyclessment of effectiveness of cleaning and sanitization.	ted products. Le ning agents and le of equipments:	gal standards for methods, CIP flosilo, tanker, pas	or milk w syste steurize	and em, ty	milk ypes	products 9 ag agents
Adulterants in milk in frozen dairy pround to the following of CIP system: Ce and methods, Associated to the following of CIP system: Ce and methods, Associated to the following of CIP system: Ce and methods, Associated to the following of CIP system: CIP sy	Quality assurance of dairy products: and their detection, Defects in market milks, Defects in fat-ric oducts, Defects in coagulated products, Defects in fermen Cleaning and sanitization of dairy equipment: g: Trade obligations, moral obligations, legal obligations, Cleantralized CIP system and decentralized CIP system, CIP cyclessment of effectiveness of cleaning and sanitization. De, "Outlines of Dairy Technology", 46th Edition, Royal Oxford Dairy Science and Technology Handbook: Applications Scien	ning agents and le of equipments: University Press,	gal standards for methods, CIP flo silo, tanker, pas New Delhi, 2019	or milk w syste steurize	em, ty	milk /pes nitizin	products 9 ng agents Total:

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	summarize the physico-chemical properties of milk	Understanding (K2)
CO2	apply the acquired knowledge of raw milk collection, transportation and reception in practical scenarios	Applying (K3)
CO3	infer the technical aspects of unit processing operations of milk	Understanding (K2)
CO4	identify defects in milk and milk products	Applying (K3)
CO5	choose suitable cleaning operations in dairy industry	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2			1				1		1	1	1
CO2	3	2	2		1	2				1		2	2	3
CO3	3	2	3		2	2				1		2	3	3
CO4	3	2	3		1	3		1		1		2	2	3
CO5	3	2	2		2	3				1		2	2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

		AGGL	OOMENT I ATTENT	1112011			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	60	20				100
CAT3	20	40	40				100
ESE	20	50	30				100

 * ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 mark

Programme & Branch	B.TECH. – FOOD TECHNOLOGY	Sem.	Category	L	Т	P	Credit
Prerequisites	Nil	6	PC	3	0	0	3
Preamble	To give insight on food quality, safety and its	regulatory standards.					
Unit - I	Food quality and safety:						9
	afety concepts. Characterization of food hazar od spoilage- microbial aspects in food safety-						
Unit - II	Quality Assurance and Safety operations	in Food industry:					9
	portance and functions of quality control and Practice, Good Laboratory Practices, Good Hy		ality Control and	l Assura	nce p	roce	dures, HACCP, Goo
Unit - III	Sampling and Statistical Quality Control:						9
	cept, methods and importance. Statistical Proce pes, design process, Control limits and errors		– concept, impo	rtance a	nd tool	s. Co	ontrol charts:
Unit - IV	Quality and Safety Standards:						9
Quality Standa	irds - mandatory and optional standards. Mech	anism of developing an					y Systems
- ISO 22000, F	FSSC 22000. National organizations: BIS, CCFS	S, AGMARK and APE		of Weig	ınts ai	nd N	leasures. Organic
- ISO 22000, F food certification Unit - V	FSSC 22000. National organizations: BIS, CCFS on-POP, NPOP. International organizations: I Regulations for Food Business Operator:	S, AGMARK and APE ISO, CAC, WTO, USFE	DA, EIC.				9
 ISO 22000, F food certification Unit - V Food adulterate Commodities F 	FSSC 22000. National organizations: BIS, CCFS on-POP, NPOP. International organizations: I	S, AGMARK and APE SO, CAC, WTO, USFE ty and Standards Act A Audit, IPR and Paten	OA, EIC. (FSSAI), Prevents, Issues affecti	ition of	Food /	Adult	9
 ISO 22000, F food certification Unit - V Food adulterate Commodities F 	FSSC 22000. National organizations: BIS, CCF3 on-POP, NPOP. International organizations: I Regulations for Food Business Operator: tion and food safety, Food laws — Food Safe Rules, Functions of Food Business Operator, Q	S, AGMARK and APE SO, CAC, WTO, USFE ty and Standards Act A Audit, IPR and Paten	OA, EIC. (FSSAI), Prevents, Issues affecti	ition of	Food /	Adult	9 eration Act,Package
– ISO 22000, F food certification Unit - V Food adulterat Commodities F industry – Gen	FSSC 22000. National organizations: BIS, CCF3 on-POP, NPOP. International organizations: I Regulations for Food Business Operator: tion and food safety, Food laws — Food Safe Rules, Functions of Food Business Operator, Q	S, AGMARK and APE ISO, CAC, WTO, USFE ety and Standards Act A Audit, IPR and Paten Residues, Organic Food	OA, EIC. (FSSAI), Prevents, Issues affectids, Food Additive	ntion of ling cons	Food / umers	Adult and	9 eration Act,Package Total:4
- ISO 22000, F food certification Unit - V Food adulterat Commodities F industry - Gen TEXT BOOK: 1.	FSSC 22000. National organizations: BIS, CCF3 on-POP, NPOP. International organizations: I Regulations for Food Business Operator: tion and food safety, Food laws — Food Safe Rules, Functions of Food Business Operator, Q etically Modified Foods, Fortification, Pesticide	S, AGMARK and APE ISO, CAC, WTO, USFE ety and Standards Act A Audit, IPR and Paten Residues, Organic Food	OA, EIC. (FSSAI), Prevents, Issues affectids, Food Additive	ntion of ling cons	Food / umers	Adult and	9 eration Act,Package
- ISO 22000, F food certification Unit - V Food adulterat Commodities F industry - Gen TEXT BOOK: 1.	FSSC 22000. National organizations: BIS, CCF3 on-POP, NPOP. International organizations: I Regulations for Food Business Operator: tion and food safety, Food laws — Food Safe Rules, Functions of Food Business Operator, Q etically Modified Foods, Fortification, Pesticide I Inteaz Alli, "Food Quality Assurance: Principle	S, AGMARK and APE ISO, CAC, WTO, USFE ety and Standards Act IA Audit, IPR and Paten Residues, Organic Food	PA, EIC. (FSSAI), Prevents, Issues affectids, Food Additive	ntion of ling conses.	Food / umers	Adult and 2014	9 eration Act,Package Total:4

COURSE OU On completi	ITCOMES: on of the course, the students will be able to	BT Mapped (Highest Level)
CO1	interpret the concepts of quality and safety in food processing	Understanding (K2)
CO2	apply principles of quality assurance and safety in food industries	Applying (K3)
CO3	analyze and categorize sampling and statistical quality control techniques	Applying (K3)
CO4	outline suitable food quality and Safety standards	Understanding (K2)
CO5	make use of various regulations for food business operator	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3			3	1	2		1		1	1	3
CO2	3	2	3	2		3	1	2		1		1	1	3
CO3	3	3	3	3	1	3				1		1	2	3
CO4	3	1	3			3	1	2		1		2	2	3
CO5	3	2	3			3	1	2		1		2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22MNT31 - ENVIRONN	MENTAL SCIENCE					
	(Common to All BE/E	BTech branches)					
Programme & Branch	All B.E/B.Tech Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	3/6	МС	2	0	0	0
Preamble	This course provides an approach to unders pollution control & monitoring methods for s awareness for engineering students on biologi	sustainable life and also					
Unit – I	Environmental Studies and Natural Resour						5
Introduction to Er resources-case s	nvironmental Science – uses, over-exploitation and	d conservation of forest,	water, minera	al, fo	od, e	nergy	and land
Unit – II	Ecosystem and Biodiversity						5
Food web only). E	cept and components of an ecosystem -structural Biodiversity: Introduction – Classification – Bio geo of biodiversity - case studies.						
Unit – III	Environmental Pollution						5
	ollution: Definition – causes, effects and control me						
acio rain, ozone i	ayer depletion (b)Water pollution (c) Soil pollution -	Role of an individual in p	prevention of p	pollu	tion -	case	studies.
Unit – IV	Environmental Monitoring						5
Unit – IV Sustainability -thr - Introduction to		nmental sustainability-ap	proaches for	susta	ainab	le dev	5 /elopment
Unit – IV Sustainability -thr - Introduction to (prevention and c	Environmental Monitoring ee pillars of sustainability- factors affecting enviror EIA - objectives of EIA - environment protection	nmental sustainability-ap	proaches for	susta	ainab	le dev	5 /elopment
Unit – IV Sustainability -thr - Introduction to (prevention and c Unit – V Functions of Carl nucleus- Heredity	Environmental Monitoring ee pillars of sustainability- factors affecting enviror EIA - objectives of EIA - environment protection ontrol of pollution) act.	nmental sustainability-ap n act – air (prevention ells and its organelles -	proaches for and control plasma mem	susta of po	ainab ollutic	le dev	5 velopment ct – water 5 undria and
Unit – IV Sustainability -thr - Introduction to (prevention and c Unit – V Functions of Carl nucleus- Heredity	Environmental Monitoring ee pillars of sustainability- factors affecting enviror EIA - objectives of EIA - environment protection ontrol of pollution) act. Introduction to Biological Science cohydrates, lipids, proteins and nucleic acids - Cottand DNA - organization of DNA in cells - Genes a	nmental sustainability-ap n act – air (prevention ells and its organelles -	proaches for and control plasma mem	susta of po	ainab ollutic	le dev	5 velopment ct – water 5 ndria and n- mitosis
Unit – IV Sustainability -thr - Introduction to (prevention and c Unit – V Functions of Carl nucleus- Heredity	Environmental Monitoring ee pillars of sustainability- factors affecting enviror EIA - objectives of EIA - environment protection ontrol of pollution) act. Introduction to Biological Science cohydrates, lipids, proteins and nucleic acids - Cottand DNA - organization of DNA in cells - Genes a	nmental sustainability-ap n act – air (prevention ells and its organelles -	proaches for and control plasma mem	susta of po	ainab ollutic	le dev	5 velopment ct – water 5 undria and
Unit – IV Sustainability -thr - Introduction to (prevention and complete of Carl nucleus- Heredity & meiosis - Cell complete of Carl Anubha I	Environmental Monitoring ee pillars of sustainability- factors affecting enviror EIA - objectives of EIA - environment protection ontrol of pollution) act. Introduction to Biological Science cohydrates, lipids, proteins and nucleic acids - Cottand DNA - organization of DNA in cells - Genes a	nmental sustainability-ap n act – air (prevention ells and its organelles - and chromosomes- Cell	proaches for and control plasma mem division -Type	susta of po bran	ainab ollutic e, mi cell c	le dev on) ac itocho divisio	5 velopment ct – water 5 ndria and n- mitosis Total:25
Unit – IV Sustainability -thr - Introduction to (prevention and compression of Carl nucleus- Heredity & meiosis - Cell compression of Carl nucleus- Heredity & meiosis - Cell compression of Carl nucleus- Heredity & Meiosis - Cell co	Environmental Monitoring ee pillars of sustainability- factors affecting enviror EIA - objectives of EIA - environment protection ontrol of pollution) act. Introduction to Biological Science cohydrates, lipids, proteins and nucleic acids - Company and DNA - organization of DNA in cells - Genes and DNA - organization of DNA in cells - Genes and public and molecules that control cell cycle. Kaushik, and Kaushik C.P., "Environmental Science and Pvt. Ltd., New Delhi, 2018, for Unit-I, II, III, IV. SC, "Cells and Molecular Biology", 2nd Edition, rep	nmental sustainability-ap n act – air (prevention ells and its organelles - and chromosomes- Cell ce and Engineering", 6th	proaches for and control plasma mem division -Type	susta of po bran es of	e, mi cell c	le devon) actiochodivisio	5 velopment ct – water 5 ndria and n- mitosis Total:25
Unit – IV Sustainability -thr - Introduction to (prevention and compression of Carl nucleus- Heredity & meiosis - Cell compression of Carl nucleus- Heredity & meiosis - Cell compression of Carl nucleus- Heredity & meiosis - Cell compression of Carl nucleus- Heredity & meiosis - Cell compression of Carl nucleus- Heredity & meiosis - Cell compression of Carl nucleus- Heredity & Meiosis - Cell c	Environmental Monitoring ee pillars of sustainability- factors affecting enviror EIA - objectives of EIA - environment protection ontrol of pollution) act. Introduction to Biological Science cohydrates, lipids, proteins and nucleic acids - Company and DNA - organization of DNA in cells - Genes and DNA - organization of DNA in cells - Genes and public and molecules that control cell cycle. Kaushik, and Kaushik C.P., "Environmental Science and Pvt. Ltd., New Delhi, 2018, for Unit-I, II, III, IV. SC, "Cells and Molecular Biology", 2nd Edition, rep	nmental sustainability-ap n act – air (prevention ells and its organelles - and chromosomes- Cell ce and Engineering", 6th	proaches for and control plasma mem division -Type	susta of po bran es of	e, mi cell c	le devon) actiochodivisio	5 velopment ct – water 5 ndria and n- mitosis Total:25
Unit – IV Sustainability -thr - Introduction to (prevention and compression of Carl nucleus- Heredity & meiosis - Cell c	Environmental Monitoring ee pillars of sustainability- factors affecting enviror EIA - objectives of EIA - environment protection ontrol of pollution) act. Introduction to Biological Science cohydrates, lipids, proteins and nucleic acids - Company and DNA - organization of DNA in cells - Genes and DNA - organization of DNA in cells - Genes and public and molecules that control cell cycle. Kaushik, and Kaushik C.P., "Environmental Science and Pvt. Ltd., New Delhi, 2018, for Unit-I, II, III, IV. SC, "Cells and Molecular Biology", 2nd Edition, rep	nmental sustainability-apon act – air (prevention ells and its organelles and chromosomes- Cell ce and Engineering", 6th	proaches for and control plasma mem division -Type Multicolour E	sustate of post-	e, miccell o	le devon) accitocho divisio	5 velopment t – water 5 ndria and n- mitosis Total:25

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	illustrate the various natural resources and role of individual for its conservation	Understanding (K2)
CO2	elaborate the features of ecosystem and biodiversity to find the need for conservation.	Understanding (K2)
CO3	manipulate the sources, effects and control methods of various environmental pollution.	Applying (K3)
CO4	make use of the knowledge of EIA and environmental legislation laws towards sustainability.	Applying (K3)
CO5	explain the functions of carbohydrates, lipids, proteins, nucleic acids, Cells and its organelles	Understanding (K2)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1					3							
CO2	2	1					3							
CO3	3	2	1				3							
CO4	3	2	1				3							
CO5	3	1												

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	NA						
ESE	NA						

* $\pm 3\%$ may be varied (CAT 1, 2 – 50 marks)

Progra Branc	amme &	B.TECH. – I	Food Technolo	gy			Sem.	Category	L	ТР	Credit					
	equisites	Food Chemi	stry, Food Micro	obiology			6	PC	0	0 2	1					
Prear	mble	To deal abo	ut analysis and	estimation of r	hysicoch	nemica	l propertie	es of milk								
		/ Experiments		Community of p	311y310001	Territoa	Гргороги	75 OF THINK								
1.		-	lity and specific	gravity of milk												
2.	Estimation	n of fat and soli	ds-not-fat conte	ents of milk and	d Analysi	s of the	ermal stab	oility of milk.								
3.	Detection	of adulterants	in milk.													
4.	Studies o	n homogenizat	ion process of r	nilk.												
5.	Studies o	n standardizati	on process of m	nilk and Develo	opment of	f marke	et milk.									
6.	Developm	nent of flavoure	d and fortified n	nilk.												
7.	Developm	Development of coagulated milk product. Development of ghee.														
8.	Developm	nent of ghee.	<u> </u>													
9.	Developm	nent of spray dr	ied milk powde	r												
10.	-		ration from milk													
		· ·									Total:3					
REFE	RENCES/ M	ANUAL /SOFT	WARE:													
1.	Laborato	y manual.														
2.	Sukumar	De, "Outlines o	of Dairy Techno	logy", 46th Edi	tion, Roy	al Oxfo	ord Unive	sity Press, New	Delhi, 201	9.						
3.	Hui,Y.H,, New Delh		and Technolog	gy Handbook:	Applicati	ons Sc	ience, Te	chnology and E	Engineering	g", 3rd Editi	on, Wiley					
		•	ssing Handbook	" 1st Edition,	Гetra Pak	Proce	ssing Sys	stems AB, 2015.								
4.	1 //	v.rpaulsingh.co	m/learning/virtu	ual/experiment	s/heatex	change	er/index.h	tml								
	http://www									BT Mappe						
5. COUR	SE OUTCO	MES:														
5. COUR On co	SE OUTCO empletion of	MES: the course, the	ne students wi							Highest Le	vel)					
5. COUR On co	SE OUTCO empletion of	MES: the course, the	ne students wi							(Highest Le Analyzing (Precision(vel) <4), 63)					
5. COUR On co	SE OUTCO impletion of analyze p	MES: the course, the		milk					E	(Highest Le Analyzing (Precision(valuating (k anipulation((4), (3) (5), (52)					
5. COUR On co	SE OUTCO impletion of analyze p	MES: the course, the hysico-chemical e technical asp	al properties of	milk					E M	(Highest Le Analyzing (Precision(valuating (h	vel) (4), (53) (5), (S2) (K5),					
5. COUR On co	SE OUTCO impletion of analyze p	MES: the course, the hysico-chemical e technical asp	al properties of ects of raw milk	milk	os with l	POs ar	nd PSOs		E M	(Highest Le Analyzing (Precision(\(\frac{\text{Valuating (Fracion()}}{\text{Valuation()}}\)	(4), (33) (5), (S2) (K5),					
5. COUR On co CO1 CO2 CO3	analyze p assess th prepare d	MES: the course, the hysico-chemical especial technical aspection products a PO2 PO3	al properties of ects of raw milk nd evaluate its	milk a processing properties Mapping of C PO6 PO7	PO8	PO9	PO10	PO11	PO12	(Highest Le Analyzing (Precision() valuating (kanipulation() Evaluating (Manipulation()	vel) (4), (53) (5), (S2) (S2)					
5.	analyze p assess th prepare d	MES: the course, the hysico-chemical e technical aspairy products a	al properties of ects of raw milk nd evaluate its	milk processing properties Mapping of C	1			PO11	E M	(Highest Le Analyzing (Precision() valuating (Panipulation() Evaluating (Manipulation()	(4), (53) (5), (52) (55), ((S2)					

						22FTI	L62 - F	OOD A	ANALY	SIS LAB	ORATORY				
Programr Branch	ne &	в.тес	CH. – F	ood Te	chnolo	gy				Sem.	Category	L	Т	Р	Credit
Prerequ	isites	Food	l Chem	istry						6	PC	0	0	2	1
Prean	nble	To im	part kn	owledg	e on an	alysis c	of variou	ıs food ı	products	S					
List of Ex	ercises	/ Experi	ments	:											
1.	Analysis	s of vege	etable o	ils / Fa	ts.										
2.	Analysis	s of spice	es (Tur	meric /	Chilly).										
3.	Analysis	s of Vine	gar/ Te	a/ Coff	ee.										
4.	Analysis	s of Jam	/Jelly/ N	Marmal	ade / Ju	iices.									
5.	Analysis	s of dehy	ydrated	vegeta	ıbles an	d Fruits	S.								
6.	Analysis	s of wate	er.												
7.	Analysis	s of salt/	sugar/	Jagger	у.										
8.		on of foo													
9.	Textura	I and Co	lour pro	ofile an	alvsis o	f food m	naterial.								
10.		ination o													
11.	Virtual I	aborator	y expe	riments			of mine	rals by	flame p	hotometry	/ – Demo. b. De	termining	g wate	r rehydr	ation in
11.	pasta –	- Experii	mentat	ion											Total:3
DEEEDE1	1050/14		(0.0.E.T.)												i Otai.3
REFEREN				WARE	-										
1.		ory man		Family '	Welfare	e. "Manı	ual of M	ethods	for the A	Analvsis o	f Foods", Gover	nment of	India.	New De	elhi.
2.	2016.					,									- ,
3.	Sadasiv	/am, S.,	and Ma	anickam	n, A, "Bi	ochemi	cal Met	hods", 3	3rd Editi	ion, New A	Age Internationa	ıl, Delhi, 2			
COURSE On compl			ırse. th	e stude	ents wi	II be ab	ole to							Mappe nest Lev	
CO1		various											Anal	yzing (K	4),
														cision (S ating (K	-
CO2	detect a	ıdulterati	ion in fo	ood san	nples								Pred	ision (S	3)
002	determi	ne the te	extural a	and col	or profil	e of foo	d mater	ials						ating (K sision (S	
						Mappir	ng of C	os with	POs a	nd PSOs					
								DO	DOO	PO10	PO11				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	1 010	POTT	PO12	l	PSO1	PSO2
COs/POs	PO1 3	2	3	3	PO5	PO6	PO7	1	3	2	POTT	2	I	3	3
CO3	PO1				PO5	PO6	P07				POTT				

Programi Branch	me &	B.TE	CH. – F	ood Te	chnolo	gy				Sem.	Cate gory	L	Т	Р	Credit	
Prerequis	sites	NIL								5	PC	0	0	2	1	
Preamble	е	To de	esign aı	nd draw	various	s equipr	ments u	sed in f	ood pro	cess oper	rations					
List of Ex	cercises .	/ Exper	iments	:												
1.	Studies	of sym	bols and	d mater	ials use	d for de	sign an	d drawi	ng.							
2.	Design	and dra	wing of	pipes a	and fittin	ıgs.										
3.	Design	and dra	wing of	storage	e vesse											
4.	Design	and dra	wing of	agitate	d vesse	ı.										
5.	Design	and dra	wing of	double	pipe he	at exch	nanger.									
6.	Design	and dra	wing of	shell a	nd tube	heat ex	change	er.								
7.	Design	Design and drawing of plate heat exchanger.														
8.	Design and drawing of plate heat exchanger. Design and drawing of single effect evaporator.															
9.	Design	and dra	wing of	cyclon	e separa	ator.										
10.	Design	and dra	wing of	rotary	drier/spi	ay drie	r									
11.	Demons	stration	experin	nent on	design	and dra	awing of	a food	plant la	ayout						
			<u> </u>						<u> </u>						Total:30	
REFERE	NCES/ M	ANUAL	./SOFT	WARE	:											
1.	Laborat	tory Ma	nual													
2.	Dawand	de S.D.,	"Proce	ss Equi	ipment I	Design	Volume	1 and 2	2", 5th E	dition, De	enett and Compa	any, India	a, 2015			
3.	Joshi M	l.V. and	Mahaja	an V.V.,	"Proces	ss Equi	pment [Design"	, 4th Ed	ition, Mac	Millan India, Ne	w Delhi, 2	2009.			
4.	Perry R	.H. and	Green	D.W., "	Chemic	al Engir	neers H	andboo	k", 8th E	Edition, M	cGraw-Hill, New	/ York, 20	007.			
COURSE On comp			uroo th	o otud	onto wi	II bo ob	ulo to							Mapped est Leve		
CO1	design t							ass one	rations				Applyi	ng (K3),		
					<u> </u>			css ope	rations					sion(S3) ing (K3),		
000	design t												Precis	sion(S3) ng (K3),		
	design t	he sepa	arating a	and dryi	ing equi	pment								sion(S3)		
	ucaigii t				-	Mappir			1	nd PSOs						
СОЗ				_						DO40	DO44					
CO3	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	! !	PSO1		
CO2 CO3 COs/POs CO1 CO2		PO2 2 2	PO3 3	PO4 2 2		PO6	PO7	P08	3	2	P011	1 1		2 3	2 2	

						22FTP	61- PR	OJEC	T WOF	RKI					
Programr Branch	ne &	В.ТЕ	CH. – F	Food Te	echnolo	gy				Sem.	Category	L	т	Р	Credit
Prerequ	isites	Nil								6	EC	0	0	8	4
															Total:60
COURSE On comp			urse, th	ne stud	ents wi	II be ab	le to							Mapped est Lev	
CO1	identify	and de	fine the			Appl	ying (K	3)							
CO2	select a	appropri	ate liter	ature a	nd frame			Appl	ying (K	3)					
CO3	develop method		n value	added t	ood pro	ools and		Crea	ating (Ke	3)					
CO4	analyze	the exp	perimer	ntal data	and de	rive the	valid c	onclusio	on				Analy	zing (K	4)
CO5	elabora	ite the p	oroject i	n the fo	rm of or	al prese	entation	, report	and ted	chnical pa	per publications		Crea	ating (Ke	3)
						Mappii	ng of C	os with	POs a	nd PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	F	PSO1	PSO2
CO1	3	3	2	3	2	2	3	2	3	3	3	3		3	3
CO2	3	2	2	2	3	2	2	2	3	3	3	3		2	2
CO3	3	3	3	3	3	3	3	2	3	3	3	3		3	3
CO4	3	3	2	3	3	2	2	2	3	3	3	3		2	2
CO5	3	2	2	2	2	2	2	2	3	3	3	3		2	2
1 – Slight,	2 – Mod	lerate, 3	3 – Subs	stantial,	BT- Blo	om's T	axonom	ny							

						22FTP	62- PR	OJEC	T WOF	RKI					
Programn Branch	ne &	В.ТЕ	:CH. – F	Food Te	echnolo	ogy				Sem.	Category	L	Т	Р	Credit
Prerequ	isites	Nil								6	EC	0	0	10	5
COURSE On compl			urse, tł	ne stud	ents wi	II be ab	ole to							Mappediest Lev	
CO1	identify					Арр	lying (K	3)							
CO2	select a	ppropri	ate liter	ature ar	nd fram			Арр	lying (K	3)					
CO3	develop		n value	added f	ood pro	tools and		Cre	ating (Ke	3)					
CO4	analyze	the exp	perimer	ital data	and de	erive the	valid c	onclusio	on				Anal	yzing (K	4)
CO5	elabora	te the p	oroject i	n the fo	rm of o	al prese	entation	, report	and ted	chnical pa	aper publications		Crea	ating (Ke	3)
						Mappii	ng of C	os with	POs a	nd PSOs	}				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	ı	PSO1	PSO2
CO1	3	3	2	3	2	2	3	2	3	3	3	3		3	3
CO2	3	2	2	2	3	2	2	2	3	3	3	3		2	2
CO3	3	3	3	3	3	3	3	2	3	3	3	3		3	3
CO4	3	3	2	3	3	2	2	2	3	3	3	3		2	2
CO5	3	2	2	2	2	2	2	2	3	3	3	3		2	2
CO3 CO4	3 3	3 3 2	3 2 2	3 3 2	3 3 2	3 2 2	3 2 2	2 2 2	3	3	3	3		3	_

				2	2GEP6	61– CO	MPRE	HENS	IVE TE	ST AND	VIVA			
						(Comm	on to a	II BE/B1	ech bra	anches)				
Programn Branch	ne &	В.Т	ECH. –	Food T	echnol	ogy				Sem.	Category	L	ТР	Credit
Prerequ	isites	Nil								6	EC	0	0 0	2
														Total:60
COURSE (urse, th	ne stud	ents wi	II be ab	le to					(BT Mapped Highest Lev	
CO1	demon	strate k	nowled	ge in the	eir respe	ective p	rogram	me dom	ain.				Applying (K	3)
CO2	defend	any typ	e of inte	erviews	, viva-vo	oce, and	d aptitud	de tests	conduc	ted for ca	reer progression	1	Applying (K3	3)
СОЗ	exhibit	profess	sional et	iquette	and solv	/e relate	ed engir	neering	problen	ns			Applying (K3	3)
						Марр	oing of	Cos wi	th POs	and PSC)s			
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2					1	2	2	3	3	2
CO2	3	3	2	2					1	2	2	3	3	2
	3	3	2	2					1	2	2	3	3	2

										PHASE-	•				
Programr Branch	ne &	В.Т	ECH. –	Food T	echnolo	ogy				Sem.	Category	L	Т	Credit	
Prerequ	uisites	Nil								7	EC	0	0 10	5	
														Total:90	
COURSE On comp			urse, th	ne stud	ents wi	II be ab	le to						BT Mappe Highest Le		
CO1	identify	and de	fine the	probler	ns that			Applying (K	3)						
CO2	select a	appropri	ate liter	ature a	nd frame			Applying (K	3)						
CO3	select appropriate literature and frame the objectives Applying (K3) develop/ design value added food products and equipments using research tools and methods Creating (K6)														
CO4	analyze	e the ex	perimer	ntal data	and de	rive the	valid co	onclusio	n			,	Analyzing (K	4)	
CO5	elabora	ite the	project i	n the fo	rm of or	al prese	entation,	, report a	and tech	nical pape	er publications		Creating (Ke	5)	
						Маррі	ing of C	os with	POs ar	nd PSOs					
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	3	2	3	2	2	3	2	3	3	3	3	3	3	
CO2	3	2	2	2	3	2	2	2	3	3	3	3	2	2	
CO3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	
CO4	3	3	2	3	3	2	2	2	3	3	3	3	2	2	
CO5	3	2	2	2	2	2	2	2	3	3	3	3	2	2	

Programn Branch	ne &	В.Т	ECH. –	Food T	echnolo	ogy				Sem.	Category	L	T P	Credit
Prerequ	iisites	Nil								7	EC	0	0 12	6
														Total:90
COURSE On compl			urse, th	ne stud	ents wi	ll be ab	le to					(BT Mappe Highest Le	
CO1	identify	and de	fine the	probler	ns that	need to	be solve	ed				,	Applying (K3)
CO2	select a	appropri	ate liter	ature a	nd frame		,	Applying (K3)					
CO3	develop	o/ desig	n value		Creating (K6)								
CO4	analyze	the ex	perimer	ntal data	and de	rive the	valid co	onclusio	n			A	Analyzing (K	1)
CO5	elabora	ite the	oroject i	n the fo	rm of or	al prese	entation,	report a	and tech	nical pape	er publications		Creating (K6)
						Маррі	ing of C	os with	POs a	nd PSOs				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2	2	3	2	3	3	3	3	3	3
CO2	3	2	2	2	3	2	2	2	3	3	3	3	2	2
CO3	3	3	3	3	3	3	3	2	3	3	3	3	3	3
CO4	3	3	2	3	3	2	2	2	3	3	3	3	2	2
CO5	3	2	2	2	2	2	2	2	3	3	3	3	2	2

					2	2GEI7	1- INDI	USTRI	AL TRA	INING				
Programr Branch	ne &	В.Т	ECH. –	Food T	echnol	ogy				Sem.	Category	L	ТР	Credit
Prerequ	uisites	Nil								7	EC	0	0 0	1
														Total:20
COURSE On comp			urse, tl	ne stud	ents wi	ll be ab	le to						BT Mappe (Highest Lev	
CO1	take pa	ırt in rea	al time p	ractices	s in food	d industr	ries						Applying (K3)
CO2	apply tl	ne gaine	ed techi	nical kn	owledge	and sk	ills to so	olve issu	ues in fo	od industr	у		Applying (K3)
CO3	work as	s an ind	ividual	or lead	a team i	ndepen	dently ir	n exhibit	ing man	agerial sk	ills		Applying (K3))
						Маррі	ing of C	os with	n POs ai	nd PSOs		·		
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CO2	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CO3							1	3	3	3	3	3	1	2
1 – Slight,	2 – Mod	lerate, 3	3 – Sub	stantial,	BT- Blo	om's Ta	axonom	У	•				•	•

		22GCT71 - ENGINEERING ECONOI	MICS AND MANAGE	IVIEN I				
		(Common to All BE/BT	ech branches)					
Program Branch		All BE/BTech branches	Sem.	Category	L	Т	P	Credit
Prerequ	uisites	Nil	7	HS	3	0	0	3
Preamb	le	The aim of the course is to create fundamental know economics, national income, marketing, operations					pts lik	ке
Unit – I		Micro Economics						9
		sics Concepts and Principles – Demand and Supply – cular Flow of Economic Activities and Income.	- Law of demand and S	Supply – Dete	rmin	ants	– Mai	rket
Unit – II		Macro Economics, Business Ownership and Ma	nagement concepts					9
Busines	s – Owne	and its Measurement Techniques. Inflation - Causes of ership Types. Management concepts: Taylor and Fayon Management - Roles of Manager.						
Unit – II	I	Marketing Management						9
		Concepts of Marketing - Four P's of Marketing - New le - Pricing Strategies and Decisions.	Product Developmen	t – Intellectua	l Pro	perty	Righ	ts (IPR),
Unit – I	V	Operations Management						9
		agement - Resources - Types of Production System - Sectory - EOQ Determination.	Site Selection, Plant L	ayout, Steps i	n Pr	oduct	ion P	lanning
Unit – V	/	Financial Management						9
		iples – Financial Statements and its Uses – Deprecial Capital Budgeting - Significance –Traditional and Disc			Bala	nce l	Metho	od – Break
								Total:4
	OOK:							
TEXT B		d by Department of Management Studies, Kongu Engrs", 1st Edition, McGraw Hill Education, Noida, 2013.	ineering College, "Eco	onomics and I	Mana	gem	ent fo	or
	Enginee							
1.	Enginee							
1.	ENCES:	Piyali Ghosh and Purba Roy Choudhury, "Manageria	I Economics", 3 rd Editi	on, McGraw-l	Hill, N	lew [Delhi,	2018.
1. REFERI	ENCES: Geetika,	Piyali Ghosh and Purba Roy Choudhury, "Manageria J. Stevenson, "Operations Management", 14 th Edition,			∃iII, N	lew [Delhi,	2018.

	SE OUTCOMES: npletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	identify market equilibrium and interpret national income calculations and inflation issues	Applying (K3)
CO2	choose a suitable business ownership for their enterprise and illustrate managerial functions	Applying (K3)
CO3	infer marketing management decisions	Understanding (K2)
CO4	apply appropriate operation management concept in business situations	Applying (K3)
CO5	interpret financial and accounting statements and evaluate new proposals	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	2			3		2	2	2	3	2		
CO2		1	2			2	2	2	2	2	3	2		
CO3	1	2	1			2		2	2	2	3	2		
CO4	1	2	1			2		2	2	2	3	2		
CO5	2	2				2		2	2	2	3	2		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

 * ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

					22FTP	81- PR	OJEC	T WOF	RK II PI	HASE- I	<u> </u>			
Programn Branch	ne &	В.Т	ECH. –	Food T	echnol	ogy				Sem.	Category	L	Т	Cred
Prerequ	isites	Nil								8	EC	0	0 8	4
COURSE On compl			urse. th	ne stud	ents wi	II be ab	ole to					(1	BT Mar	
CO1					ns that			/ed				,	Applyin	g (K3)
CO2	select a	appropri	ate liter	ature a	nd fram	e the ob	ojectives	S					Applyin	g (K3)
CO3	develop		n value	added	food pro	oducts a	and equ	ipments	s using ı	research	tools and		Creatin	g (K6)
CO4	analyze	e the ex	perimer	ntal data	a and de	erive the	e valid c	onclusi	on				Analyzir	ng (K4)
CO5	elabora	ate the p	oroject i	n the fo	rm of or	al prese	entation	, report	and tec	hnical pa	per publications		Creatin	g (K6)
					N	lapping	of Cos	s with F	Os and	d PSOs				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO	1 PSO
CO1	3	3	2	3	2	2	3	2	3	3	3	3	3	3
CO2	3	2	2	2	3	2	2	2	3	3	3	3	2	2
CO3	3	3	3	3	3	3	3	2	3	3	3	3	3	3
CO4	3	3	2	3	3	2	2	2	3	3	3	3	2	2

CO5

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

Programme &	B.Tech &Food Technology	Sem.	Category	L	т	Р	Credit
Branch	0,				_	-	
Prerequisites	NIL	5	PE	3	0	0	3
Preamble	To have a knowledge on different categories	of snack products	including the p	orocess	technolog	gy.	
Unit - I	Introduction:						9
Functions of ingructions of ingructions	s, Half Products, Directly expanded extruded redients – structure forming materials, dispersances, coloring and flavouring substances.						uble solids
Unit - II	Potato and Rice Based Snacks: e cleaning and peeling, slicing, drying/frying, s	alting and access	ing guality as	ontrol F	Cabricata	d note:	9
potato flakės, pot	ato granules, potato starch, ground and crushe fed rice. Products using flours.						
Unit - III	Corn Based Snacks:						
J III	COITI Dased Stlacks.						9
Tortilla chip – Co methods, oil pop	orn soaking and smoking, Grinding, Masa flou ping and dry popping. Commercial and indus						- Popping
Tortilla chip – Co methods, oil pop snacks. Quality o	orn soaking and smoking, Grinding, Masa flou						- Popping
Tortilla chip – Comethods, oil popsnacks. Quality out - IV Extruders for maand Third genera	orn soaking and smoking, Grinding, Masa flou oping and dry popping. Commercial and indus- control for snack foods.	strial popcorn pro	cess. Flavorir	ngs and	d Applica	tors. M	Poppinglasa basedggeneratio
Tortilla chip – Comethods, oil popsnacks. Quality ounit - IV Extruders for maand Third generaand processing.	orn soaking and smoking, Grinding, Masa flou ping and dry popping. Commercial and indus- control for snack foods. Extrusion Based Snacks: king snacks. Pre-conditioning of raw materials	strial popcorn pro	cess. Flavorir	ngs and	d Applica	tors. M	Poppinglasa baseggeneration
Tortilla chip – Comethods, oil popsnacks. Quality of Unit - IV Extruders for ma and Third genera and processing. Unit - V Pasta and Precoder	prin soaking and smoking, Grinding, Masa flouring and dry popping. Commercial and industrontrol for snack foods. Extrusion Based Snacks: King snacks. Pre-conditioning of raw materials tion snacks, Co extruded snacks, Breakfast cere	used in extrusion eals - Type and pro	process. Stagocessing. Text	es in exurized v	d Applica drusion. Segetable	Second protein	- Popping flasa base 9 d generation - Definition
Tortilla chip – Comethods, oil popsnacks. Quality of Unit - IV Extruders for ma and Third genera and processing. Unit - V Pasta and Precoder	orn soaking and smoking, Grinding, Masa flour ping and dry popping. Commercial and industrontrol for snack foods. Extrusion Based Snacks: king snacks. Pre-conditioning of raw materials tion snacks, Co extruded snacks, Breakfast ceres placed pasta - Raw materials. Preparation of raw in the products:	used in extrusion eals - Type and pro	process. Stagocessing. Text	es in exurized v	d Applica drusion. Segetable	Second protein	Popping lasa base 9 d generation - Definition 9 products
Tortilla chip – Comethods, oil popsnacks. Quality out - IV Extruders for ma and Third genera and processing. Unit - V Pasta and Precoders.	orn soaking and smoking, Grinding, Masa flour ping and dry popping. Commercial and industrontrol for snack foods. Extrusion Based Snacks: king snacks. Pre-conditioning of raw materials tion snacks, Co extruded snacks, Breakfast ceres placed pasta - Raw materials. Preparation of raw in the products:	used in extrusion eals - Type and pro	process. Stagocessing. Text	es in exurized v	d Applica drusion. Segetable	Second protein	Popping lasa base 9 d generation - Definition 9 products
Tortilla chip – Comethods, oil popsnacks. Quality of Unit - IV Extruders for ma and Third genera and processing. Unit - V Pasta and Precoders - Spaghetti, nood	orn soaking and smoking, Grinding, Masa flour ping and dry popping. Commercial and industrontrol for snack foods. Extrusion Based Snacks: king snacks. Pre-conditioning of raw materials tion snacks, Co extruded snacks, Breakfast ceres placed pasta - Raw materials. Preparation of raw in the products:	used in extrusion eals - Type and pro	process. Stag processing. Text	es in exurized v	trusion. Segetable	Second protein	- Popping flasa base 9 d generation - Definition 9
Tortilla chip – Comethods, oil popsnacks. Quality of Unit - IV Extruders for main and Third general and processing. Unit - V Pasta and Precoder - Spaghetti, nooder - Spaghetti, nooder - Spaghetti, nooder - Spaghetti - S	prin soaking and smoking, Grinding, Masa flour pring and dry popping. Commercial and industrontrol for snack foods. Extrusion Based Snacks: king snacks. Pre-conditioning of raw materials tion snacks, Co extruded snacks, Breakfast ceres pasta Products: Pasta Products: oked pasta - Raw materials. Preparation of raw in les, macaroni and similar products. Dry and froze	used in extrusion eals - Type and pro	process. Stag processing. Text	es in exurized v	trusion. Segetable	Second protein	Popping flasa base 9 d generation - Definition 9 products
Tortilla chip – Comethods, oil popsnacks. Quality of Unit - IV Extruders for ma and Third genera and processing. Unit - V Pasta and Precoder - Spaghetti, nood TEXT BOOK: 1. Edmur REFERENCES:	prin soaking and smoking, Grinding, Masa flour pring and dry popping. Commercial and industrontrol for snack foods. Extrusion Based Snacks: king snacks. Pre-conditioning of raw materials tion snacks, Co extruded snacks, Breakfast ceres pasta Products: Pasta Products: oked pasta - Raw materials. Preparation of raw in les, macaroni and similar products. Dry and froze	used in extrusion eals - Type and promaterials for extrusen pasta products.	process. Stag processing. Text sion and proce	es in exurized vessing.	d Applica Atrusion. Segetable Types of planting and pla	Second protein	Popping flasa base 9 d generation - Definition 9 products

	OUTCOMES: letion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	classify types of snacks and choose appropriate ingredient based on their functionality	Understanding (K2)
CO2	make use of potato and rice for the production of suitable snack foods	Applying (K3)
CO3	select suitable techniques for production of corn based snacks	Applying (K3)
CO4	explain the principles of extruder and processing techniques for extruded foods	Understanding (K2)
CO5	classify pasta products and explain the steps involved in their production	Understanding (K2)

COs/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO2
CO1	2	1	1							1		1	3	1
CO2	2	2	2	1						1		1	3	1
CO3	2	2	2	1						1		1	3	1
CO4	3	2	2	1						1		1	3	1
CO5	3	2	2	1						1		1	3	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	20	50	30				100
CAT3	30	70					100
ESE	20	50	30				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Programme & Branch	B.Tech &Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	5	PE	3	0	0	3
Preamble	To provide knowledge about the synthesis food processing and food packaging.	s of nano materials, i	ts characterizati	on and a	pplications	of nano	particlesin
Unit - I	Introduction to Nanotechnology:						9
	anotechnology: Introduction to nano particles o encapsulation, nano food particles and t food products						
Unit - II	Synthesis of Nano Materials:						9
methods - ball m	no Materials: Introduction to synthesis of nano nilling, sputtering, evaporation. Chemical metholysis route - spray pyrolysis. Biological method	ods - photochemical	synthesis, elec-	trochemi			
Unit - III	Nanatashnalagu in Eagd.						^
Nanotechnology	Nanotechnology in Food: in Food: Nanoparticles in functional foods, e						
Nanotechnology nanoemulsion for flavors and arom Unit - IV Nanotechnology food packaging r	in Food: Nanoparticles in functional foods, entration, potential applications of milk nanotube a compounds. Nanotechnology in Food Packaging: in Food Packaging: Bionano composites for functional packaging with the second pack	oes, nano engineered food preservation, int	elligent packagii	oplication ng, high aterials in	barrier plas	articles in stics, bio d flexible	processing delivery of general degradable
Nanotechnology nanoemulsion for flavors and arom Unit - IV Nanotechnology food packaging r	in Food: Nanoparticles in functional foods, entration, potential applications of milk nanotube a compounds. Nanotechnology in Food Packaging: in Food Packaging: Bionano composites for food Packaging:	food preservation, intith nano diamond pachitibacterial food pach	elligent packagii rticles, nano ma kaging, nano se	oplicationing, high aterials in nsors for	barrier plas	articles in stics, bio d flexible	processing delivery o
Nanotechnology nanoemulsion for flavors and arom Unit - IV Nanotechnology food packaging r materials for high Unit - V Nanotechnology biochemical cont	in Food: Nanoparticles in functional foods, et rmation, potential applications of milk nanotube a compounds. Nanotechnology in Food Packaging: in Food Packaging: Bionano composites for functional processing, new approaches in all Nanotechnology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food separation of food based pathology in Food Safety and Challenges in Nanomatents in food separation of food based pathology in Food Safety and Challenges in Nanomatents in food separation of food based pathology in Food Safety and Chal	food preservation, int ith nano diamond pa ntibacterial food pack allenges in Nanoma tterials Analysis: Nar igens using magnetic	elligent packagii rticles, nano ma kaging, nano se iterials Analysis no technology be c nanoparticles,	ng, high aterials in nsors for second ray challeng	barrier plas necorporated food quali pid detection	stics, biod flexible ity.	processing delivery of delivery of delivery of degradable packaging general and ls analysis
Nanotechnology nanoemulsion for flavors and arom Unit - IV Nanotechnology food packaging r materials for high Unit - V Nanotechnology biochemical cont sample pre-treati	in Food: Nanoparticles in functional foods, et rmation, potential applications of milk nanotube a compounds. Nanotechnology in Food Packaging: in Food Packaging: Bionano composites for functional processing, new approaches in all Nanotechnology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food separation of food based pathology in Food Safety and Challenges in Nanomatents in food separation of food based pathology in Food Safety and Challenges in Nanomatents in food separation of food based pathology in Food Safety and Chal	food preservation, int ith nano diamond pa ntibacterial food pack allenges in Nanoma tterials Analysis: Nar igens using magnetic	elligent packagii rticles, nano ma kaging, nano se iterials Analysis no technology be c nanoparticles,	ng, high aterials in nsors for second ray challeng	barrier plas necorporated food quali pid detection	stics, biod flexible ity.	processing delivery c g degradable packaging g emical and
Nanotechnology nanoemulsion for flavors and arom Unit - IV Nanotechnology food packaging r materials for high Unit - V Nanotechnology biochemical cont sample pre-treatr and quantification TEXT BOOK:	in Food: Nanoparticles in functional foods, et rmation, potential applications of milk nanotube a compounds. Nanotechnology in Food Packaging: in Food Packaging: Bionano composites for functional processing, new approaches in all Nanotechnology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food, separation of food based pathology in Food Safety and Challenges in Nanomatents in food separation of food based pathology in Food Safety and Challenges in Nanomatents in food separation of food based pathology in Food Safety and Challenges in Nanomatents in food separation of food based pathology in Food Safety and Chal	food preservation, int ith nano diamond pa ntibacterial food pack allenges in Nanoma tterials Analysis: Nar igens using magnetic irials in food and biol	elligent packagirticles, nano makaging, nano se eterials Analysis no technology be nanoparticles, ogical matrices,	ng, high aterials ir nsors for s: ased rap challeng nanoma	barrier plancorporated food qualication detection terial detections.	stics, biod flexible ity. on of che materiaction	processing delivery of deliver
Nanotechnology nanoemulsion for flavors and arom Unit - IV Nanotechnology food packaging r materials for high Unit - V Nanotechnology biochemical cont sample pre-treatr and quantification TEXT BOOK: 1. Qasim 0	in Food: Nanoparticles in functional foods, et rmation, potential applications of milk nanotube a compounds. Nanotechnology in Food Packaging: in Food Packaging: Bionano composites for finanocomposites, bioactive food packaging with pressure processing, new approaches in all Nanotechnology in Food Safety and Chin Food Safety and Challenges in Nanoma tents in food, separation of food based pathoment methods, characterization of nano matern methods.	food preservation, int ith nano diamond pa ntibacterial food pack allenges in Nanoma tterials Analysis: Nar igens using magnetic irials in food and biol	elligent packagirticles, nano makaging, nano se eterials Analysis no technology be nanoparticles, ogical matrices,	ng, high aterials ir nsors for s: ased rap challeng nanoma	barrier plancorporated food qualication detection terial detections.	stics, biod flexible ity. on of che materiaction	processing delivery of deliver
Nanotechnology nanoemulsion for flavors and arom Unit - IV Nanotechnology food packaging materials for high Unit - V Nanotechnology biochemical cont sample pre-treatrand quantification TEXT BOOK: 1. Qasim (REFERENCES: Rai M.,	in Food: Nanoparticles in functional foods, et rmation, potential applications of milk nanotube a compounds. Nanotechnology in Food Packaging: in Food Packaging: Bionano composites for finanocomposites, bioactive food packaging with pressure processing, new approaches in all Nanotechnology in Food Safety and Chin Food Safety and Challenges in Nanoma tents in food, separation of food based pathoment methods, characterization of nano matern methods.	food preservation, int ith nano diamond pa ntibacterial food pack allenges in Nanoma terials Analysis: Nar gens using magnetic trials in food and biol	elligent packaging rticles, nano makaging, nano se eterials Analysis no technology be nanoparticles, ogical matrices,	ng, high aterials in nsors for s: ased ral challeng nanoma	barrier plas barrier plas ncorporated food quali pid detecti es in nano terial detecti	stics, biod flexible ity. on of che material otion	processing delivery of the packagin packagin packagin packagin sanalysis Total:4
Nanotechnology nanoemulsion for flavors and arom Unit - IV Nanotechnology food packaging r materials for high Unit - V Nanotechnology biochemical cont sample pre-treatr and quantification TEXT BOOK: 1. Qasim 0 REFERENCES: 1. Rai M., Switzer Guozho	in Food: Nanoparticles in functional foods, et rmation, potential applications of milk nanotub a compounds. Nanotechnology in Food Packaging: in Food Packaging: Bionano composites for finanocomposites, bioactive food packaging with pressure processing, new approaches in an Nanotechnology in Food Safety and Chin Food Safety and Challenges in Nanomatents in food, separation of food based pathoment methods, characterization of nano matern methods. Chaudhry, Laurence Castle and Richard Wat Ribeiro C., Mattoso L., and Duran N, "Nanotic reactions of maternal pathons in Food Safety and Richard Wat Ribeiro C., Mattoso L., and Duran N, "Nanotic reactions in Food Safety and Richard Wat Ribeiro C., Mattoso L., and Duran N, "Nanotic reactions in Food Safety and Richard Wat Ribeiro C., Mattoso L., and Duran N, "Nanotic reactions in Food Safety and Richard Wat Ribeiro C., Mattoso L., and Duran N, "Nanotic reactions in Food Safety and Richard Wat Ribeiro C., Mattoso L., and Duran N, "Nanotic reactions in Food Safety and Challenges in Nanotic Ribeiro C., Mattoso L., and Duran N, "Nanotic Ribeiro C., Mattoso L., and Duran Ribeiro C., and Duran Ribeiro C., and Duran Ribeiro C., and Duran Ribeiro C., and D	food preservation, intended in the nano diamond particle and the nano diamond packallenges in Nanomal terials Analysis: Naragens using magnetic rials in food and biole with the nanomal terials in food and the nano	elligent packaging rticles, nano makaging, nano se sterials Analysis no technology be nanoparticles, ogical matrices, gies in Food", 2r and Agriculture	ng, high aterials in nsors for s: ased raichalleng nanoma	barrier plas ncorporated food quali pid detection es in nano terial detection	stics, biod flexible ity. on of che materiaction blishing,	processing delivery of 9 degradabl packagin 9 emical an ls analysis Total:4 UK,2017.

	E OUTCOMES: upletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	outline the fundamentals of nanotechnology and the challenges / public perception of nano particles in food	Understanding (K2)
CO2	make use of appropriate method for manufacturing nano particles	Applying (K3)
CO3	solve the food quality issues by suitable nanotechnology based solutions	Applying (K3)
CO4	make use of nano materials incorporated packaging to extend shelf life of food	Applying (K3)
CO5	make use of nanotechnology in food analysis and characterization of nano particles	Applying (K3)

COs/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1		2	1				1		2	3	2
CO2	3	2	1		2	1				1		2	3	2
CO3	3	3	2	1	2	1				1		2	3	3
CO4	3	3	3	1	2	1	1			1		2	3	3
CO5	3	3	3	1	2	2	1			1		3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

		7,002,001					
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 - 50 marks & ESE - 100 marks)

	22FTE03-FERMENTATION	TECHNOLOGY					
Programme & Branch	B.Tech &Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Food microbiology, Food chemistry	5	PE	3	0	0	3
Preamble	To provide an insight about the concepts of fermentation	process and produ	cts				
Unit - I	Introduction and Food Fermentation:						9
	Basic principles of food fermentation, Properties of fermented firms for fermentation, Starter Cultures and fermented products oculums.						
Unit - II	Fermentation media:						9
	media: Natural and Synthetic media; Basic components of mediation of del factor, Calculation of holding time at constant temporary		in media. Ste	erilizatio	n: Steriliz	zationof	media
Unit - III	Types of Fermentation & Design of fermenter:						9
supply, deterr Unit - IV Recovery and	ermenter construction- construction material, Temperature continuation of KLa values & factors affecting the operation of ferme Recovery and Purification of Fermentation products: I Purification of Fermentation products: Removal of microbial continuation, cell disruption, membrane process, chromatography, drying ar	enter. : ells and other solid					9
Unit - V	Production of Fermented Products:						9
	Fermented Food Products: Meat fermentation-Sausages. Asiar f Metabolites: Production of vitamins, amino acids, organic acids						Miso.
	·	-					Total:4
TEXT BOOK:							
	anbury P.F, Whitaker A. and Hall S.J, "Principles of Fermenta	ation Technology",	3rd Edition,	worth H	Heinemar	n, New	York,
1 Sta	anbury P.F, Whitaker A. and Hall S.J , "Principles of Fermenta 16.	ation Technology",	3rd Edition,	worth H	Heinemar	nn, New	York,
1. Sta 20	anbury P.F, Whitaker A. and Hall S.J , "Principles of Fermenta 16.					nn, New	York,

	OUTCOMES: Detion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	outline the principles and concepts of fermentation	Understanding (K2)
CO2	select suitable media component and sterilization methods	Applying (K3)
CO3	identify the suitable fermentation process and construction of fermenter	Applying (K3)
CO4	choose appropriate techniques for recovery of fermented products	Applying (K3)
CO5	illustrate the production of different fermented products	Understanding (K2)

COs/ Pos	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2		1					1		1	2	1
CO2	3	2	2	2	2					1		1	2	2
CO3	3	2	2	2	2					1		2	3	2
CO4	3	2	2		2					1		1	3	2
CO5	3	2	1		1					1		1	3	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

		AUULUU	,				
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	CAT1	20	60	20			
CAT2	CAT2	20	40	40			
CAT3	CAT3	20	60	20			
ESE	ESE	20	60	20			

* ±3% may be varied (CAT 1,2,3 - 50 marks & ESE - 100 marks)

	22FTE04- FOOD STORAGE AND INFE	STATION CON	TROL				
Programme & Branch	B.Tech &Food Technology	Sem.	Category	L	Т	Р	Cre dit
Prerequisites	Nil	5	PE	3	0	0	3
Preamble	To understand about the effect of insects and pest on pest infestation	stored products	and to learn	about t	the meth	nods to	control
Unit - I	Fundamentals of Storage Infestation:						9
	st-harvest losses - total production of food grains in India. It pests namely insects, mites, rodents, birds and microoural products. Ecology of Insects and Storage Losses:						
temperature and changes and co position, identific	ts and Storage Losses: Ecology of insect pests of stored continuity in safe storage of food grains and commodities. Support the storage structures; association of cation, distribution, nature and extent of damage, role of cation, and their effect as quality including bias beginning to be a support to the storage of their effect as quality including bias beginning to be a support to the storage of their effect as quality including bias beginning to be a support to the storage of the	Stored grain deter stored grain inse field and cross i	ioration procects with fung	ess, phy i and r	/sical an nites, th	d bioch eir sys	nemica tematic
	rains and their effect on quality including piochemical change	es.					
Unit - III Grain Storage a	grains and their effect on quality including biochemical change Grain Storage and Management: nd Management: Grain storage, Types of storage structure	es - traditional, in					
Unit - III Grain Storage a current usage. Ic chemical and che	Grain Storage and Management:	es - traditional, in t rodent pests as ol of infestation by	sociated with	stored	grains a	and the	ures in
Unit - III Grain Storage a current usage. Ichemical and che Preventive meas	Grain Storage and Management: nd Management: Grain storage, Types of storage structure deal seeds and commodities storage conditions. Important emical control. Pest Birds — role and its management. Control	es - traditional, in t rodent pests as ol of infestation by	sociated with	stored	grains a	and the	ures in
Unit - III Grain Storage a current usage. It chemical and che Preventive measure methods. Unit - IV Pest Control M	Grain Storage and Management: Ind Management: Grain storage, Types of storage structure deal seeds and commodities storage conditions. Important emical control. Pest Birds — role and its management. Control sures- Hygiene/sanitation, disinfestations of stores/receptaresures: Non-chemical control measures- ecological, mil- prophylactic and curative. Pesticides — characteristics, u	es - traditional, in t rodent pests as ol of infestation by acles, legal nechanical, phys	sociated with insect pests,	stored mites	grains a and mid	and the croorga	ures in ir non-nisms. 9 eering.
Unit - III Grain Storage a current usage. Ic chemical and che Preventive measmethods. Unit - IV Pest Control M Chemical contro	Grain Storage and Management: Ind Management: Grain storage, Types of storage structure deal seeds and commodities storage conditions. Important emical control. Pest Birds — role and its management. Control sures- Hygiene/sanitation, disinfestations of stores/receptaresures: Non-chemical control measures- ecological, mil- prophylactic and curative. Pesticides — characteristics, u	es - traditional, in t rodent pests as ol of infestation by acles, legal nechanical, phys	sociated with insect pests,	stored mites	grains a and mid	and the croorga	ures in ir non-nisms. 9 eering.
Unit - III Grain Storage a current usage. Ichemical and che Preventive measure methods. Unit - IV Pest Control M Chemical control stored grain pessure Unit - V Quality Control in grains, determinate	Grain Storage and Management: Ind Management: Grain storage, Types of storage structure deal seeds and commodities storage conditions. Important emical control. Pest Birds — role and its management. Control sures- Hygiene/sanitation, disinfestations of stores/receptal Pest Control Measures: Pest Control Measures: easures: Non-chemical control measures- ecological, management.	es - traditional, in t rodent pests as ol of infestation by acles, legal nechanical, phys ises and precautions, s, losses in stored	ical, cultural, ons in handlind food grains	stored mites biologing. Inte	grains a and mid	dengine approac	y eering. hes to
Unit - III Grain Storage a current usage. Ichemical and che Preventive measure methods. Unit - IV Pest Control M Chemical control stored grain pessure Unit - V Quality Control in grains, determination of the control of the cont	Grain Storage and Management: Ind Management: Grain storage, Types of storage structure deal seeds and commodities storage conditions. Important emical control. Pest Birds — role and its management. Control sures- Hygiene/sanitation, disinfestations of stores/receptares: Pest Control Measures: Leasures: Non-chemical control measures- ecological, modern prophylactic and curative. Pesticides — characteristics, ut to management. Quality Control in Grains: Grains: Detection of insect infestation in stored food grains ation of moisture content in stored food grains, Quality control in Grains;	es - traditional, in t rodent pests as ol of infestation by acles, legal nechanical, phys ises and precautions, s, losses in stored	ical, cultural, ons in handlind food grains	stored mites biologing. Inte	grains a and mid	dengine denyeroace den	y eering. hes to
Unit - III Grain Storage a current usage. Ichemical and che Preventive measmethods. Unit - IV Pest Control M Chemical control stored grain pestunit - V Quality Control in grains, determination on seed quality.	Grain Storage and Management: Ind Management: Grain storage, Types of storage structure deal seeds and commodities storage conditions. Important emical control. Pest Birds — role and its management. Control sures- Hygiene/sanitation, disinfestations of stores/receptares: Pest Control Measures: Leasures: Non-chemical control measures- ecological, modern prophylactic and curative. Pesticides — characteristics, ut to management. Quality Control in Grains: Grains: Detection of insect infestation in stored food grains ation of moisture content in stored food grains, Quality control in Grains;	es - traditional, in t rodent pests as ol of infestation by acles, legal nechanical, phys ises and precautions, s, losses in stored	ical, cultural, ons in handlind food grains	stored mites biologing. Inte	grains a and mid	dengine denyeroace den	y eering. hes to g evilled
Unit - III Grain Storage a current usage. Ichemical and che Preventive measure methods. Unit - IV Pest Control M Chemical control stored grain pestored grain pestoric - V Quality Control in grains, determinate Demonstration of on seed quality. TEXT BOOK: Naray	Grain Storage and Management: Ind Management: Grain storage, Types of storage structure deal seeds and commodities storage conditions. Important emical control. Pest Birds — role and its management. Control sures- Hygiene/sanitation, disinfestations of stores/receptares: Pest Control Measures: Leasures: Non-chemical control measures- ecological, modern prophylactic and curative. Pesticides — characteristics, ut to management. Quality Control in Grains: Grains: Detection of insect infestation in stored food grains ation of moisture content in stored food grains, Quality control in Grains;	es - traditional, in t rodent pests as ol of infestation by icles, legal nechanical, phys ises and precaution s, losses in stored introl aspects in Forecontrol aspects in Forecontrol	ical, cultural, ons in handling of food grains CI godowns, nent of packi	stored mites biologing. Inte	grains a and mid gical and grated a villed an warehou erials an	dengine dunwe use. d their	y eering. hes to g evilled
Unit - III Grain Storage a current usage. Ichemical and che Preventive measure methods. Unit - IV Pest Control M Chemical control stored grain pessure Unit - V Quality Control in grains, determinate Demonstration of on seed quality. TEXT BOOK: Naray	Grain Storage and Management: Ind Management: Grain storage, Types of storage structure deal seeds and commodities storage conditions. Important emical control. Pest Birds — role and its management. Control sures- Hygiene/sanitation, disinfestations of stores/receptares: Pest Control Measures: Leasures: Non-chemical control measures- ecological, moreophylactic and curative. Pesticides — characteristics, untamagement. Quality Control in Grains: In Grains: Detection of insect infestation in stored food grains ation of moisture content in stored food grains, Quality configure for preventive and curative measures including fumigation to the store of the storage of the sto	es - traditional, in t rodent pests as ol of infestation by icles, legal nechanical, phys ises and precaution s, losses in stored introl aspects in Forecontrol aspects in Forecontrol	ical, cultural, ons in handling of food grains CI godowns, nent of packi	stored mites biologing. Inte	grains a and mid gical and grated a villed an warehou erials an	dengine dunwe use. d their	y eering. hes to g evilled
Unit - III Grain Storage a current usage. Ichemical and che Preventive measure methods. Unit - IV Pest Control M Chemical control stored grain pessure Unit - V Quality Control in grains, determinate Demonstration of on seed quality. TEXT BOOK: 1. Naray House REFERENCES:	Grain Storage and Management: Ind Management: Grain storage, Types of storage structure deal seeds and commodities storage conditions. Important emical control. Pest Birds — role and its management. Control sures- Hygiene/sanitation, disinfestations of stores/receptares: Pest Control Measures: Leasures: Non-chemical control measures- ecological, moreophylactic and curative. Pesticides — characteristics, untamagement. Quality Control in Grains: In Grains: Detection of insect infestation in stored food grains ation of moisture content in stored food grains, Quality configure for preventive and curative measures including fumigation to the store of the storage of the sto	es - traditional, in t rodent pests as ol of infestation by incles, legal nechanical, phys ises and precaution s, losses in stored introl aspects in Forection aspects in Forection echniques; treating	ical, cultural, ons in handling of food grains CI godowns, nent of packing, 1st Edition, S	stored mites biologing. Inte	grains a and mid grated a villed an warehou erials an	dengine approace d unweuse. d their of T	y eering. hes to g evilled

	OUTCOMES: letion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	outline possible sources of pest infestation in storage	Understanding (K2)
CO2	identify ecology of region specific insects and infer their impact on storage	Applying (K3)
CO3	choose appropriate storage structures and preventive measures for pests	Applying (K3)
CO4	select integrated pest management approach and curative measures in grain storage	Applying (K3)
CO5	utilize suitable quality control techniques in grain storage	Applying (K3)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO 8	PO9	PO10	PO 11	PO12	PSO1	P S O 2
CO1	3	2	1	1		1				1		1		3
CO2	3	2	2	2		1				1		1	1	3
CO3	3	2	2	2	2	2				1		1	1	3
CO4	3	2	2	1	2	2				1		2	1	3
CO5	3	2	2	1	1	3				1		2	2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

* ±3% may be varied (CAT 1,2,3 - 50 marks & ESE - 100 marks)

Programme &	P Tech 9 Food Technology	Sam	Cotomoru		т	Р	Cradit
Branch	B.Tech & Food Technology	Sem.	Category	L	1	Ρ	Credit
Prerequisites	Food Chemistry	5	PE	3	0	0	3
Preamble	To provide deeper insight to students on role of food a	additives and nutraceution	cals on food P	roduc	t Devel	opme	ent.
Unit - I	Food Preservatives and Antioxidants:						9
preservatives; a Permitted prese primary and se	es and functions of food additives in food processin cidulants and low pH –organic acids and esters; sulphurvatives in foods as per FSSAI. Antioxidants: Na tural condary antioxidants; selection and application of antioxidoods. Sequestarants and its functions.	ur dioxide and its salts; and synthetic antioxida dants in foods; evaluatio	nitrites; antibi ants; mechani	iotics; ism of	surface antiox	e pres idant	servation function
Unit - II	Food Colorants, Flavors, Emulsifiers and Stabilize	ers:					9
of emulsifiers a of polyols, appli	trictions on the use of flavoring agents in Foods. Emulsifiend stabilizers in foods; permitted emulsifiers and stabilization in food industry, permitted polyols in foods.						
Safety limits of	Safety, Regulation and Quality Standards: Food additives; FSSAI regulations And GRAS additives F						
Safety limits of acute toxicity, neffect, immune	Food additives; FSSAI regulations And GRAS additives Foutagenicity and carcinogenicity, reproductive and develor toxicity. Determination of the limit for addition – NOEL –	opmental toxicity, terato	genicity, neur	otoxic	ity and	beha	osure, ivioral
Safety limits of acute toxicity, n effect, immune GRAS additives	Food additives; FSSAI regulations And GRAS additives Foutagenicity and carcinogenicity, reproductive and develor toxicity. Determination of the limit for addition – NOEL –	opmental toxicity, terato	genicity, neur	otoxic	ity and	beha	osure, ivioral
Safety limits of acute toxicity, neffect, immune GRAS additives Unit - IV Introduction, deanimal based r Nutraceuticals	Food additives; FSSAI regulations And GRAS additives Food additives; FSSAI regulations And GRAS additives Food additives and developments. Functional Foods and Nutraceuticals: finition. Difference between functional foods and nutraceuticals. Health benefits of Polyphenols, Flavonoid compounds: Distillation, ultrahydrostatic pressure treatness.	opmental toxicity, terato Method of determining acceuticals. Examples for ds, Omega-3 Fatty Acid ment, dense carbon-di-	genicity, neur toxicity – LD5 r fortified fulls, Carotenoid oxide treatme	otoxic 50. FS nction ls. Te	ity and SAI rec al food chnolog	beha gulation ds. F	osure, vioral ons and 9
acute toxicity, n effect, immune GRAS additives Unit - IV Introduction, de animal based n Nutraceuticals	Food additives; FSSAI regulations And GRAS additives Futtagenicity and carcinogenicity, reproductive and developments. Functional Foods and Nutraceuticals: finition. Difference between functional foods and nutraceuticals. Health benefits of Polyphenols, Flavonoid	ppmental toxicity, terato Method of determining accuticals. Examples for ds, Omega-3 Fatty Acid ment, dense carbon-di- rocesses, nano encapsu	genicity, neur toxicity – LD5 r fortified fulls, Carotenoid oxide treatme	otoxic 50. FS nction ls. Te	ity and SAI rec al food chnolog	beha gulation ds. F	osure, vioral ons and 9
Safety limits of acute toxicity, neffect, immune GRAS additives Unit - IV Introduction, deanimal based nutraceuticals nutraceuticals - Unit - V Nutraceuticals Market Production	Food additives; FSSAI regulations And GRAS additives in the productive and developmentation of the limit for addition – NOEL – . Functional Foods and Nutraceuticals: finition. Difference between functional foods and nutraceuticals. Health benefits of Polyphenols, Flavonoid compounds: Distillation, ultrahydrostatic pressure treatmentations. The processes and chemical based processes and chemical based processes.	ppmental toxicity, terato Method of determining accuticals. Examples for ds, Omega-3 Fatty Acid ment, dense carbon-di- rocesses, nano encapsu : r, Probiotics Cardiovas s- tablets, capsules, p	genicity, neur toxicity – LD5 r fortified fulls, Carotenoid oxide treatmentation.	otoxic 50. FS nction ls. Telent, er	ity and SAI regard al food chnolog ncapsul	beha gulation ds. F gies to ation	osure, avioral ons and one of ecove of end Use
Safety limits of acute toxicity, neffect, immune GRAS additives Unit - IV Introduction, deanimal based result acceuticals nutraceuticals - Unit - V Nutraceuticals Market Production	Food additives; FSSAI regulations And GRAS additives in the substitution of the limit for addition – NOEL –	ppmental toxicity, terato Method of determining accuticals. Examples for ds, Omega-3 Fatty Acid ment, dense carbon-di- rocesses, nano encapsu : r, Probiotics Cardiovas s- tablets, capsules, p	genicity, neur toxicity – LD5 r fortified fulls, Carotenoid oxide treatmentation.	otoxic 50. FS nction ls. Telent, er	ity and SAI regard al food chnolog ncapsul	beha gulation ds. F gies to ation	osure, ivioral ons and 9 Plant and orecove of 9 End Use, liquids
Safety limits of acute toxicity, neffect, immune GRAS additives Unit - IV Introduction, deanimal based result Nutraceuticals nutraceuticals - Unit - V Nutraceuticals Market Production Nutraceuticals of Nutraceu	Food additives; FSSAI regulations And GRAS additives in the substitution of the limit for addition – NOEL –	ppmental toxicity, terato Method of determining accuticals. Examples for ds, Omega-3 Fatty Acid ment, dense carbon-di- rocesses, nano encapsu : r, Probiotics Cardiovas s- tablets, capsules, p	genicity, neur toxicity – LD5 r fortified fulls, Carotenoid oxide treatmentation.	otoxic 50. FS nction ls. Telent, er	ity and SAI regard rega	beha gulation ds. F gies to ation	osure, ivioral ons and 9 Plant and orecove of 9 End Use, liquids
Safety limits of acute toxicity, neffect, immune GRAS additives Unit - IV Introduction, deanimal based result acuticals nutraceuticals nutraceuticals Market Production Nutraceuticals Market Production Nutraceuticals of TEXT BOOK:	Food additives; FSSAI regulations And GRAS additives in the substitution of the limit for addition – NOEL –	opmental toxicity, terato Method of determining acceuticals. Examples for dis, Omega-3 Fatty Acid ment, dense carbon-dirocesses, nano encapsus: r, Probiotics Cardiovas s- tablets, capsules, pals.	genicity, neur toxicity – LD5 r fortified fur s, Carotenoid oxide treatmentation. cular and Choowders, soft	otoxic 50. FS nction ls. Telent, er ronic t gels	ity and SAI recall all food chnologoncapsul Diseas, gel	beha gulation ds. F gies to ation	osure, ivioral ons and 9 Plant and orecove of 9 End Use, liquids
Safety limits of acute toxicity, neffect, immune GRAS additives Unit - IV Introduction, deanimal based not nutraceuticals nutraceuticals - Unit - V Nutraceuticals Market Production Nutraceuticals of Nutraceutic	Food additives; FSSAI regulations And GRAS additives in the productive and developmentation of the limit for addition – NOEL – N	opmental toxicity, terato Method of determining acceuticals. Examples for dis, Omega-3 Fatty Acid ment, dense carbon-dirocesses, nano encapsus: r, Probiotics Cardiovas s- tablets, capsules, pals.	genicity, neur toxicity – LD5 r fortified fur s, Carotenoid oxide treatmentation. cular and Choowders, soft	otoxic 50. FS nction ls. Telent, er ronic t gels	ity and SAI recall all food chnologoncapsul Diseas, gel	beha gulation ds. F gies to ation	osure, avioral ons and one of ecove of end Use
Safety limits of acute toxicity, neffect, immune GRAS additives Unit - IV Introduction, deanimal based noutraceuticals nutraceuticals nutraceuticals Market Production Nutraceuticals of Nutrace	Food additives; FSSAI regulations And GRAS additives in the productive and developmentation of the limit for addition – NOEL – N	opmental toxicity, terato Method of determining accuticals. Examples for dis, Omega-3 Fatty Acid ment, dense carbon-dirocesses, nano encapsus: r, Probiotics Cardiovas s- tablets, capsules, peals.	genicity, neur toxicity – LD5 r fortified fulls, Carotenoid oxide treatmentation. cular and Choowders, soft	otoxic 50. FS nction ls. Terent, er ronic t gels	ity and SAI recall all food chnologoncapsul Diseas, gel	beha gulation ds. F gies to ation	osure, ivioral ons and 9 Plant and orecove of 9 End Use, liquids

	SE OUTCOMES: npletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	select appropriate preservatives and antioxidants.	Understanding (K2)
CO2	choose suitable food colours, flavours, emulsifiers and stabilizers	Applying (K3)
CO3	relate the safety, regulations and quality standards to food additives in food processing	Understanding (K2)
CO4	identify technology to recover nutraceuticals.	Applying (K3)
CO5	identify the effect of nutraceuticals in health promotion and disease prevention	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1							1		2	3	3
CO2	3	3	1							1		2	3	3
CO3	3	3	2		1	2		2		1		2	1	3
CO4	3	3	1		1	2				1		2	3	3
CO5	3	3	2		1	2				1		3	2	3

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

AGGEGGINENT LATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	60	20				100
CAT3	20	40	40				100
ESE	20	50	30				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Programme & Branch	B.Tech &Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Food Chemistry , Food microbiology	6	PE	3	0	0	3
Preamble	To provide knowledge on toxicology related to food and the	human food chain					
Unit - I	Introduction to Food Toxicology:						9
	need for understanding food toxicology; Hazards -Microbiologic oral and cell mediated response. Allergen and mechanism of all		environment	al. Ba	sics of	immu	ne
Unit - II	Natural Toxins, Food Allergy and Sensitivity:	<u> </u>					9
	toxin in animal and plant foods. Microbial toxins- toxin charact sorders associated with metabolism- lactose intolerance, favism					disea	se,
Unit - III	Toxicants Formed During Food Processing:						9
	nts, heavy metals, other organic residues and packaging n		or neated a	ana p		ea too	us, 1000
Unit - IV	d mutagens - Polycyclic aromatic hydrocarbons, N - nitrosamine Assessment of Toxicants in Food Sampling:	es, Acrylamide and	I their mode o	f action	on		9
Unit - IV Quantitative and assessment and		nination of toxical	nts. Assessm	ent c	of food		– Risk
Unit - IV Quantitative and assessment and toxicity, neurotox Unit - V	Assessment of Toxicants in Food Sampling: d qualitative analysis of toxicants in foods; Biological determed risk benefit indices of human exposure, acute toxicity, mutage xicity and behavioural effect, immunotoxicity. Instrumentation Techniques to Detect Toxins:	nination of toxical	nts. Assessm genicity, repro	ent c	of food ve and	devel	– Risk
Unit - IV Quantitative and assessment and toxicity, neurotox Unit - V Chromatography exchange chrom	Assessment of Toxicants in Food Sampling: d qualitative analysis of toxicants in foods; Biological deterned risk benefit indices of human exposure, acute toxicity, mutage xicity and behavioural effect, immunotoxicity.	mination of toxical enicity and carcino ography, Gas chroctrophotometry, Pri	nts. Assessm genicity, repro matography o	ent coducti	of food ve and	develo	— Risk opmental
Unit - IV Quantitative and assessment and toxicity, neurotox Unit - V Chromatography exchange chrom	Assessment of Toxicants in Food Sampling: d qualitative analysis of toxicants in foods; Biological determed risk benefit indices of human exposure, acute toxicity, mutage exicity and behavioural effect, immunotoxicity. Instrumentation Techniques to Detect Toxins: y, Principles, procedure and applications of Thin layer chromatomatography and High performance liquid chromatography. Speci	mination of toxical enicity and carcino ography, Gas chroctrophotometry, Pri	nts. Assessm genicity, repro matography o	ent coducti	of food ve and	develo	— Risk opmental 9 aphy, Ion olications
Unit - IV Quantitative and assessment and toxicity, neurotox Unit - V Chromatography exchange chrom of Atomic Absorption	Assessment of Toxicants in Food Sampling: d qualitative analysis of toxicants in foods; Biological determed risk benefit indices of human exposure, acute toxicity, mutage exicity and behavioural effect, immunotoxicity. Instrumentation Techniques to Detect Toxins: y, Principles, procedure and applications of Thin layer chromatomatography and High performance liquid chromatography. Speci	nination of toxical enicity and carcino ography, Gas chroptrophotometry, Prihotometry (AES).	nts. Assessm genicity, repro matography c inciples, Instru	ent coducti	of food ve and n chron tation a	develo	— Risk ppmenta 9 aphy, lor blications
Unit - IV Quantitative and assessment and toxicity, neurotox Unit - V Chromatography exchange chrom of Atomic Absorption TEXT BOOK: 1. Helferic	Assessment of Toxicants in Food Sampling: d qualitative analysis of toxicants in foods; Biological determed risk benefit indices of human exposure, acute toxicity, mutage xicity and behavioural effect, immunotoxicity. Instrumentation Techniques to Detect Toxins: y, Principles, procedure and applications of Thin layer chromatomatography and High performance liquid chromatography. Speciption Spectrophotometry (AAS) and Atomic Emission Spectrophotometry (AAS	nination of toxical enicity and carcino ography, Gas chroptrophotometry, Prihotometry (AES).	nts. Assessm genicity, repro matography c inciples, Instru	ent coducti	of food ve and n chron tation a	develo	— Risk ppmenta 9 aphy, lon blications
Unit - IV Quantitative and assessment and toxicity, neurotox Unit - V Chromatography exchange chrom of Atomic Absorption TEXT BOOK: 1. Helferic	Assessment of Toxicants in Food Sampling: d qualitative analysis of toxicants in foods; Biological determed risk benefit indices of human exposure, acute toxicity, mutage xicity and behavioural effect, immunotoxicity. Instrumentation Techniques to Detect Toxins: y, Principles, procedure and applications of Thin layer chromatomatography and High performance liquid chromatography. Speciption Spectrophotometry (AAS) and Atomic Emission Spectrophotometry (AAS	nination of toxical enicity and carcino ography, Gas chroptrophotometry, Prince (AES).	nts. Assessm genicity, repro matography o inciples, Instru	columiument	of food ve and n chron tation a	natogrand app	Risk ppmenta 9 aphy, lor blications
Unit - IV Quantitative and assessment and toxicity, neurotox Unit - V Chromatography exchange chrom of Atomic Absorption TEXT BOOK: 1. Helferic REFERENCES: 1. Labbe	Assessment of Toxicants in Food Sampling: d qualitative analysis of toxicants in foods; Biological determed risk benefit indices of human exposure, acute toxicity, mutage xicity and behavioural effect, immunotoxicity. Instrumentation Techniques to Detect Toxins: y, Principles, procedure and applications of Thin layer chromator anatography and High performance liquid chromatography. Speciption Spectrophotometry (AAS) and Atomic Emission Spectrophotometry (CAS) and Atomic Emission Spectrophotometry (CAS) and Carl K. Winter, "Food Toxicology", 1st Edition, Carl, William and Carl K. Winter, "Food Toxicology", 1st Edition, Carl, William and Carl K. Winter, "Food Toxicology", 1st Edition, Carl, William and Carl K. Winter, "Food Toxicology", 1st Edition, Carl, William and Carl K. Winter, "Food Toxicology", 1st Edition, Carl, William and Carl K. Winter, "Food Toxicology", 1st Edition, Carl, William and Carl K. Winter, "Food Toxicology", 1st Edition, Carl, William and Carl K. Winter, "Food Toxicology", 1st Edition, Carl, William and Carl K. Winter, "Food Toxicology", 1st Edition, Carl, William and Carl K. Winter, "Food Toxicology", 1st Edition, Carl, William and Carl K. Winter, "Food Toxicology", 1st Edition, Carl, William and Carl, William	mination of toxical enicity and carcino or c	nts. Assessm genicity, repro matography o inciples, Instru ork Washingt	columi columi ument	of food ve and n chron tation a	natogrand app	— Risk ppmenta 9 aphy, lor blications

	SE OUTCOMES: npletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	infer the concepts of food toxicology	Understanding (K2)
CO2	classify toxins, allergens and interpret its sensitivity in human food chain	Understanding (K2)
CO3	identify toxicants formed during food processing	Applying (K3)
CO4	identify the risks involved in human exposure to toxicants	Applying (K3)
CO5	select suitable method for detection of toxins	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2			2	1			1		1	1	3
CO2	3	2	2			3	1			1		3	1	3
CO3	3	2	3	2		3	2			1		3	1	3
CO4	3	2	3	2		3	2			1		3	1	3
CO5	3	2	3	2		1	1			1		3	1	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

		ACCECONIENT	· AllEini	III OIKI			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70					100
CAT2	20	60	20				100
CAT3	20	40	40				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22FTE07- MODERN SEPARATIO	N PROC	ESS				
Programm e & Branch	B.Tech &Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisit es	Food Process Engineering I , Food Process Engineering II	6	PE	3	0	0	3
Preamble	To learn about different separation techniques with its potential a	application.					
Unit - I	Mechanism of Separation and Filtration Processes:						9
special chara	nventional processes. Recent advances in separation techniques acteristics of substances. Process concept, theory and equipment er, Surface based solid — liquid separations involving a second liquid separations.	used in cr	oss flow filtration				
Unit - II	Membrane based separation technique (MBSTs):						9
membranes	chemical properties of membranes, Techniques of membrane and modules. Osmosis and osmotic pressure. Working principle , electrodialysis and pervaporation. Gaseous separation by memb	e, operatio	n and design	of revers	se osmo	osis, u	Itrafiltration
Unit - III	Adsorption and Chromatography:						9
	Mechanism, Types and choice of adsorbents, Adsorption technique phy: Theory, paper chromatography, TLC, GC, HPLC, Affinity and				e swing	cycles	S.
Unit - IV	Ionic Separation and Permeation:						9
	ctors, Applications, Types of equipment employed for electrophoss. Separations involving pervaporation and permeation techniques				ange chi	romato	graphy and
Unit - V	Other Separation Processes:						9
	, Adductive crystallization, Supercritical fluid extraction, Oil spill Meffluent treatment.	1anagemer	nt, Application	of mode	rn separ	ationte	echniques
							Total:4
TEXT BOOK	:						
1. Seader 2011.	J.D., Ernest J. Henley and Keith Roper D., "Separation Process F	Principles",	3rd Edition, Jo	hn Wiley	and Soi	ns Inc.	,New York,
REFERENCE	:S:						
1. Rousse	el Ronald W., "Handbook of Separation Process Technology", 1st E	Edition, Joh	n Wiley, New Y	ork, 200	8.		
	rey Jimmy L. and George E. Keller, "Separation Process Technologe 997.	gy", 1st E	dition, McGraw	-Hill Publ	ishingCo	ompan	y Ltd.,

	SE OUTCOMES: upletion of the course, the students will be able to	BT Mapped (Highest Level)
C O1	explain the concepts of separation and filtration techniques	Understanding (K2)
C O2	select suitable membrane process and cleaning techniques	Applying (K3)
C O3	classify and adapt appropriate adsorption and chromatography techniques	Understanding (K2)
C O4	apply the concepts of ionic separation and permeation	Applying (K3)
C O5	choose appropriate techniques for effluent treatment	Applying (K3)

COs/P os	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2			1	2			1		1	2	1
CO2	3	2	2		3	1	2			1		2	3	2
CO3	3	2	3		3	1	2			1		1	2	2
CO4	3	2	3		3	1	2			1		1	2	1
CO5	3	2	2			2	3			1		2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	60	20				100
CAT3	20	40	40				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 - 50 marks & ESE - 100 marks)

	22FTE08- BIOPROCESS ENGINEER	ING					
Programme & Branch	B.Tech &Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Food Microbiology, Food Process calculations, Food Process Engineering II	6	PE	3	0	0	3
Preamble	To provide the concepts of bioreactors, sterilization kinetics and productformation, rheological properties of fermented flu						
Unit - I	Introduction and Design of Novel Bioreactors:						9
bioreactors, Bubl	ess engineer, Kinetics of microbial growth, substrate utilization ar ole-column bioreactors, fluidized bed bioreactors, trickle bed biore ch, fed-batch and continuous fermentations- ideal reactors for kine	eactors,	airlift loop bio	reac	tors, pł	noto	or, fed-
Unit - II	Sterilization Kinetics and Monod chemostat model:						9
media, air steriliz	netics of microorganisms, batch and continuous heat sterilization ation and design of sterilization equipment - batch and continuo itors -substrate inhibition, product inhibition and inhibition by toxic	us. Kine	tic modeling				
Unit - III	Stoichiometry of Cell Growth and Product Formation:						9
	ces, degrees of reduction of substrate and biomass, available election, maintenance coefficients, energetic analysis of microbial gro					of bio	omass
Unit - IV	Rheology of fermentation fluids and Mass Transfer in Bio	-proces	sing operation	ons:			9
	Ion -Newtonian fluids, Aeration and agitation, power requirement xing. Types of Mass transfer. Heat transfer in Bio-processing ope		ed and unga	ssed	systen	ns, tin	ne
Unit - V	Bio Product Recovery Methods and Applications in Food	Industr	y:				9
	entation, centrifugation, precipitation, cell disruption, chromatograpuction, Citric Acid Production, HFCS Production, Baker Yeast Production		allization, lyo	philli	sation,	dryin	
							Total:4
TEXT BOOK:							
1. Michael India.201	_Shuler,Fikret Kargı, Matthew DeLisa, "Bioprocess Engineering E 8	Basic Co	ncepts", 3rd	Editio	n, Pre	ntice	Hall,
maia,20							
REFERENCES:							
REFERENCES:	. Doran, "Bioprocess Engineering Principles", 2nd Edition, Elsevie	r Science	e & Technolo	gy, Ir	dia, 20	12.	

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)						
CO1	O1 explain the kinetics of microbial growth and types of novel reactors Unders							
CO2	outline the concepts of sterilization kinetics and monod chemostat models	Understanding (K2)						
CO3	relate the principle of stochiometric concepts in cell growth and product formation	Understanding (K2)						
CO4	translate the concepts of rheology and heat mass transfer for the fermentation fluids	Understanding (K2)						
CO5	summarize the various bio product recovery methods and its application in food industries	Understanding (K2)						

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1					1		1	1	3
CO2	3	2	2	1	2					1		1	1	3
CO3	3	3	2	2	1					1		1	1	3
CO4	3	3	3	2	2					1		1	1	1
CO5	3	3	3	2	1					1		1	2	1

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	20	80					100
CAT3	20	80					100
ESE	20	80					100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks

		22FTE09- EMERGING TECHNOLOGIES IN FOOD	PROCE	ESSING				
Programn	me &	B.Tech &Food Technology	Sem.	Category	L	т	P	Credit
Branch Prerequis	sites	Food Process Engineering I, Food Process Engineering II	6	PE	3	0	0	3
Preamble)	To impart knowledge effectively in various novel methods of food processing and preservation	process	ing utilizing t	heir a	advar	tages f	for food
Unit - I		High Pressure Processing and Pulsed Electric Field:						9
on food q High Pres	quality. F ssure no	ocessing of Foods: High Pressure Processing-Principle - Descript ligh Pressure Regulations. Other applications of high pressure - In- ph-frozen storage. Application and limitations. Pulsed Electric Field stems - processing parameters. Applications. Safety aspects, Prob	High pres d Proces	ssure freezin ssing: Princip	g, Hi le -	igh P Mech	ressure	thawing
Unit - II		High Intensity Pulsed Light Technology and Cold Plasma:						9
products,	enzyme	ulsed Light Technology: Principles of Pulsed Light Technology, es and food properties. PLT systems. Irradiation of Foods. Cold Plion-effects-limitations and toxicology.						
Unit - III		Ultrasound and Ozonation:						9
		ng and homogenization, foam formation and destruction, precipita						
extraction Food appl Unit - IV	n. Ozona lications	ation: Solubility, stability and reactivity of ozone. Antimicrobial pro Ohmic and Di-electric Heating:	perties	of ozone. Oz	one	Treat	ment S	System.
extraction Food appl Unit - IV Ohmic He and Collii Dielectric baking, th	n. Ozona lications eating - near Oh heating nawing,	ation: Solubility, stability and reactivity of ozone. Antimicrobial pro	perties of the control of the contro	of ozone. Ozonfiguration, Teating: Dieleole. Microwa	rans	Sverse proproces	e Ohmi	9 c heating of foods.
extraction Food appl Unit - IV Ohmic He and Collii Dielectric baking, th	n. Ozona lications eating - near Oh heating nawing,	Ation: Solubility, stability and reactivity of ozone. Antimicrobial process. Ohmic and Di-electric Heating: Fundamentals, electrical conductivity. Generic Configurations -Bounic heating. Product suitability for thermal treatments. Di-electrical conductivity for the product suitability for the product suitab	perties of the control of the contro	of ozone. Ozonfiguration, Teating: Dieleole. Microwa	rans	Sverse proproces	e Ohmi	9 c heating of foods.
extraction Food appl Unit - IV Ohmic He and Collin Dielectric baking, th heating ar Unit - V Novel Hyl combined spouted by	eating - near Ohe heating hawing, nd drying brid Dry microw hed drying	Antimicrobial procession. Chmic and Di-electric Heating: Fundamentals, electrical conductivity. Generic Configurations -Bound heating. Product suitability for thermal treatments. Di-electrical difference between MW and RF. Microwave heating — workindrying, pasteurization and sterilization. Radio-frequency heating — grapplication. Limitations of Dielectric and RF heating.	eatch Co ctrical Hag princip material ems - Hadrying, p in tools	of ozone. Ozonfiguration, Teating: Diele ble. Microwa Il properties, eat pump dragges of automat	Fransectric ve pradop ying, ulatin	sverse proproces of luiding dry	e Ohmi perties sing of RF tec zed be zed be ring, ro	9 c heating of foods. f foods — hnology, 9 ed drying otating jet
extraction Food appl Unit - IV Ohmic He and Collin Dielectric baking, th heating ar Unit - V Novel Hyl combined spouted to	eating - near Or heating hawing, rbrid Dry d microw bed dryin	Ohmic and Di-electric Heating: Fundamentals, electrical conductivity. Generic Configurations -B mic heating. Product suitability for thermal treatments. Di-electric drying, pasteurization and sterilization. Radio-frequency heating — working application. Limitations of Dielectric and RF heating. Novel Hybrid Drying Technologies and Automation wing Technologies: Need for hybrid drying, superheated steam of the steam of the superheated steam o	eatch Co ctrical Hag princip material ems - Hadrying, p in tools	of ozone. Ozonfiguration, Teating: Diele ble. Microwa Il properties, eat pump dragges of automat	Fransectric ve pradop ying, ulatin	sverse proproces of luiding dry	e Ohmi perties sing of RF tec zed be zed be ring, ro	9 c heating of foods. f foods — hnology, 9 ed drying otating jet
extraction Food appl Unit - IV Ohmic He and Collin Dielectric baking, th heating ar Unit - V Novel Hyl combined spouted by	eating - near Or heating hawing, rbrid Dry d microw bed dryin	Ohmic and Di-electric Heating: Fundamentals, electrical conductivity. Generic Configurations -B mic heating. Product suitability for thermal treatments. Di-electric drying, pasteurization and sterilization. Radio-frequency heating — working application. Limitations of Dielectric and RF heating. Novel Hybrid Drying Technologies and Automation wing Technologies: Need for hybrid drying, superheated steam of the steam of the superheated steam o	eatch Co ctrical Hag princip material ems - Hadrying, p in tools	of ozone. Ozonfiguration, Teating: Diele ble. Microwa Il properties, eat pump dragges of automat	Fransectric ve pradop ying, ulatin	sverse proproces of luiding dry	e Ohmi perties sing of RF tec zed be zed be ring, ro	9 c heating of foods. foods — hnology, 9 ed drying, otating jet ressing —
extraction Food appl Unit - IV Ohmic He and Collin Dielectric baking, th heating ar Unit - V Novel Hyl combined spouted to Computer	eating - near Or heating hawing, horid Dry d microw bed dryin r vision s	Ohmic and Di-electric Heating: Fundamentals, electrical conductivity. Generic Configurations -B mic heating. Product suitability for thermal treatments. Di-electric drying, pasteurization and sterilization. Radio-frequency heating — working application. Limitations of Dielectric and RF heating. Novel Hybrid Drying Technologies and Automation wing Technologies: Need for hybrid drying, superheated steam of the steam of the superheated steam o	eatch Coctrical Higher princip material ems - Higher princip in tools in tools	of ozone. Ozonfiguration, Teating: Diele ble. Microwa Il properties, eat pump drugessure regis of automat tegrated Mar	Fransectric ve posed adoption in inuface	Treat Severse proproces proces fluid gg dry n focturing	e Ohminerties sing of RF tec	9 c heating of foods foods hhology, 9 ed drying tating jet tessing — Total:45
extraction Food appl Unit - IV Ohmic He and Collin Dielectric baking, th heating ar Unit - V Novel Hyl combined spouted to Computer TEXT BOO 1. D	eating - near Or he heating hawing, horid Dry d microw bed drying r vision s	Antimicrobial procession. Ohmic and Di-electric Heating: Fundamentals, electrical conductivity. Generic Configurations -Bound heating. Product suitability for thermal treatments. Di-electry, difference between MW and RF. Microwave heating — working drying, pasteurization and sterilization. Radio-frequency heating — grapplication. Limitations of Dielectric and RF heating. Novel Hybrid Drying Technologies and Automation wing Technologies: Need for hybrid drying systems. Hybrid systems and vacuum drying, infra-red drying, superheated steam of the systems of the systems. On-line sensors, Expert systems, Robot Technology, Communication in the systems of the systems of the systems.	eatch Coctrical Higher princip material ems - Higher princip in tools in tools	of ozone. Ozonfiguration, Teating: Diele ble. Microwa Il properties, eat pump drugessure regis of automat tegrated Mar	Fransectric ve posed adoption in inuface	Treat Severse proproces proces fluid gg dry n focturing	e Ohminerties sing of RF tec	9 c heating of foods foods hhology, 9 ed drying tating jet tessing — Total:45
extraction Food appl Unit - IV Ohmic He and Collin Dielectric baking, th heating ar Unit - V Novel Hyl combined spouted b Computer TEXT BOO 1. D REFEREN	eating - near Ohe heating hawing, drying bed drying r vision s	Antimicrobial procession. Ohmic and Di-electric Heating: Fundamentals, electrical conductivity. Generic Configurations -Bound heating. Product suitability for thermal treatments. Di-electry, difference between MW and RF. Microwave heating — working drying, pasteurization and sterilization. Radio-frequency heating — grapplication. Limitations of Dielectric and RF heating. Novel Hybrid Drying Technologies and Automation wing Technologies: Need for hybrid drying systems. Hybrid systems and vacuum drying, infra-red drying, superheated steam of the systems of the systems. On-line sensors, Expert systems, Robot Technology, Communication in the systems of the systems of the systems.	eatch Coetrical Heg principer material	of ozone. Ozonfiguration, Teating: Diele ble. Microwa Il properties, eat pump draressure regressure regressure degrated Mar	Franssectric ve pradop	Treat Sverse proproces fluid g dry n foce cturing	e Ohminerties sing of RF tec	9 c heating of foods f foods — hnology, 9 ed drying otating jetessing — Total:45
extraction Food appl Unit - IV Ohmic He and Collin Dielectric baking, th heating ar Unit - V Novel Hyl combined spouted th Computer TEXT BOO 1. D REFEREN 1. H	n. Ozona lications leating - near Oh c heating nawing, nd drying d microw bed drying r vision s OK: Oa-Wen S NCES: Han, Jun	Ohmic and Di-electric Heating: Fundamentals, electrical conductivity. Generic Configurations -Bound heating. Product suitability for thermal treatments. Di-electry, difference between MW and RF. Microwave heating — working pasteurization and sterilization. Radio-frequency heating — grapplication. Limitations of Dielectric and RF heating. Novel Hybrid Drying Technologies and Automation wing Technologies: Need for hybrid drying systems. Hybrid systems and vacuum drying, infra-red drying, superheated steam of the systems of the systems. On-line sensors, Expert systems, Robot Technology, Communication Technologies for Food Processing, 2nd Edition, Electrication.	ems - Hodrying, pin tools	of ozone. Ozonfiguration, Teating: Diele ble. Microwa Il properties, eat pump draressure regressure regressure degrated Mar	Franssectric ve pradop	Treat Sverse proproces fluid g dry n foce cturing	e Ohminerties sing of RF tec	9 c heating of foods. f foods — hnology, 9 ed drying, otating jet ressing — Total:45

high pressure processing and pulsed electrical field for food processing.	
light pressure processing and pulsed electrical field for food processing.	Applying (K3)
ht technology and irradiation for food processing and preservation	Applying (K3)
ozone techniques for food processing	Applying (K3)
tric heating principles in food processing	Applying (K3)
chniques and adapt automation in food processing	Applying (K3)
c	opht technology and irradiation for food processing and preservation ozone techniques for food processing otric heating principles in food processing echniques and adapt automation in food processing

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	3	2				1		2
CO2	3	3	2	1	3	2				1		2
CO3	3	3	2	1	3	2				1		2
CO4	3	3	2	1	3	2				1		2
CO5	3	3	2	1	3	1				1		3

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3)	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Programme & Branch	B.Tech & Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	6	PE	3	0	0	3
Preamble	To provide an idea about the plantation crop & spices material quality.	s and their processing	with special ir	ngred	ients	as flavo	ouring
Unit - I	Plantation Crops:						9
Cocoa liquor, coco of tuber crops – ta Jnit - II Spices and Condin	ured tea. Grading of Tea. Coffee– Occurrence, Manufa pa powder manufacturing. Coconut– Processing and by p pioca. Processing of potatoes-processed potato products Spices and Condiments: ments: Description of various types of spices and condiment major spices and their health benefits. Importance in culina	oroducts. Cashew nut	and Oil palm	Proce	essing	. Proce	ssing 9
Unit - III		711					•
	Processing of spices:						9
Solid Products. Sp	processing of spices: ces – Pepper, Chilli, Turmeric, Cardamom, Cinnamon, Clopice Oils–Concept and importance. Extraction methods-Secation of oleoresins. Importance of Cryogenic grinding of spices.	olvent extraction, Stea					ucts and
Solid Products. Sp Quality and Applic	ces – Pepper, Chilli, Turmeric, Cardamom, Cinnamon, Clopice Oils–Concept and importance. Extraction methods-Se	olvent extraction, Stea					ucts and
Solid Products. Sp Quality and Applic Unit – IV Herbs & Flavourin	ces – Pepper, Chilli, Turmeric, Cardamom, Cinnamon, Clopice Oils–Concept and importance. Extraction methods-Scation of oleoresins. Importance of Cryogenic grinding of s	olvent extraction, Stea pices , Cilantro, Dill, Coriano	m distillation.	Oleoi	esins	- Extra	ucts and ction,
Solid Products. Sp Quality and Applic Unit – IV Herbs & Flavourin leaves, Safflower.	ces – Pepper, Chilli, Turmeric, Cardamom, Cinnamon, Clopice Oils–Concept and importance. Extraction methods-Secation of oleoresins. Importance of Cryogenic grinding of secation of Secation of Secation of Secation of Sec	olvent extraction, Stea pices , Cilantro, Dill, Coriano	m distillation.	Oleoi	esins	- Extra	ucts and ction,
Solid Products. Sp Quality and Applic Unit – IV Herbs & Flavourin leaves, Safflower. Unit - V Flavouring materi spices, gas sterili	ces – Pepper, Chilli, Turmeric, Cardamom, Cinnamon, Clopice Oils–Concept and importance. Extraction methods-Scation of oleoresins. Importance of Cryogenic grinding of spation of Scation of Oleoresins. Importance of Cryogenic grinding of spations of Scation of Oleoresins. Importance of Cryogenic grinding of spations of Scation of Oleoresing and Scation of Oleonesia of Scation of Oleonesia of Scation of Oleonesia of Ole	olvent extraction, Stea pices , Cilantro, Dill, Coriand harvest handling.	der, Mint, Ore	gano	, Bora	- Extra	yme,Bilva
Solid Products. Sp Quality and Applic Unit – IV Herbs & Flavourin leaves, Safflower. Unit - V Flavouring materi spices, gas sterili	ces – Pepper, Chilli, Turmeric, Cardamom, Cinnamon, Clopice Oils–Concept and importance. Extraction methods-Secution of oleoresins. Importance of Cryogenic grinding of secution of various types of herbs. Basil, Nutritive value and health benefits. Processing and post-Filorous materials of natural origin: Flavouring materials of natural origin: ials of natural origin: Natural flavours, sources of natural origin of spices, gamma irradiation, heat treatment.	olvent extraction, Stea pices , Cilantro, Dill, Coriand harvest handling.	der, Mint, Ore	gano	, Bora	- Extra	yme,Bilva
Solid Products. Sp Quality and Applica Unit – IV Herbs & Flavourin leaves, Safflower. Unit - V Flavouring materi spices, gas sterili	ces – Pepper, Chilli, Turmeric, Cardamom, Cinnamon, Clopice Oils–Concept and importance. Extraction methods-Secution of oleoresins. Importance of Cryogenic grinding of secution of various types of herbs. Basil, Nutritive value and health benefits. Processing and post-Filorous materials of natural origin: Flavouring materials of natural origin: ials of natural origin: Natural flavours, sources of natural origin of spices, gamma irradiation, heat treatment.	olvent extraction, Stea pices , Cilantro, Dill, Coriand harvest handling.	der, Mint, Ore	gano	, Bora	- Extra	yme,Bilva 9 biology on the recent r
Solid Products. Sp Quality and Applic Unit – IV Herbs & Flavourin leaves, Safflower. Unit - V Flavouring materi spices, gas sterili trends, Seasoning	ces – Pepper, Chilli, Turmeric, Cardamom, Cinnamon, Clopice Oils–Concept and importance. Extraction methods-Section of oleoresins. Importance of Cryogenic grinding of spation of oleoresins. Importance of Cryogenic grinding of spations. Herbs & Flavouring materials: In g materials: Description of various types of herbs. Basil, Nutritive value and health benefits. Processing and post-fractions of natural origin: Flavouring materials of natural origin: ials of natural origin: Natural flavours, sources of naturization of spices, gamma irradiation, heat treatment. Engineering blend duplication and tricks.	olvent extraction, Stea pices , Cilantro, Dill, Coriand harvest handling. ural flavouring materia Encapsulation of spice	der, Mint, Ore	gano and s urs -	pices met	- Extra	yme,Bilva 9 biology ond recent
Solid Products. Sp Quality and Applic Unit – IV Herbs & Flavourin leaves, Safflower. Unit - V Flavouring materi spices, gas sterili trends, Seasoning TEXT BOOK: 1. Kumar N. NewDelhi	ces – Pepper, Chilli, Turmeric, Cardamom, Cinnamon, Clopice Oils–Concept and importance. Extraction methods-Section of oleoresins. Importance of Cryogenic grinding of spation of oleoresins. Importance of Cryogenic grinding of spations. Herbs & Flavouring materials: In g materials: Description of various types of herbs. Basil, Nutritive value and health benefits. Processing and post-fractions of natural origin: Flavouring materials of natural origin: ials of natural origin: Natural flavours, sources of naturization of spices, gamma irradiation, heat treatment. Engineering blend duplication and tricks.	olvent extraction, Stea pices , Cilantro, Dill, Coriand harvest handling. ural flavouring materia Encapsulation of spice	der, Mint, Ore	gano and s urs -	pices met	- Extra	yme,Bilva 9 biology cond recer
Solid Products. Sp Quality and Applic Unit – IV Herbs & Flavourin leaves, Safflower. Unit - V Flavouring materi spices, gas sterili trends, Seasoning TEXT BOOK: 1. Kumar N. NewDelhi, REFERENCES: Panda H.	ces – Pepper, Chilli, Turmeric, Cardamom, Cinnamon, Clopice Oils–Concept and importance. Extraction methods-Section of oleoresins. Importance of Cryogenic grinding of spation of oleoresins. Importance of Cryogenic grinding of spations. Herbs & Flavouring materials: In g materials: Description of various types of herbs. Basil, Nutritive value and health benefits. Processing and post-fractions of natural origin: Flavouring materials of natural origin: ials of natural origin: Natural flavours, sources of naturization of spices, gamma irradiation, heat treatment. Engineering blend duplication and tricks.	olvent extraction, Stead pices , Cilantro, Dill, Coriancharvest handling. ural flavouring material encapsulation of spice	der, Mint, Ore als — Herbs are based flavor	gano nnd s urs -	pices met	- Extra	yme,Bilva 9 biology ond recent
Solid Products. Sp Quality and Applic Unit – IV Herbs & Flavourin leaves, Safflower. Unit - V Flavouring materi spices, gas sterili trends, Seasoning TEXT BOOK: 1. Kumar N. NewDelhi, REFERENCES: 1. Panda H. Industrial	ces – Pepper, Chilli, Turmeric, Cardamom, Cinnamon, Clopice Oils–Concept and importance. Extraction methods-Section of oleoresins. Importance of Cryogenic grinding of spation of oleoresins. Importance of Cryogenic grinding of spations. Herbs & Flavouring materials: In g materials: Description of various types of herbs. Basil, Nutritive value and health benefits. Processing and post-from the processing materials of natural origin: In a section of spices, gamma irradiation, heat treatment. Engine blend duplication and tricks. In a section of spices, gamma irradiation, heat treatment. Engine blend duplication and tricks. In a section of spices, gamma irradiation, heat treatment. Engine blend duplication and tricks.	olvent extraction, Stead pices , Cilantro, Dill, Coriand harvest handling. ural flavouring material encapsulation of spice and aromatic plants", it is a spice and aromatic plants and essing and extraction)	der, Mint, Ore als — Herbs are based flavor	gano nnd s urs -	pices met	- Extra	yme,Bilva 9 biology ond recei Total:45

	SE OUTCOMES: npletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	demonstrate the processing stages involved in plantation processing	Understanding(K2)
CO2	utilize functional properties of spices and herbs in product development	Applying(K3)
CO3	select processing steps required for spices processing	Applying(K3)
CO4	choose processing steps required for herbs processing	Applying(K3)
CO5	identify suitable flavouring materials for food processing	Applying(K3)

					М	apping	of COs w	ith POs	and PS	Os				
COs/P Os	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			1	1			1		1	2	2
CO2	3	2	3			2	1	1		1		1	2	2
CO3	3	2	2			1	1	1		1		1	2	2
CO4	3	2	3			2	1	1		1		1	2	2
CO5	3	2	2			2	2	1		1		2	3	2
CO6	3	2	1			1	1			1		1	2	2

^{1 –} Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category *	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	50	30				100
CAT3	20	30	30				100
ESE	20	50	30				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Programme & Branch	B.Tech & Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Food chemistry	7	PE	3	0	0	3
Preamble	To learn about enzymes and their application in p	processing and developmen	t of food prod	ucts.			
Unit - I	Enzyme kinetics and Production of industrial	enzymes:					9
	Enzyme-Classification and Nomenclature, Units of A Plots / Km and Vmax. Production of industrial enzyme formulation.						
Unit - II	Enzymes in milk processing and brewing indu	ustry:					9
	Milk clotting enzymes, Lactoperoxidase, Cheese-ripe, Brewhouse processing, Enzyme applications and the				ransglu	utamir	nase.
Unit - III	Enzymes in non alcoholic beverage:						9
	alcoholic beverage: Application of enzymes in tea and	cocoa processing. Role of	the enzymes	in frui	it iuice	nrodu	ction
factors affecting t	he enzymatic activity. Enzymatic clarification of apple						
Unit - IV	Enzymes in baking industry:	and guava juices, factors at	fecting the cla	arifica	tion of	ruit ju	ices.
Unit - IV Enzymes in baking degrading enzyme		and guava juices, factors at	fecting the cla	arifica bakin	tion of t	ruit ju stry, S	g Starch
Unit - IV Enzymes in baking degrading enzyme	Enzymes in baking industry: ng industry: Enzymes for baking industry, Use of the	and guava juices, factors at	fecting the cla	arifica bakin	tion of t	ruit ju stry, S	g Starch
Unit - IV Enzymes in baking degrading enzymapplication. Unit - V Enzymes in meat	Enzymes in baking industry: ng industry: Enzymes for baking industry, Use of the nes: sources, analysis and application of starch degra	and guava juices, factors at e proteinases, lipases and ding enzymes. Hemicellula	pentosans in se, xylanases	bakin :: sou	ig industres, a	stry, S	g Starch s and
Unit - IV Enzymes in baking degrading enzymapplication. Unit - V Enzymes in meat	Enzymes in baking industry: Ing industry: Enzymes for baking industry, Use of the les: sources, analysis and application of starch degrae Enzymes in meat processing: It processing: Enzymes used for meat processing: protein	and guava juices, factors at e proteinases, lipases and ding enzymes. Hemicellula	pentosans in se, xylanases	bakin :: sou	ig industres, a	stry, S	g Starch s and 9 nzyme.
Unit - IV Enzymes in baking degrading enzymapplication. Unit - V Enzymes in meat Meat tenderization	Enzymes in baking industry: Ing industry: Enzymes for baking industry, Use of the les: sources, analysis and application of starch degrae Enzymes in meat processing: It processing: Enzymes used for meat processing: protein	and guava juices, factors at e proteinases, lipases and ding enzymes. Hemicellula	pentosans in se, xylanases	bakin :: sou	ig industres, a	stry, S	g Starch s and 9 nzyme.
Unit - IV Enzymes in baking degrading enzymapplication. Unit - V Enzymes in meat Meat tenderization TEXT BOOK:	Enzymes in baking industry: Ing industry: Enzymes for baking industry, Use of the les: sources, analysis and application of starch degrae Enzymes in meat processing: It processing: Enzymes used for meat processing: protein	and guava juices, factors at a proteinases, lipases and ding enzymes. Hemicellula rease and peptidase, lipases ir in meat products, Restruc	pentosans in se, xylanases s, trans glutar turing of unhe	bakin s: sou ninas eat me	ng industries, a	stry, S nalysi	g Starch s and 9 nzyme.
Unit - IV Enzymes in baking degrading enzymapplication. Unit - V Enzymes in meat Meat tenderization TEXT BOOK: 1. Robert	Enzymes in baking industry: Ing industry: Enzymes for baking industry, Use of the les: sources, analysis and application of starch degrated in the less in meat processing: Enzymes in meat processing: It processing: Enzymes used for meat processing: protein with added enzyme, Enzymatic generation of flavour	and guava juices, factors at a proteinases, lipases and ding enzymes. Hemicellula rease and peptidase, lipases ir in meat products, Restruc	pentosans in se, xylanases s, trans glutar turing of unhe	bakin s: sou ninas eat me	ng industries, a	stry, S nalysi	g Starch s and
Unit - IV Enzymes in baking degrading enzymapplication. Unit - V Enzymes in meat Meat tenderization TEXT BOOK: 1. Robert C REFERENCES:	Enzymes in baking industry: Ing industry: Enzymes for baking industry, Use of the les: sources, analysis and application of starch degrated in the less in meat processing: Enzymes in meat processing: It processing: Enzymes used for meat processing: protein with added enzyme, Enzymatic generation of flavour	e proteinases, lipases and ding enzymes. Hemicellula ease and peptidase, lipases ir in meat products, Restruct	pentosans in se, xylanases s, trans glutar turing of unhe	bakin :: sou ninaseat me	ig industrices, a e, oxidate eat.	stry, S nalysi	g Starch s and 9 nzyme.

	SE OUTCOMES: opletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	infer the enzyme kinetics and production of industrial enzymes	Understanding (K2)
CO2	select suitable enzymes for milk processing and brewing	Applying (K3)
СОЗ	choose appropriate enzymes for non alcoholic beverage production	Applying (K3)
CO4	apply and relate the effect of enzymes in baking process	Applying (K3)
CO5	make use of enzymes in processing of meat and meat products	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1		1				1		2	2	1
CO2	3	2	3	1		1				1		2	3	2
CO3	3	2	3	1		1				1		2	3	2
CO4	3	2	3	1		1				1		2	3	2
CO5	3	2	3	1		1				1		2	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

* $\pm 3\%$ may be varied (CAT 1 & 2 – 60 marks & ESE – 100 marks)

	22FTE12 - DAIRY PRODUCTS TECHNO	LOGY					
Programme & Branch	B.Tech & Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Dairy Technology	7	PE	3	0	0	3
		-					
Preamble	To explore the technology of variety of products and by-product	ts develo	ped from mill	۲.			
Unit - I	Coagulated Milk Products and Fermented Milk Products:						9
Types ofcheese, I Yoghurt Productio Milk.	Products: Definitions, Classification, Paneer: Types of paneer, Basic operations in Cheese Production. Fermented Milk Production resignificance of each processing steps; Dahi: Types of dahi, I	cts: Defir	nitions; Class	sificat	tion; Y	'oghu	rt: Types, red Butter
Unit - II	Traditional dairy products:						9
Product Description	aditional dairy products, Khoa: Definition, varieties and standards on, Method of Preparation, Quality; Peda: Product Description, od of Preparation, Quality; Shrikhand: Product Description, Metho	Method	of Preparation	n, Q			
Unit - III	Condensed Milk and Dried Milk:						9
Condensed Milk, N Dried Milk: Definiti	Definition, Classification, Legal Standards for Evaporated and Con Manufacture of Evaporated Milk. on, Classification, Legal Standards for dried milks, Manufacture of the of Instant Dried Milks.						
Unit - IV	Fat Rich Dairy Products:						9
	ethods of cream separation, Processing of cream, Consumer countlines of butter making, Continuous Butter Making; Methods of					d clas	ssification
Unit - V	Frozen dairy products and Dairy By-products:						9
ice creammanufac	lucts: Definition, Classification, Composition of Ice cream, Otherure, Dried ice cream mix: Composition, Technology, Uses: Definition, Types; Caseinates: Composition, Process of manucture.				_		-
TEXT BOOK:							
1. Sukumar [De, "Outlines of Dairy Technology", 46 th edition Edition, Oxford Un	iversity F	Press, New D	elhi,	2019.		
REFERENCES/ M	ANUAL / SOFTWARE:						
1. Edgar Spr	eer, "Milk and Dairy Product Technology", CRC Press 2017.						
2. Pieter Wal	stra, Jan T. M. Wouters, Tom J. Geurts, "Dairy Science and Tech	nology",	Taylor & Fra	ncis,	UK, 2	006.	

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	explain the technology of coagulated milk products and fermented milk products	Understanding (K2)
CO2	explain the production of different traditional dairy products	Understanding (K2)
CO3	outline the technology of condensed milk and dried milk	Understanding (K2)
CO4	outline the technology of fat-rich dairy products	Understanding (K2)
CO5	summarize the manufacturing process of frozen dairy products and dairy by-products	Understanding (K2)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2		1					1		1	2	1
CO2	3	2	2	2	2					1		1	2	2
CO3	3	2	2	2	2					1		1	3	2
CO4	3	2	2		2					1		1	3	2
CO5	3	2	1		1					1		1	3	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

			—	•			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	20	80					100
CAT3	20	80					100
ESE	20	80					100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22FTE13-TECHNOLOGY OF FATS A	ND OILS					
Programme &Branch	B.Tech & Food Technology	Sem.	Category	L	т	Р	Credit
Prerequisites	Food Chemistry	7	PE	3	0	0	3
Preamble	To provide insight of the basic chemistry, properties and processi	ing of fats and oils	<u> </u>				
Unit - I	Properties of Oils and Fats:						9
color, odour, co	ls and Fats: Oils and fats — sources, composition. Nutritional importance nsistency, melting point, flash point, smoke point, solid fat index an ponification value, free fatty acids, peroxide value.						
Unit - II	Vegetable Oil and Animal Fat Production:						9
Processing- pea	nd Animal Fat Production: Industrial production of oils- seed handling anut oil, rice bran oil, sunflower oil, coconut oil and Palm oil. Pret pressing, Equipments- Filter press, hydraulic press. Production of many press.	oduction of cod	liver oil. Me				
Unit - III	Solvent Extraction and Refining of Oils:						9
O 1	and Defining of Oiles Only on the standing and an and disease and					rom n	niccolla
	on and Refining of Oils: Solvent extraction — prepress and direct ext sidue. Physical and Chemical Refining: Degumming - types, Neutraliz						
andextracted res							
andextracted results in the second of the se	sidue. Physical and Chemical Refining: Degumming - types, Neutraliz	zation, dewaxing/ tion. Modified Fat s, Non edible fat/ o	winterization, I products: sproil products.	eads,	hing, mayo	deodo	orizing. 9 e.
andextracted resolunit - IV Modification of C Shortenings in b Design and App - Applications Unit - V	Modification of Oils and Modified Fat Products: Dils: Methods- Fractionation, Blending, Hydrogenation, Interesterification of Fat-Based Surfactants: Introduction to Surface and Interface Frying and Storage of Oil:	tion, dewaxing/ tion. Modified Fat s, Non edible fat/ o cial Activity - Emu	winterization, l products: sprobil products. Ision Formation	eads,	mayo	onnais and	orizing. 9 e. Stabilizatio
andextracted res Unit - IV Modification of C Shortenings in b Design and App – Applications Unit - V Frying and Stor	Modification of Oils and Modified Fat Products: Modification of Oils and Modified Fat Products: Dils: Methods- Fractionation, Blending, Hydrogenation, Interesterificate takery products and confectionery lipids. Fat substitutes and its types lication of Fat-Based Surfactants: Introduction to Surface and Interface	tion. Modified Fat s, Non edible fat/ c cial Activity - Emu	products: sprobil products. Ision Formatic	eads,	mayo thods	onnais and s	orizing. 9 e. Stabilization 9 oil.
andextracted res Unit - IV Modification of C Shortenings in b Design and App – Applications Unit - V Frying and Stor	Modification of Oils and Modified Fat Products: Dils: Methods- Fractionation, Blending, Hydrogenation, Interesterificat pakery products and confectionery lipids. Fat substitutes and its types lication of Fat-Based Surfactants: Introduction to Surface and Interface Frying and Storage of Oil: age of Oil: Changes during storage of oil. Role of fat or oil in fryin	tion. Modified Fat s, Non edible fat/ c cial Activity - Emu	products: sprobil products. Ision Formatic	eads,	mayo thods	onnais and s	orizing. 9 e. Stabilizatio
andextracted resolution of Control Shortenings in being and App Applications Unit - V Frying and Stor Rancidity - atmost	Modification of Oils and Modified Fat Products: Dils: Methods- Fractionation, Blending, Hydrogenation, Interesterificat pakery products and confectionery lipids. Fat substitutes and its types lication of Fat-Based Surfactants: Introduction to Surface and Interface Frying and Storage of Oil: age of Oil: Changes during storage of oil. Role of fat or oil in fryin	tion. Modified Fat s, Non edible fat/ cial Activity - Emu	winterization, In products: sproducts: sproducts. Ision Formation ying oil. Appli Packaging of	eads, on me cation oils a	mayo thods	onnais and s	orizing. 9 e. Stabilization 9 oil.
andextracted resolution of Control Shortenings in being and App Applications Unit - V Frying and Stor Rancidity - atmost	Modification of Oils and Modified Fat Products: Dils: Methods- Fractionation, Blending, Hydrogenation, Interesterificate to takery products and confectionery lipids. Fat substitutes and its types lication of Fat-Based Surfactants: Introduction to Surface and Interface Frying and Storage of Oil: age of Oil: Changes during storage of oil. Role of fat or oil in frying spheric oxidation and enzyme action, Prevention of rancidity. Quality on Shahidi, "Bailey's Industrial Oil and Fat Products", 6th Edition, Wiley	tion. Modified Fat s, Non edible fat/ cial Activity - Emu	winterization, In products: sproducts: sproducts. Ision Formation ying oil. Appli Packaging of	eads, on me cation oils a	mayo thods	onnais and s	orizing. 9 e. Stabilization 9 oil.
andextracted resolution of Control Shortenings in being and App Applications Unit - V Frying and Stor Rancidity - atmost	Modification of Oils and Modified Fat Products: Dils: Methods- Fractionation, Blending, Hydrogenation, Interesterificate to takery products and confectionery lipids. Fat substitutes and its types lication of Fat-Based Surfactants: Introduction to Surface and Interface Frying and Storage of Oil: age of Oil: Changes during storage of oil. Role of fat or oil in frying spheric oxidation and enzyme action, Prevention of rancidity. Quality on Shahidi, "Bailey's Industrial Oil and Fat Products", 6th Edition, Wiley	tion. Modified Fat s, Non edible fat/ ocial Activity - Emu ag. Selection of fr r standards of oil,	products: sprobil products. Ision Formation ying oil. Appli Packaging of ew Jersey, 20	eads, eads, on me cation oils a	mayo thods ns of nd fat	onnais and s frying s.	orizing. 9 e. Stabilization 9 oil.
andextracted resolution of Control Shortenings in being and App-Applications Unit - V Frying and Stor Rancidity - atmost	Modification of Oils and Modified Fat Products: Modification of Oils and Modified Fat Products: Dils: Methods- Fractionation, Blending, Hydrogenation, Interesterificate takery products and confectionery lipids. Fat substitutes and its types lication of Fat-Based Surfactants: Introduction to Surface and Interface Frying and Storage of Oil: age of Oil: Changes during storage of oil. Role of fat or oil in fryin spheric oxidation and enzyme action, Prevention of rancidity. Quality a Shahidi, "Bailey's Industrial Oil and Fat Products", 6th Edition, Wiley	tion. Modified Fat s, Non edible fat/ ocial Activity - Emu g. Selection of fr y standards of oil, y - Interscience, N	products: sprobil products. Ision Formatic ying oil. Appli Packaging of ew Jersey, 20	eads, eads, on me cation oils a	mayo thods ns of nd fat	onnais and s frying s.	orizing. 9 e. Stabilization 9 oil.

	RSE OUTCOMES: ompletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	interpret the physical and chemical properties of fats and oils	Understanding (K2)
CO2	recommend suitable mechanical methods for oil extraction	Applying (K3)
CO3	apply solvent extraction and refining techniques to improve the quality of oil	Applying (K3)
CO4	develop modified fat/ oil products	Applying (K3)
CO5	identify the changes occurred during frying and storage of fats/oils	Applying (K3)

COs/PO	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	2		1				1			1	1
CO2	3	2	2		3					1		2	3	2
CO3	3	2	2		3	1				1		2	3	2
CO4	3	2	3		3	1				1		2	3	2
CO5	3	2	2		1	1				1		2	3	3

^{1 -} Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

			INEURI				
Test / Bloom's Category*	Rememberi ng(K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6)	Total %
CAT1	20	60	20				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Programme & Branch B. Tech & Food Technology Branch NIL T P Prerequisites NIL T P Preamble To impart knowledge on Laplace transformation for first and second order system, controllers, computer based automation and instrumentation in process industries. Unit - I Laplace transformation, application. Open-loop systems, first order systems and their transient response for standard input functinearization and its application in process control. Unit - II Second Order System: Second order systems - Interacting system and non-interacting system, manometer, damped oscillator, dynamic response of secorder systems, Closed loop control systems, development of block diagram for feed-back control systems, servo and regulatorprocupits. Controllers - Proportional, Proportional Integral, Proportional Derivative and Proportional Derivative (PID). Dynamic befredback controlled processes. Effect of proportional, Integral, Proportional and controlled processes. Stability for linear systems, Routh stability criterion and its limitations. Introduction to control system designeducery, Bode diagram Unit - IV Automation: Unit - V Process Instruments: Principles of measurements - Static and dynamic response of instruments, Temperature measurements - Expansion Thermoulded system thermometers, thermocouple, optical prometers, pressure measurements - Manometers, bogauge and bellows gauge, pressure measurement by vacuum Mccleod guage, Piraniguage. Level measurement - sight glas indicator, float and tape liquid level gauge. FEXT BOOK: 1. Vyas, R.P., "Process Control and Instrumentation", 8th Edition, Dennet & Co, India, 2015 REFERENCES: 1. Stephanopoulos, S.G., "Chemical Process Control: An Introduction to Theory and Practice", 1st Edition, Prentice Hall of I New Delhi, 2013. Donald R. Cough anowr and Steven E. LeBlanc, "Process Systems Analysis and Control", 3rd Edition, Tata McGraw Hill Company Ltd., New Delhi, 2013.		22FTE14 - PROCESS INSTRUMENTA	TION AND CONTRO	OL				
Preamble To impart knowledge on Laplace transformation for first and second order system, controllers, computer based automation and instrumentation in process industries. Laplace Transform and First Order System: Laplace transformation, application. Open-loop systems, first order systems and their transient response for standard input functinearization and its application in process control. Unit - II Second Order System: Second order systems - Interacting system and non-interacting system, manometer, damped oscillator, dynamic response of storder system, Closed loop control systems, development of block diagram for feed-back control systems, servo and regulatorprocure system, Closed loop control systems, development of block diagram for feed-back control systems, servo and regulatorprocure systems, Closed loop control all Integral, Proportional Derivative and Proportional Integral Derivative (PID). Dynamic before the deback controlled processes. Effect of proportional, Integral, Derivative and Composite control actions on the response of controlled processes. Stiffect of proportional, Integral, Derivative and composite control actions on the response of controlled processes. Stability for linear systems, Routh stability criterion and its limitations. Introduction to control system designate of the stability of the system of the stability criterion and its limitations. Introduction to control system designate of SCADA, Sensors and its classification. Control components of SCADA, Sensors and its classification. Unit - V Process Intruments: Process Intruments: Process Control and Instrumentation of SCADA, Comparison of SCADA with DCS, comparison of PLC with Application and advantages of SCADA, Sensors and its classification. Unit - V Process Intruments: 1. Vyas, R.P., "Process Control and Instrumentation", 8th Edition, Dennet & Co, India, 2015 REFERENCES: 1. Stephanopoulos, S.G., "Chemical Process Control: An Introduction to Theory and Practice", 1st Edition, Prentice Hall of Instrumentation of t		B.Tech & Food Technology	Sem.	Category	L	Т	Р	Credi
based automation and instrumentation in process industries. Unit - I Laplace Transform and First Order System: Laplace transformation, application. Open-loop systems, first order systems and their transient response for standard input func Linearization and its application in process control. Unit - II Second Order System: Second order systems - Interacting system and non-interacting system, manometer, damped oscillator, dynamic response of storder system, Closed loop control systems, development of block diagram for feed-back control systems, servo and regulatorprofunit - III Controllers, Dynamic Response and its Stability: Controllers - Proportional, Proportional Integral, Proportional Derivative and Proportional Integral Derivative (PID). Dynamic befeedback controlled processes. Effect of proportional, Integral, Derivative and composite control actions on the response of controlled processes. Stability for linear systems, Routh stability criterion and its limitations. Introduction to control system designate of the system of SCADA, working of SCADA, comparison of SCADA with DCS, comparison of PLC with Application and advantages of SCADA, working of SCADA, comparison of SCADA with DCS, comparison of PLC with Application and advantages of SCADA, Sensors and its classification. Unit - V Process Instruments: Principles of measurements - Static and dynamic response of instruments, Temperature measurements - Expansion Thermofilled system thermometers, thermocouple, optical pyrometers, radiation pyrometers. Pressure measurements - Manometers, borgauge and bellows gauge, pressure measurement by vacuum Mccleod guage, Piraniguage. Level measurement - sight glas indicator, float and tape liquid level gauge. TEXT BOOK: 1. Vyas, R.P. "Process Control and Instrumentation", 8th Edition, Dennet & Co, India, 2015 Stephanopoulos, S.G., "Chemical Process Control: An Introduction to Theory and Practice", 1st Edition, Prentice Hall of Insection and the process of the process of the process of the process of the	rerequisites	NIL	7	PE	3	0	0	3
Laplace transformation, application. Open-loop systems, first order systems and their transient response for standard input functional transition and its application in process control. Unit - II Second Order System: Second order systems - Interacting system and non-interacting system, manometer, damped oscillator, dynamic response of seorder system, Closed loop control systems, development of block diagram for feed-back control systems, servo and regulatorpro Unit - III Controllers, Dynamic Response and its Stability: Controllers - Proportional, Proportional Integral, Proportional Derivative and Proportional Integral Derivative (PID). Dynamic befreedback controlled processes. Effect of proportional, Integral, Derivative and composite control actions on the response of controlled processes. Stability for linear systems, Routh stability criterion and its limitations. Introduction to control system designation. Unit - IV Automation: Control components of SCADA, working of SCADA, comparison of SCADA with DCS, comparison of PLC with Application and advantages of SCADA, Sensors and its classification. Unit - V Process Instruments: Principles of measurements - Static and dynamic response of instruments, Temperature measurements - Expansion Thermon figuage and bellows gauge, pressure measurement by vacuum Mccleod guage, Piraniguage. Level measurement - sight glas indicator, float and tape liquid level gauge. TEXT BOOK: 1. Vyas, R.P., "Process Control and Instrumentation", 8th Edition, Dennet & Co, India, 2015 Stephanopoulos, S.G., "Chemical Process Control: An Introduction to Theory and Practice", 1st Edition, Prentice Hall of New Delhi, 2011. Donald R. Cough anowr and Steven E. LeBlanc, "Process Systems Analysis and Control", 3rd Edition, Tata McGraw Hill	reamble	, ,	•	stem, control	lers,	com	outer	
Unit - II Second Order System: Second order systems - Interacting system and non-interacting system, manometer, damped oscillator, dynamic response of seconder system, Closed loop control systems, development of block diagram for feed-back control systems, servo and regulatorprofesser, Closed loop control systems, development of block diagram for feed-back control systems, servo and regulatorprofesser, Closed loop control systems, development of block diagram for feed-back control systems, servo and regulatorprofesser, Closed loop control systems, Response and its Stability: Controllers - Proportional, Proportional Integral, Proportional Derivative and Proportional Integral Derivative (PID). Dynamic befeedback controlled processes. Effect of proportional, Integral, Derivative and composite control actions on the response of controlled processes. Stability for linear systems, Routh stability criterion and its limitations. Introduction to control system designed frequency, Bode diagram Unit - IV Automation: Control components of SCADA, working of SCADA, comparison of SCADA with DCS, comparison of PLC with Application and advantages of SCADA, Sensors and its classification. Unit - V Process Instruments: Principles of measurements - Static and dynamic response of instruments, Temperature measurements - Expansion Thermofilled system thermometers, thermocouple, optical pyrometers, radiation pyrometers. Pressure measurements - Manometers, bogauge and bellows gauge, pressure measurement by vacuum. – Mccleod guage, Piraniguage. Level measurement – sight glas indicator, float and tape liquid level gauge. TEXT BOOK: 1. Vyas, R.P., "Process Control and Instrumentation", 8th Edition, Dennet & Co, India, 2015 REFERENCES: 1. Stephanopoulos, S.G., "Chemical Process Control: An Introduction to Theory and Practice", 1st Edition, Prentice Hall of I New Delhi, 2011. Donald R. Cough anowr and Steven E. LeBlanc, "Process Systems Analysis and Control", 3rd Edition, Tata McGraw Hill	Init - I	Laplace Transform and First Order System:						9
Second order systems - Interacting system and non-interacting system, manometer, damped oscillator, dynamic response of so order system, Closed loop control systems, development of block diagram for feed-back control systems, servo and regulatorpro Unit - III Controllers, Dynamic Response and its Stability: Controllers - Proportional, Proportional Integral, Proportional Derivative and Proportional Integral Derivative (PID). Dynamic befredback controlled processes. Effect of proportional, Integral, Derivative and composite control actions on the response of controlled processes. Stability for linear systems, Routh stability criterion and its limitations. Introduction to control system designed the control components of SCADA, working of SCADA, comparison of SCADA with DCS, comparison of PLC with Application and advantages of SCADA, Sensors and its classification. Unit - V Process Instruments: Principles of measurements - Static and dynamic response of instruments, Temperature measurements - Expansion Thermore filled system thermometers, thermocouple, optical pyrometers, radiation pyrometers. Pressure measurements - Manometers, borgauge and bellows gauge, pressure measurement by vacuum Mccleod guage, Piraniguage. Level measurement - sight glas indicator, float and tape liquid level gauge. TEXT BOOK: 1. Vyas, R.P., "Process Control and Instrumentation", 8th Edition, Dennet & Co, India, 2015 REFERENCES: 2. Stephanopoulos, S.G., "Chemical Process Control: An Introduction to Theory and Practice", 1st Edition, Prentice Hall of I New Delhi, 2011. Donald R. Cough anowr and Steven E. LeBlanc, "Process Systems Analysis and Control", 3rd Edition, Tata McGraw Hill			and their transient res	sponse for sta	ındar	d inp	ut func	ctions,
Unit - III Controllers, Dynamic Response and its Stability: Controllers - Proportional, Proportional Integral, Proportional Derivative and Proportional Integral Derivative (PID). Dynamic befeedback controlled processes. Effect of proportional, Integral, Derivative and composite control actions on the response of controlled processes. Stability for linear systems, Routh stability criterion and its limitations. Introduction to control system designed frequency, Bode diagram Unit - IV Automation: Control components of SCADA, working of SCADA, comparison of SCADA with DCS, comparison of PLC with Application and advantages of SCADA, Sensors and its classification. Unit - V Process Instruments: Principles of measurements - Static and dynamic response of instruments, Temperature measurements - Expansion Thermofilled system thermometers, thermocouple, optical pyrometers, radiation pyrometers. Pressure measurement - Manometers, borgauge and bellows gauge, pressure measurement by vacuum Mccleod guage, Piraniguage. Level measurement - sight glass indicator, float and tape liquid level gauge. TEXT BOOK: 1. Vyas, R.P., "Process Control and Instrumentation", 8th Edition, Dennet & Co, India, 2015 REFERENCES: 2. Stephanopoulos, S.G., "Chemical Process Control: An Introduction to Theory and Practice", 1st Edition, Prentice Hall of Instrumental Response of the Process System Sanalysis and Control", 3rd Edition, Tata McGraw Hill Donald R. Cough anowr and Steven E. LeBlanc, "Process Systems Analysis and Control", 3rd Edition, Tata McGraw Hill	Init - II	Second Order System:						9
Controllers - Proportional, Proportional Integral, Proportional Derivative and Proportional Integral Derivative (PID). Dynamic befeedback controlled processes. Effect of proportional, Integral, Derivative and composite control actions on the response of controlled processes. Stability for linear systems, Routh stability criterion and its limitations. Introduction to control system designed requency, Bode diagram Unit - IV Automation: Control components of SCADA, working of SCADA, comparison of SCADA with DCS, comparison of PLC with Application and advantages of SCADA, Sensors and its classification. Unit - V Process Instruments: Principles of measurements - Static and dynamic response of instruments, Temperature measurements - Expansion Thermore filled system thermometers, thermocouple, optical pyrometers, radiation pyrometers. Pressure measurements - Manometers, bog gauge and bellows gauge, pressure measurement by vacuum Mccleod guage, Piraniguage. Level measurement - sight glass indicator, float and tape liquid level gauge. TEXT BOOK: 1. Vyas, R.P, "Process Control and Instrumentation", 8th Edition, Dennet & Co, India, 2015 REFERENCES: 3. Stephanopoulos, S.G., "Chemical Process Control: An Introduction to Theory and Practice", 1st Edition, Prentice Hall of International Representation of the Process Systems Analysis and Control", 3rd Edition, Tata McGraw Hill Donald R. Cough anowr and Steven E. LeBlanc, "Process Systems Analysis and Control", 3rd Edition, Tata McGraw Hill								
feedback controlled processes. Effect of proportional, Integral, Derivative and composite control actions on the response of controlled processes. Stability for linear systems, Routh stability criterion and its limitations. Introduction to control system designed frequency, Bode diagram Unit - IV Automation: Control components of SCADA, working of SCADA, comparison of SCADA with DCS, comparison of PLC with Application and advantages of SCADA, Sensors and its classification. Unit - V Process Instruments: Principles of measurements - Static and dynamic response of instruments, Temperature measurements - Expansion Thermor filled system thermometers, thermocouple, optical pyrometers, radiation pyrometers. Pressure measurements - Manometers, bogauge and bellows gauge, pressure measurement by vacuum Mccleod guage, Piraniguage. Level measurement - sight glas indicator, float and tape liquid level gauge. TEXT BOOK: 1. Vyas, R.P, "Process Control and Instrumentation", 8th Edition, Dennet & Co, India, 2015 REFERENCES: 1. Stephanopoulos, S.G., "Chemical Process Control: An Introduction to Theory and Practice", 1st Edition, Prentice Hall of Integral New Delhi, 2011. Donald R. Cough anowr and Steven E. LeBlanc, "Process Systems Analysis and Control", 3rd Edition, Tata McGraw Hill	Init - III	Controllers, Dynamic Response and its Stability:						9
Application and advantages of SCADA, Sensors and its classification. Unit - V	equency, Bode	diagram	nd its limitations. Introd	duction to cor	ntrol s	syste	m desi	gn by
Principles of measurements - Static and dynamic response of instruments, Temperature measurements - Expansion Thermofilled system thermometers, thermocouple, optical pyrometers, radiation pyrometers. Pressure measurements - Manometers, borgauge and bellows gauge, pressure measurement by vacuum Mccleod guage, Piraniguage. Level measurement - sight glass indicator, float and tape liquid level gauge. TEXT BOOK: 1. Vyas, R.P, "Process Control and Instrumentation", 8th Edition, Dennet & Co, India, 2015 REFERENCES: 1. Stephanopoulos, S.G., "Chemical Process Control: An Introduction to Theory and Practice", 1st Edition, Prentice Hall of I New Delhi, 2011. Donald R. Cough anowr and Steven E. LeBlanc, "Process Systems Analysis and Control", 3rd Edition, Tata McGraw Hill			son of SCADA with D	CS, comparis	son c	of PL	C with	RTU,
filled system thermometers, thermocouple, optical pyrometers, radiation pyrometers. Pressure measurements - Manometers, borgauge and bellows gauge, pressure measurement by vacuum. – Mccleod guage, Piraniguage. Level measurement – sight glas indicator, float and tape liquid level gauge. TEXT BOOK: 1. Vyas, R.P, "Process Control and Instrumentation", 8th Edition, Dennet & Co, India, 2015 REFERENCES: 1. Stephanopoulos, S.G., "Chemical Process Control: An Introduction to Theory and Practice", 1st Edition, Prentice Hall of I New Delhi, 2011. Donald R. Cough anowr and Steven E. LeBlanc, "Process Systems Analysis and Control", 3rd Edition, Tata McGraw Hill	Init - V	Process Instruments:						9
TEXT BOOK: 1. Vyas, R.P, "Process Control and Instrumentation", 8th Edition, Dennet & Co, India, 2015 REFERENCES: 1. Stephanopoulos, S.G., "Chemical Process Control: An Introduction to Theory and Practice", 1st Edition, Prentice Hall of I New Delhi, 2011. Donald R. Cough anowr and Steven E. LeBlanc, "Process Systems Analysis and Control", 3rd Edition, Tata McGraw Hill	lled system then auge and bellow	mometers, thermocouple, optical pyrometers, radiation pyros gauge, pressure measurement by vacuum. – Mccleod g	ometers. Pressure me	asurements -	Man	omet	ers, bo	urdon
1. Vyas, R.P, "Process Control and Instrumentation", 8th Edition, Dennet & Co, India, 2015 REFERENCES: 1. Stephanopoulos, S.G., "Chemical Process Control: An Introduction to Theory and Practice", 1st Edition, Prentice Hall of I New Delhi, 2011. Donald R. Cough anowr and Steven E. LeBlanc, "Process Systems Analysis and Control", 3rd Edition, Tata McGraw Hill								Total:4
REFERENCES: 1. Stephanopoulos, S.G., "Chemical Process Control: An Introduction to Theory and Practice", 1st Edition, Prentice Hall of I New Delhi, 2011. Donald R. Cough anowr and Steven E. LeBlanc, "Process Systems Analysis and Control", 3rd Edition, Tata McGraw Hill	EXT BOOK:							
Stephanopoulos, S.G., "Chemical Process Control: An Introduction to Theory and Practice", 1st Edition, Prentice Hall of I New Delhi, 2011. Donald R. Cough anowr and Steven E. LeBlanc, "Process Systems Analysis and Control", 3rd Edition, Tata McGraw Hill	. Vyas, R.F	P, "Process Control and Instrumentation", 8th Edition, Denn	net & Co, India, 2015					
New Delhi, 2011. Donald R. Cough anowr and Steven E. LeBlanc, "Process Systems Analysis and Control", 3rd Edition, Tata McGraw Hill								
			to Theory and Practice	", 1st Edition,	Pren	itice I	Hall of	India,
			Analysis and Control"	3rd Edition,	Tata	McG	raw Hil	I

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	make use of Laplace transformation for first order systems	Applying (K3)
CO2	apply Laplace Transformation for second order systems and determine its dynamic behavior	Applying (K3)
CO3	Make use of concepts of feedback controller and determine its dynamic response and stability	Applying (K3)
CO4	summarize the concept of computer based controls in automation	Understanding (K2)
CO5	select temperature, pressure and level measuring instruments	Applying (K3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
COs/POs														
CO1	3	2	2	2	2					1		1	1	2
CO2	3	2	2	2	2					1		1	1	2
CO3	3	2	2	2	2					1		1	1	3
CO4	3	2	1	2	3					1		2	1	2
CO5	3	2	2	1	1					1		1	1	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	40	40				100
CAT3	20	60	20				100
ESE	20	40	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Programme & Branch												
Prerequisites	Heat transfer operations, Mass transfer in food processing operations	7	PE	3	0	0	3					
Preamble	To impart knowledge about application of computational	fluid dynamics	in various field	ds of foo	od proce	essing.						
Unit - I	Introduction to CFD:				•		9					
	CFD: Theory of CFD modeling - Conservation of mass, M fication of simple PDEs and fluid flow equations	lomentum Eq	uation, Energy	/ Equat	ion, Na	vier St	okes					
Unit - II	Turbulence and Modeling:						9					
	Modeling: Transition from laminar to turbulent flow, Effect of simple turbulent flows - Free turbulence models, turbulent f						ations,					
Unit - III	The Finite Volume Method for Diffusion Problems:						9					
The Finite Volundimensional diffuscheme, higher	ne Method for Diffusion Problems: Introduction - One dimenusions. The central differencing scheme, The upwind difference order differencing schemes.	•					oower- lav					
The Finite Volundimensional diffuscheme, higher of Unit - IV CFD software pa	ne Method for Diffusion Problems: Introduction - One dimenusions. The central differencing scheme, The upwind difference	cing scheme,	the hybrid diffe	erencing	schements s in Foo	e, the pod Proc	9 essing,					
The Finite Volundimensional diffuscheme, higher of Unit - IV CFD software pa	ne Method for Diffusion Problems: Introduction - One dimensions. The central differencing scheme, The upwind difference order differencing schemes. CFD Analysis: ackages and tools, CFD analysis — Preprocessing, solving ar	cing scheme,	the hybrid diffe	erencing	schements s in Foo	e, the pod Proc	9 essing,					
The Finite Volundimensional diffuscheme, higher of Unit - IV CFD software paspray Drying-Air Unit - V Applications of C	ne Method for Diffusion Problems: Introduction - One dimensions. The central differencing scheme, The upwind difference order differencing schemes. CFD Analysis: ackages and tools, CFD analysis — Preprocessing, solving are Flow Pattern, Atomization, air-particle interaction, Residence	nd post procese time of the pa	sing, CFD Apparticle, Modelin	erencing Dication g in Bre	s in Focead Baki	e, the pod Proc	essing, cess					
The Finite Volundimensional diffuscheme, higher of Unit - IV CFD software paspray Drying-Air Unit - V Applications of C	ne Method for Diffusion Problems: Introduction - One dimensions. The central differencing scheme, The upwind difference order differencing schemes. CFD Analysis: ackages and tools, CFD analysis — Preprocessing, solving are Flow Pattern, Atomization, air-particle interaction, Residence Applications of CFD: CFD: Canning of foods, Canned solid liquid food mixtures, Bar	nd post procese time of the pa	sing, CFD Apparticle, Modelin	erencing Dication g in Bre	s in Focead Baki	e, the pod Proc	essing, cess					
The Finite Volundimensional diffuscheme, higher of Unit - IV CFD software paspray Drying-Air Unit - V Applications of Coduring sterilizations TEXT BOOK:	ne Method for Diffusion Problems: Introduction - One dimensions. The central differencing scheme, The upwind difference order differencing schemes. CFD Analysis: ackages and tools, CFD analysis — Preprocessing, solving are Flow Pattern, Atomization, air-particle interaction, Residence Applications of CFD: CFD: Canning of foods, Canned solid liquid food mixtures, Baron, Thermal processing of canned foods, Other applications in	nd post proces time of the pa	sing, CFD Apparticle, Modelination kinetics, sing.	erencing olication g in Bre analysis	s in Focead Baki	od Procing Prod	essing, cess 9 attern Total:4					
The Finite Volundimensional diffuscheme, higher of Unit - IV CFD software paspray Drying-Air Unit - V Applications of Coduring sterilization TEXT BOOK: Anandh	ne Method for Diffusion Problems: Introduction - One dimensions. The central differencing scheme, The upwind difference order differencing schemes. CFD Analysis: ackages and tools, CFD analysis — Preprocessing, solving are Flow Pattern, Atomization, air-particle interaction, Residence Applications of CFD: CFD: Canning of foods, Canned solid liquid food mixtures, Bar	nd post proces time of the pa	sing, CFD Apparticle, Modelination kinetics, sing.	erencing olication g in Bre analysis	s in Focead Baki	od Procing Prod	essing, cess 9 attern Total:4					
The Finite Volundimensional diffuscheme, higher of Unit - IV CFD software paspray Drying-Air Unit - V Applications of Coduring sterilization TEXT BOOK: 1. Anandh Media,	ne Method for Diffusion Problems: Introduction - One dimensions. The central differencing scheme, The upwind difference order differencing schemes. CFD Analysis: ackages and tools, CFD analysis — Preprocessing, solving are Flow Pattern, Atomization, air-particle interaction, Residence Applications of CFD: CFD: Canning of foods, Canned solid liquid food mixtures, Bacton, Thermal processing of canned foods, Other applications in the processing of canned foods, Other applications in the processing of canned Fluid Dynamics Applications in the processing of the processing of canned Fluid Dynamics Applications in the processing of the proc	nd post proces time of the pa	sing, CFD Apparticle, Modelination kinetics, sing.	erencing olication g in Bre analysis	s in Focead Baki	od Procing Prod	essing, cess 9 attern Total:4					
The Finite Volundimensional diffuscheme, higher of Unit - IV CFD software paspray Drying-Air Unit - V Applications of Coduring sterilization TEXT BOOK: 1. Anandh Media, REFERENCES: Verstee	ne Method for Diffusion Problems: Introduction - One dimensions. The central differencing scheme, The upwind difference order differencing schemes. CFD Analysis: ackages and tools, CFD analysis — Preprocessing, solving are Flow Pattern, Atomization, air-particle interaction, Residence Applications of CFD: CFD: Canning of foods, Canned solid liquid food mixtures, Bacton, Thermal processing of canned foods, Other applications in the processing of canned foods, Other applications in the processing of canned Fluid Dynamics Applications in the processing of the processing of canned Fluid Dynamics Applications in the processing of the proc	nd post procese time of the particle food process	sing, CFD Apparticle, Modelination kinetics, sing.	erencing Dication g in Bre analysis	s in Focead Bakins of fluid	e, the pod Procing Procing Proceeding Proceeding Proceeding Proceeding Procedure Proce	essing, cess 9 attern Total:4					

	SE OUTCOMES: npletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	explain the equations involved in CFD modelling	Understanding (K2)
CO2	apply the turbulence model in fluid flow operations	Applying (K3)
CO3	make use of finite volume method for developing solution of steady state diffusionprocesses	Applying (K3)
CO4	infer the application of CFD in spray drying and bread baking processes	Analyzing (K4)
CO5	interpret the various applications of CFD in food processing	Evaluating (K5)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1		2							1		1
CO2	3	2	1	3	3							1		1
CO3	3	2	1	3	3							1		1
CO4	3	3	2	3	3							2	3	
CO5	3	3	3	3	3							2	3	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

						*	
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	40	40				100
CAT3	10	10	30	30	20		100
ESE	10	20	30	30	10		100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22FTE16- ENERGY MANAGEMENT IN P	ROCESS INDUS	TRIES				
Programme & Branch	B.Tech & Food Technology	Sem.	Category	L	т	Р	Credit
Prerequisites	Heat transfer operations	7	PE	3	0	0	3
Preamble	To provide the knowledge on energy management, aud	dit and conservation	in many syst	ems.			
Unit - I	Energy Basics:						9
Temperature & P transfer. Global Protocol, Confered Development.	Load management and Maximum demand control, Power ressure, Heat capacity, Sensible and Latent heat, Evapora Environmental Concerns: United Nations Framewonce of Parties (COP), Clean Development Mechanism (COP)	ation, Condensation ork Convention or	n, Steam, Moi n Climate C	st air Chang	and l	Humic JNFC	dity & He C), Kyo ole
Unit - II	Energy Management and audits:						9
for preparing Prod Investment- need	y audit- need, Types of energy audit. Material and Enercess flow, Material and energy balance diagrams. Energy I, Appraisal and criteria, Financial analysis techniques-Simble of return; Cash flows, Risk and sensitivity analysis.	Monitoring and Tar	geting. Finan	cial N	lanaç	jemen	nt:
Unit - III	Energy conservation in Electrical Systems and Con	npressed air syste	m:				9
and its benefit. E and motor replac	al System: Electricity billing, Electrical load management lectric motors: Types, Losses in induction motors, Motor element issues, Energy saving opportunities with energy. Tration, Compressed air system components, Capacit efficiency. Energy conservation in Thermal systems and Wastern	efficiency, Factors a Types of air compre ty assessment, Le	affecting moto essors, Comp	r per	forma or effi	ance, i	Rewindir /, efficien
	Combustion in boilers, Performances evaluation, Analys		water treat	nont	Dlov	, dow	
conservation opp trapping, Conder	nortunities. Steam System: Properties of steam, Assessm nsate and flash steam recovery system, Identifying opp commercially viable waste heat recovery devices, saving p	nent of steam distrib portunities for energ	oution losses	Stea	am le	ak-ag	es, Stear
Unit - V	Energy conservation in Food Process Industries:						9
Processing -ener conservation in E	- Potential Energy Conservation measures in pasteurizating flow in canned products, energy conservation measures aking and confectionery units. Thermo chemical Convertication and liquefaction.	es in blanching, pas	steurization, s	teriliz	ation	. Ene	rgy
							Total:4
TEXT BOOK:							Total:4
	ive, "Energy: Management Supply and Conservation", 2 nd r	revised Edition, Rou	ıtledge, 2015.				Total:

Lijun Wang, "Energy Efficiency and Management in Food Processing Facilities", Taylor and Francis Group, 2019

1.

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	summarize the energy sources and energy consumption	Understanding(K2)
CO2	plan and perform energy audits and survey	Applying (K3)
CO3	identify energy conservation opportunities in electrical systems and compressed air system	Applying (K3)
CO4	select energy conservation measures in thermal systems	Applying(K3)
CO5	apply energy conservation practices in food industries	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2			1	2			1		1	1	
CO2	3	2	2			1	2			1		1	1	
CO3	3	2	3			1	2			1		1	1	2
CO4	3	1	3			1	2			1		1	1	2
CO5	3		3			1	2			1		1	1	2

^{1 –} Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	40	40				100
CAT3	20	60	20				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22FTE17- TECHNOLOGY OF CERE SEEDS	EALS, PULSES ANI	OOIL				
Programme &Branch	B.Tech & Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	7	PE	3	0	0	3
Preamble	To learn the techniques involved in milling of various cerea	als, pulses, and oil see	ds along with	the rece	nt adva	ancen	nents
Unit - I	Grain Properties:						9
wheat, maize, bagged storag	es: Grains - Definition. Importance. Physical properties of gr millet, oat, sorghum. Anti-nutritional factors and its meth- ge, bulk storage, hermetic storage, outdoor storage. Losses of ods. Integrated stored grain pest management	ods of reduction. Gra	in storage sy	/stems	- farm	level	storage
Unit - II	Milling of Paddy:						9
parboiling, E dehusker,und type and abra	ddy: Rice milling flow sheet. Cleaning. Parboiling- tradition ffect of parboiling on rice quality. Husking- Methods lerrunner disc huller, rubber roll Sheller. Separation – indesive type whiteners. Color sorter. New quality control instrum	s of husking, Huske ented tray and compar	ers/Shellers tment type se	impa	ct typ	e, c	entrifuga – friction
Unit - III	Milling of Wheat:				A / 1 / 1	, , ,	9
 wheat blend specification, 	at: Types of wheat. Wheat milling – Simple and detailed flow ling, tempering or conditioning, Chakki milling, Roller milling Sifting – Plan sifters, Purifying - purifier. Milling performance nhancement of flour appearance, Improvement of functional	 break rolls and redee evaluation. Functions 	uction rolls, o _l	peration f flour. F	and co	orruga	ation
Unit - IV	Processing of Corn, Millet and Sorghum:						9
starch and glu	Corn: Types of corn. Dry milling – Tempering, dehulling, deten separation, starch refinement. By products from corn mill essing - cleaning, decortication, milling and classification, dry	ling. Millet and Sorghu	m Processing	: Types	oing, G of mille	erm, ets.Sc	fiber, orghum
Unit - V	Milling of Pulses and Oil Seeds:						9
treatment, dr Equipments.	ses: Legumes – Structure, Types, Nutritional and Anti-nurying, dehusking – TADD, CIAE design, Schule design Milling - Dry and wet milling, Modern milling. Dehulling Mechanical extraction – Hydraulic press, Screw press, Filter and Hot Pressing. Solvent extraction, Factors influencial extraction.	n, CFTRI design, Hu efficiency.Milling of er press. Mechanical	usk separatio Oil Seeds: T extraction of	on and ypes of coconut	gradin Oil se oil and	ng, S _l eds. d palr	plitting - Oil seed m oil.
Cold pressing							Total:4
Cold pressing							Total:4

Kulp K. & Pont J.G, "Handbook of Cereal Science and Technology", 2nd Edition, Marcel Dekker Inc, New York, 2000.

Sahay K.M. & Singh K. K, "Unit Operations of Agricultural Processing", 2nd Edition, Vikas Publishing House Pvt. Ltd, New Delhi,

1.

2.

2012.

	RSE OUTCOMES: ompletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	outline grain properties and storage structures	Understanding(K2)
CO2	select suitable parboiling and milling methods for paddy	Applying (K3)
CO3	identify appropriate techniques for wheat milling and its enrichment	Applying (K3)
CO4	summarize the process involved in corn, sorghum and millet processing	Understanding(K2)
CO5	choose suitable technologies for processing of pulses and oil seeds	Applying (K3)

COs/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1		1	1			1		1	3	2
CO2	3	3	2	1		1	1			1		2	3	3
CO3	3	3	2	1		1	1			1		2	3	3
CO4	3	3	2	1		1	1			1		2	3	3
CO5	3	3	2	1		1	1			1		2	3	3

^{1 -} Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Rememberi ng(K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	2 0	60	20				100
CAT2	2	40	40				100
CAT3	2	60	20				100
ESE	2	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Programme & Branch	B.Tech & Food Technology	Sem.	Category	L	Т	Р	Credi
Prerequisites	Food Chemistry, Food Microbiology, Food Process Engineering I	7	PE	3	0	0	3
Preamble	To educate the students about processing, preservation, pand egg and also ensuring quality	product developm	ent from mea	at, fis	h, po	oultry n	neat
Unit - I	Meat Processing:						9
nspection and gr meat- curing, dryi Unit - II	nd its sources, composition, structure of meat. Ante mortem rading of meat. Post-mortem changes of meat. Meat - tenderizing. Processed meat products - hamburgers, sausages and me Fish Processing: mposition and nutritive value of fish. Harvesting of fish. Sp	zation, aging. Me eat balls.	eat quality eva	aluat	ion. I	Preserv	vation o
	n - freezing and individual quick freezing. Canning and smoking						
	Poultry Processing:	cessing Pre-slau	ighter factors	affe	ectino	ı noul	9 try mea
Types and chara quality. Factors at techniques: chem	acteristics of poultry products. Unit operation in poultry proc affecting the shelf-life of poultry meat. Sensory quality of po- nical treatments, heating-microwave & IR, freeze drying and irr	oultry meat- colo					try mea
Types and chara quality. Factors a techniques: chem	acteristics of poultry products. Unit operation in poultry producting the shelf-life of poultry meat. Sensory quality of ponical treatments, heating-microwave & IR, freeze drying and irr Egg Processing:	oultry meat- colo radiation.	ur, texture a	nd fl	avou	r. Pres	try measervation
Types and chara quality. Factors a techniques: chem Unit - IV Structure, compo	acteristics of poultry products. Unit operation in poultry proc affecting the shelf-life of poultry meat. Sensory quality of po- nical treatments, heating-microwave & IR, freeze drying and irr	cultry meat- colo radiation. Factors affecting	ur, texture a	nd fl	avou	r. Pres	try measervation
Types and chara quality. Factors a techniques: chem Unit - IV Structure, compoundity. Preservat	acteristics of poultry products. Unit operation in poultry producting the shelf-life of poultry meat. Sensory quality of ponical treatments, heating-microwave & IR, freeze drying and irrespondent to the state of egg. Functional properties of eggs, position, nutritive value of egg. Functional properties of eggs,	cultry meat- colo radiation. Factors affecting	ur, texture a	nd fl	avou	r. Pres	try measervation
Types and chara quality. Factors a techniques: chem Unit - IV Structure, compo quality. Preservat Unit - V Modern abbatoirs	acteristics of poultry products. Unit operation in poultry products affecting the shelf-life of poultry meat. Sensory quality of policial treatments, heating-microwave & IR, freeze drying and irregg Processing: Distribution, nutritive value of egg. Functional properties of eggs, tion of egg by different methods. Egg powder processing-spray	Factors affecting drying, foam ma	ur, texture a g egg quality t drying.	nd fl	avou	r. Pres	try measervation 9 of egg
Types and chara quality. Factors a techniques: chem Unit - IV Structure, compo quality. Preservat Unit - V Modern abbatoirs	acteristics of poultry products. Unit operation in poultry products affecting the shelf-life of poultry meat. Sensory quality of ponical treatments, heating-microwave & IR, freeze drying and irresponding to the state of Egg Processing: Egg Processing: Distriction, nutritive value of egg. Functional properties of eggs, tion of egg by different methods. Egg powder processing-spray Hygiene and Sanitation: Hygiene and Sanitation: Seq. 12. S	Factors affecting drying, foam ma	ur, texture a g egg quality t drying.	nd fl	avou	asures	try measervation 9 of egg
Types and chara quality. Factors a techniques: chem Unit - IV Structure, compo quality. Preservat Unit - V Modern abbatoirs sanitation in mean	acteristics of poultry products. Unit operation in poultry products affecting the shelf-life of poultry meat. Sensory quality of ponical treatments, heating-microwave & IR, freeze drying and irresponding to the state of Egg Processing: Egg Processing: Distriction, nutritive value of egg. Functional properties of eggs, tion of egg by different methods. Egg powder processing-spray Hygiene and Sanitation: Hygiene and Sanitation: Seq. 12. S	Factors affecting drying, foam ma	ur, texture a g egg quality t drying.	nd fl	avou	asures	servation 9 of egg 9 and
Types and chara quality. Factors a techniques: chem Unit - IV Structure, compoundable, Preservate Unit - V Modern abbatoirs sanitation in mean	acteristics of poultry products. Unit operation in poultry products affecting the shelf-life of poultry meat. Sensory quality of ponical treatments, heating-microwave & IR, freeze drying and irresponding to the state of Egg Processing: Egg Processing: Distriction, nutritive value of egg. Functional properties of eggs, tion of egg by different methods. Egg powder processing-spray Hygiene and Sanitation: Hygiene and Sanitation: Seq. 12. S	Factors affecting drying, foam manner of tools and neat industries.	g egg quality t drying.	nd fl	avou	asures	try measervatio 9 of egg 9 and
Types and chara quality. Factors a techniques: chem Unit - IV Structure, compoundable, Preservat Unit - V Modern abbatoirs sanitation in mean	acteristics of poultry products. Unit operation in poultry products affecting the shelf-life of poultry meat. Sensory quality of ponical treatments, heating-microwave & IR, freeze drying and irregg Processing: Desition, nutritive value of egg. Functional properties of eggs, tion of egg by different methods. Egg powder processing-spray Hygiene and Sanitation: Standard S	Factors affecting drying, foam manner of tools and neat industries.	g egg quality t drying.	nd fl	avou	asures	servatio 9 of egg and
Types and chara quality. Factors a techniques: chem Unit - IV Structure, compoundable preservate Unit - V Modern abbatoirs sanitation in mean TEXT BOOK: 1. Warriss F REFERENCES:	acteristics of poultry products. Unit operation in poultry products affecting the shelf-life of poultry meat. Sensory quality of ponical treatments, heating-microwave & IR, freeze drying and irregg Processing: Desition, nutritive value of egg. Functional properties of eggs, tion of egg by different methods. Egg powder processing-spray Hygiene and Sanitation: Standard S	Factors affecting drying, foam manner of tools and neat industries.	g egg quality t drying.	nd fl	avou	asures	try measervatio 9 of egg 9 and
quality. Factors at techniques: chem Unit - IV Structure, comporting quality. Preservate Unit - V Modern abbatoirs sanitation in mean TEXT BOOK: 1. Warriss F REFERENCES: 1. Hui Y. H.	acteristics of poultry products. Unit operation in poultry products affecting the shelf-life of poultry meat. Sensory quality of ponical treatments, heating-microwave & IR, freeze drying and irregg Processing: Desition, nutritive value of egg. Functional properties of eggs, tion of egg by different methods. Egg powder processing-spray Hygiene and Sanitation: By salughter house and its features. Handling and maintenant plants. Food safety measures — GMP, GHP and HACCP in measures. Food safety measures — GMP, GHP and Edition, CABI P.D., "Meat Science: An Introductory Text", 2nd Edition, CABI P.D., "Meat Science:	Factors affecting drying, foam manner of tools and neat industries. Publications, UK, 2	g egg quality t drying. d core equip	nd fl	avou	asures	y of egg and

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	outline the handling and processing of meat	Understanding (K2)
CO2	make use of fish processing and preservation techniques	Applying (K3)
СОЗ	apply suitable processing techniques for poultry products development	Applying (K3)
CO4	make use of appropriate techniques for egg preservation	Applying (K3)
CO5	Select suitable hygiene and sanitation procedures for meat industry	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2			1				1		1	3	2
CO2	3	3	2			1				1		1	3	2
CO3	3	3	2			1				1		1	3	2
CO4	3	3	2			1				1		1	3	2
CO5	3	3	2			2				1		1	3	2

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	40	30				100
CAT3	20	60	20				100
ESE	20	50	30				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22FTE19 - TRADITIONAL F	FOODS					
Programme & Branch	B.Tech &Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	7	PE	3	0	0	3
Preamble	To learn about the popular indigenous foods of India and	other countries	and also impro	ovisatio	n of su	ch foo	
in health foods.	Introduction about Traditional Foods finitions of traditional foods, History of Indian Foods, Traditio Role of traditional foods in meeting macro and micronutrien of traditional foods. List of traditional foods of India and ar	nts, role in dietar	y patterns. Tr	adition	al food	s vers	us Junk
Unit - II	Grain Based Traditional Foods						9
Kinema, Tarhan	al and legume based foods - Idli, Dosa, Dhokla, Selroti, Sez, I a, Hawaijar, Ogi, Kenkey, Pozol, Injera, Kisera. Traditional r, sake, Koozhu, Bouza, Chicha, Mahewu, Boza, Kunu-zaki.	I millet based for					
Unit - III	Fruits, Vegetables, Dairy, Meat and fish based Tradition	onal Foods					9
	nented or Pickled cucumber, Kimchi, Traditional cassava for Gari. Traditional Dairy Foods: Traditional and improved me						
	traditional and fermented foods.	etnods of Knoa,	Chhana, Pai	neer, S	nriknai	ia, Gr	nee.
			Chhana, Pai	neer, S	nriknai	ia, Gr	9 9
meat, fishbased Unit - IV Minimal Process Comparison of t	traditional and fermented foods.	I Foods themical process food safety, nu	ses Health Astrient compos	spects	of Trad	ditiona	9 I Foods:
meat, fishbased Unit - IV Minimal Process Comparison of t	traditional and fermented foods. Minimal Processing and Health aspects of Traditional sing of Traditional Foods - Photochemical and non-photocraditional foods with typical fast foods / junk foods — cost,	I Foods themical process food safety, nu r specific ailmen	ses Health As trient compos ts /illnesses	spects	of Trad	ditiona	9 I Foods:
meat, fishbased Unit - IV Minimal Process Comparison of t energy and envir Unit - V Introduction, De Issues-Food saf	Minimal Processing and Health aspects of Traditional sing of Traditional Foods - Photochemical and non-photocraditional foods with typical fast foods / junk foods — cost, ronmental costs of traditional foods; traditional foods used for	l Foods chemical process food safety, nu r specific ailment esent and Future o Present: A Glo ation of Middle ea	ses Health Astrient composts /illnesses bal Perspectivast, Africa, Ch	spects ition, b ve, Cur ina and	of Tracioactive	ditiona e com amewo east a	9 I Foods: ponents; 9 orks and Asia and
meat, fishbased Unit - IV Minimal Process Comparison of t energy and envir Unit - V Introduction, De Issues-Food saf	Minimal Processing and Health aspects of Traditional sing of Traditional Foods - Photochemical and non-photocleraditional foods with typical fast foods / junk foods — cost, ronmental costs of traditional foods; traditional foods used for Laws and Regulations of Traditional Foods: Past, Prevelopment of Food Regulations and Food Law, From Past to ety and international standards, Trade standards and regular	l Foods chemical process food safety, nu r specific ailment esent and Future o Present: A Glo ation of Middle ea	ses Health Astrient composts /illnesses bal Perspectivast, Africa, Ch	spects ition, b ve, Cur ina and	of Tracioactive	ditiona e com amewo east a	9 I Foods: ponents;
meat, fishbased Unit - IV Minimal Process Comparison of t energy and envir Unit - V Introduction, De Issues-Food saf Latin America, Ir	Minimal Processing and Health aspects of Traditional sing of Traditional Foods - Photochemical and non-photocleraditional foods with typical fast foods / junk foods — cost, ronmental costs of traditional foods; traditional foods used for Laws and Regulations of Traditional Foods: Past, Prevelopment of Food Regulations and Food Law, From Past to ety and international standards, Trade standards and regular intellectual Property: Geographical Indications (GIs), The Future	l Foods chemical process food safety, nu r specific ailment esent and Future o Present: A Glo ation of Middle ea	ses Health Astrient composts /illnesses bal Perspectivast, Africa, Choods in a Glob	spects ition, b ve, Cur ina and pal Mar	of Trac ioactive rent Fr d south ketplac	ditiona e com amewo east a	9 I Foods: ponents; 9 orks and Asia and Total:45
meat, fishbased Unit - IV Minimal Process Comparison of t energy and envir Unit - V Introduction, De Issues-Food saf Latin America, Ir TEXT BOOK: McElhat	Minimal Processing and Health aspects of Traditional sing of Traditional Foods - Photochemical and non-photocleraditional foods with typical fast foods / junk foods — cost, ronmental costs of traditional foods; traditional foods used for Laws and Regulations of Traditional Foods: Past, Prevelopment of Food Regulations and Food Law, From Past to ety and international standards, Trade standards and regular	l Foods chemical process food safety, nu r specific ailment esent and Future o Present: A Glo ation of Middle ea	ses Health Astrient composts /illnesses bal Perspectivast, Africa, Choods in a Glob	spects ition, b ve, Cur ina and pal Mar	of Trac ioactive rent Fr d south ketplac	ditiona e com amewo east a	9 I Foods: ponents; 9 orks and Asia and Total:45
meat, fishbased Unit - IV Minimal Process Comparison of t energy and envir Unit - V Introduction, De Issues-Food saf Latin America, Ir TEXT BOOK: McElhat	Minimal Processing and Health aspects of Traditional sing of Traditional Foods - Photochemical and non-photochemical foods with typical fast foods / junk foods — cost, ronmental costs of traditional foods; traditional foods used for Laws and Regulations of Traditional Foods: Past, Prevelopment of Food Regulations and Food Law, From Past to ety and international standards, Trade standards and regulational Property: Geographical Indications (GIs), The Future Intellectual Property: Mustapha Missbah, "Modernization of traditional & El Idrissi, Mustapha Missbah, "Modernization of traditional & El Idrissi, Mustapha Missbah, "Modernization of traditional & El Idrissi, Mustapha Missbah, "Modernization of traditional foods and traditional foods are property."	l Foods chemical process food safety, nu r specific ailment esent and Future o Present: A Glo ation of Middle ea	ses Health Astrient composts /illnesses bal Perspectivast, Africa, Choods in a Glob	spects ition, b ve, Cur ina and pal Mar	of Trac ioactive rent Fr d south ketplac	ditiona e com amewo east a	9 I Foods: ponents; 9 orks and Asia and Total:45
meat, fishbased Unit - IV Minimal Process Comparison of tenergy and envir Unit - V Introduction, Delsues-Food saft Latin America, Ir TEXT BOOK: 1. McElhar Springe REFERENCES: Moham	Minimal Processing and Health aspects of Traditional sing of Traditional Foods - Photochemical and non-photochemical foods with typical fast foods / junk foods — cost, ronmental costs of traditional foods; traditional foods used for Laws and Regulations of Traditional Foods: Past, Prevelopment of Food Regulations and Food Law, From Past to ety and international standards, Trade standards and regulational Property: Geographical Indications (GIs), The Future Intellectual Property: Mustapha Missbah, "Modernization of traditional & El Idrissi, Mustapha Missbah, "Modernization of traditional & El Idrissi, Mustapha Missbah, "Modernization of traditional & El Idrissi, Mustapha Missbah, "Modernization of traditional foods and traditional foods are property."	I Foods chemical process food safety, nu r specific ailment esent and Future o Present: A Glo ation of Middle ea are: Traditional Fe	ses Health Astrient composts /illnesses bal Perspectivast, Africa, Choods in a Glob	spects ition, b ve, Cur ina and pal Mari	of Tracioactive	ditiona e com amew east / ee.	9 I Foods: ponents; 9 orks and Asia and Total:45
meat, fishbased Unit - IV Minimal Process Comparison of tenergy and environment Unit - V Introduction, Desuses-Food saft Latin America, In TEXT BOOK: 1. McElhat Springe REFERENCES: Moham Process	Minimal Processing and Health aspects of Traditional sing of Traditional Foods - Photochemical and non-photochemical foods with typical fast foods / junk foods — cost, ronmental costs of traditional foods; traditional foods used for Laws and Regulations of Traditional Foods: Past, Prevelopment of Food Regulations and Food Law, From Past to ety and international standards, Trade standards and regulational Property: Geographical Indications (GIs), The Future Intellectual Property: Geographical Indications (GIs), The Future Iton, Anna & El Idrissi, Mustapha Missbah, "Modernization of tr, USA, 2016.	Hemical process food safety, nurspecific ailment sent and Future or Present: A Gloution of Middle eare: Traditional Foot for traditional food	ses Health Astrient composits /illnesses bal Perspectivest, Africa, Choods in a Glob	spects ition, b ve, Cur ina and pal Mari	of Tracioactive	ditiona e com amew east / ee.	9 I Foods: ponents; 9 orks and Asia and Total:45

	SE OUTCOMES: npletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	outline the historical and traditional perspective of foods and food habits	Understanding (K2)
CO2	explain the preparation of grain based tradition foods	Understanding (K2)
CO3	illustrate production of fruits and vegetables, dairy based traditional foods	Understanding (K2)
CO4	apply minimal processing techniques in traditional foods in concern with health aspects	Applying (K3)
CO5	summarize the laws and regulations related to traditional foods	Understanding (K2)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1							1		1	1	1
CO2	3	2	2		1					1		1	2	1
CO3	3	2	2		1					1		1	2	1
CO4	3	2	2		1					1		1	2	2
CO5	1	2	1		1	2		3		1		1	2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

		ASSESSMEN	II LYIIFIXM.	TITLORI			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	40	60					100
CAT3	20	40	40				100
ESE	40	40	20				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22FTE20- REACTION ENGI	NEERING					
Programme & Branch	B.Tech & Food Technology	Sem.	Category	L	Т	Р	Credi
Prerequisites	Nil	7	PE	3	0	0	3
Preamble	To give knowledge on reaction kinetic principles and di	fferent type of rea	actors.				
Unit - I	Kinetics of Homogeneous reactions:						9
Mechanism, Orde	ogeneous reactions: Reaction Kinetics, Classification of r er of the reaction, Kinetic models for non-elementary reaction rhenius law, collision theory and transition theory.						
Unit - II	Analysis of Batch Reactor Data:						9
	h Reactor Data: Analysis of experimental reactor data, Inte me batch reactor, Integral method analysis of rate data, Inte						
	systems, Temperature and reaction rate.						
variable volume s	systems, Temperature and reaction rate. Ideal Reaction for a Single Reactor:						9
variable volume s Unit - III	Ideal Reaction for a Single Reactor: r a Single Reactor: Ideal reactors: Batch, Semi-batch, Stead		reactor, Stead	y state	mixed fl	ow rea	_
variable volume s Unit - III Ideal Reaction fo Unit - IV	Ideal Reaction for a Single Reactor: r a Single Reactor: Ideal reactors: Batch, Semi-batch, Stead Design for Single and Multiple Reactions:	y state plug flow i					octor.
variable volume s Unit - III Ideal Reaction fo Unit - IV Design for Single	Ideal Reaction for a Single Reactor: r a Single Reactor: Ideal reactors: Batch, Semi-batch, Stead Design for Single and Multiple Reactions: le Reactions: Size comparison of Single reactors, multiple tions in Parallel, Reactions in Series, Yield and Selectivity	y state plug flow i	em, Recycle	rector I	Design	for Mu	ector. 9 ultiple
variable volume s Unit - III Ideal Reaction fo Unit - IV Design for Sing Reactions: Reac	Ideal Reaction for a Single Reactor: r a Single Reactor: Ideal reactors: Batch, Semi-batch, Stead Design for Single and Multiple Reactions: le Reactions: Size comparison of Single reactors, multiple tions in Parallel, Reactions in Series, Yield and Selectivity	y state plug flow i	em, Recycle	rector I	Design	for Mu	ector. 9 ultiple
variable volume s Unit - III Ideal Reaction fo Unit - IV Design for Sing Reactions: Reacted reactor, Product of Unit - V Non-ideal flow: T	Ideal Reaction for a Single Reactor: r a Single Reactor: Ideal reactors: Batch, Semi-batch, Stead Design for Single and Multiple Reactions: le Reactions: Size comparison of Single reactors, multiple tions in Parallel, Reactions in Series, Yield and Selectivity distribution.	y state plug flow in the plug flow in th	em, Recycle tment: Plug fl	rector I ow, Ba	Design tch and	for Mu Mixed	9 ultiple d flow
variable volume s Unit - III Ideal Reaction fo Unit - IV Design for Sing Reactions: Reacted reactor, Product of Unit - V Non-ideal flow: T	Ideal Reaction for a Single Reactor: r a Single Reactor: Ideal reactors: Batch, Semi-batch, Stead Design for Single and Multiple Reactions: le Reactions: Size comparison of Single reactors, multiple tions in Parallel, Reactions in Series, Yield and Selectivity distribution. Non Ideal Flow: The residence time distribution as a factor performance; residence	y state plug flow in the plug flow in th	em, Recycle tment: Plug fl	rector I ow, Ba	Design tch and	for Mu Mixed	9 ultiple d flow
variable volume s Unit - III Ideal Reaction fo Unit - IV Design for Sing Reactions: Reacted reactor, Product of Unit - V Non-ideal flow: T	Ideal Reaction for a Single Reactor: r a Single Reactor: Ideal reactors: Batch, Semi-batch, Stead Design for Single and Multiple Reactions: le Reactions: Size comparison of Single reactors, multiple tions in Parallel, Reactions in Series, Yield and Selectivity distribution. Non Ideal Flow: The residence time distribution as a factor performance; residence	y state plug flow in the plug flow in th	em, Recycle tment: Plug fl	rector I ow, Ba	Design tch and	for Mu Mixed	9 ultiple d flow 9 em in
variable volume s Unit - III Ideal Reaction fo Unit - IV Design for Sing Reactions: Reactions: Reactions reactor, Product of Unit - V Non-ideal flow: Treactor. Models f	Ideal Reaction for a Single Reactor: r a Single Reactor: Ideal reactors: Batch, Semi-batch, Stead Design for Single and Multiple Reactions: le Reactions: Size comparison of Single reactors, multiple tions in Parallel, Reactions in Series, Yield and Selectivity distribution. Non Ideal Flow: The residence time distribution as a factor performance; residence	y state plug flow on the ple reactor system, Qualitative treactor sidence time functions.	em, Recycle tment: Plug fl ctions and rela	rector I ow, Ba	Design tch and	for Mu Mixed	9 ultiple d flow 9 em in
variable volume s Unit - III Ideal Reaction fo Unit - IV Design for Sing Reactions: Reacted reactor, Product of Unit - V Non-ideal flow: Treactor. Models for TEXT BOOK: 1. Levens	Ideal Reaction for a Single Reactor: r a Single Reactor: Ideal reactors: Batch, Semi-batch, Stead Design for Single and Multiple Reactions: le Reactions: Size comparison of Single reactors, multiple tions in Parallel, Reactions in Series, Yield and Selectivity distribution. Non Ideal Flow: The residence time distribution as a factor performance; restor non-ideal flow: Dispersion model and Tank in series model.	y state plug flow on the ple reactor system, Qualitative treactor sidence time functions.	em, Recycle tment: Plug fl ctions and rela	rector I ow, Ba	Design tch and	for Mu Mixed	9 ultiple d flow 9 em in
variable volume s Unit - III Ideal Reaction fo Unit - IV Design for Sing Reactions: Reacted reactor, Product of Unit - V Non-ideal flow: Treactor. Models for TEXT BOOK: 1. Levens REFERENCES:	Ideal Reaction for a Single Reactor: r a Single Reactor: Ideal reactors: Batch, Semi-batch, Stead Design for Single and Multiple Reactions: le Reactions: Size comparison of Single reactors, multiple tions in Parallel, Reactions in Series, Yield and Selectivity distribution. Non Ideal Flow: The residence time distribution as a factor performance; restor non-ideal flow: Dispersion model and Tank in series model.	y state plug flow on the ple reactor system, Qualitative treated sidence time function.	em, Recycle tment: Plug fl ctions and rela w Delhi, 2006	rector I ow, Ba	Design tch and	for Mu Mixed	actor. 9 ultiple d flow 9 em in

	SE OUTCOMES: upletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	infer reaction kinetics and mechanism	Applying (K3)
CO2	analyze batch reactor data	Analyzing (K4)
CO3	understand ideal reactors and develop performance equation	Applying (K3)
CO4	examine reactor system for single and multiple reaction	Applying (K3)
CO5	understand different non ideal flow models and perform RTD Analysis	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1							1	3	2
CO2	3	3	2	3	2							1	3	2
CO3	3	3	2	2	1							1	3	2
CO4	3	3	2	3	1							1	3	2
CO5	3	3	2	2	2							1	3	2

^{1 –} Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	50	20			100
CAT2	10	20	50	20			100
CAT3	10	30	60				100
ESE	10	20	50	20			100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Programm Branch	e & B.Tech & Food Techno	ду	; m.	Category	L	T -	₽	Cre	ik
Prerequisi	tes Nil		7	PE	3	0	0	3	3
Preamble	To impart knowledge on	odeling and simulation of different food pro	ocessir	ng operations					
Unit - I	Introduction to Modelin	:						9)
Chemical S	Systems. Modeling - Principles of	System, Entity, attributes, activity, state nodel formulation, Representation of Mod dition, Validation of model. Benefits of mo	del, Fu	ndamental L	aws,	Туре			
Unit - II	Models in Fermentation	and Modified Atmospheric Packaging:						9)
Technologi	ical models - heat transfer models	models - Genetic models, growth model oxygen transfer models and mixing mo	dels. E	conomic mo					
woaels in N	Modified Atmospheric Packaging: F	nciple and methods, macro, micro and me	000 10 40	i illoudis.					
Unit - III	Modeling of Cooling ar	Freezing Processes:			nalo t	tank n	model	9	
Unit - III Modeling of the network modeliferent modelimpermeab	Modeling of Cooling are of Cooling and Freezing Processes odel. Modeling product heat load dispodels and element model. Modelle skin and frozen foods.	Freezing Processes: Introduction, modeling product heat loading freezing. Numerical solution of heat cong of combined heat and mass transfer.	during	cooling - sir	with p	hase	chang	and tage. Fir	an
Unit - III Modeling onetwork modifferent minimpermeab	Modeling of Cooling are of Cooling and Freezing Processes odel. Modeling product heat load do nodels and element model. Model	Freezing Processes: Introduction, modeling product heat loading freezing. Numerical solution of heat cong of combined heat and mass transfer.	during	cooling - sir	with p	hase	chang	and to	an
Unit - III Modeling of the network modeling of the ne	Modeling of Cooling are of Cooling and Freezing Processes odel. Modeling product heat load de nodels and element model. Model ole skin and frozen foods. Modeling of Thermal Process: Types, base of Thermal Process: Types, base of equations, complex models for particulates. Models for microwave s.	Freezing Processes: Introduction, modeling product heat loading freezing. Numerical solution of heat cong of combined heat and mass transferes: equations - Microbiological and qualinon-uniformity and convective flows, and ohmic heating. Models for heat transference.	during onduction er - po ity kin steriliz	cooling - sir on equation vorous, non-p etics, thermation of lice	with porous	ransp	chang ds, fo ort e	and tage. Fir ods v	ani nite vitl
Unit - III Modeling onetwork modifferent manuermeab Unit - IV Modeling of Conduction containing exchangers Unit - V	Modeling of Cooling are of Cooling and Freezing Processes odel. Modeling product heat load do nodels and element model. Model ole skin and frozen foods. Modeling of Thermal P of Thermal Process: Types, base of equations, complex models for particulates. Models for microwave s. Soft Tools for Modeling	Freezing Processes: Introduction, modeling product heat loading freezing. Numerical solution of heat cong of combined heat and mass transfections: equations - Microbiological and qualing non-uniformity and convective flows, and ohmic heating. Models for heat transfection from the processes:	during onduction er - positive kin steriliz fer equi	cooling - sir on equation v prous, non-p etics, therm ration of lice ipments – ev	with porous nal to the distribution of the di	ransp food rators,	chang ds, fo oort e ds ar heat	and tage. Fire ods we see the ods we	an nite vit
Unit - III Modeling of network modifferent mimpermeab Unit - IV Modeling of Conduction containing exchangers Unit - V Soft Tools	Modeling of Cooling are of Cooling and Freezing Processes odel. Modeling product heat load do nodels and element model. Model ole skin and frozen foods. Modeling of Thermal P of Thermal Process: Types, base of equations, complex models for particulates. Models for microwave s. Soft Tools for Modeling for Modeling of Food Processes:	Freezing Processes: Introduction, modeling product heat loading freezing. Numerical solution of heat cong of combined heat and mass transferes: equations - Microbiological and qualinon-uniformity and convective flows, and ohmic heating. Models for heat transference.	during onduction er - positive kin steriliz fer equi	cooling - sir on equation v prous, non-p etics, therm ration of lice ipments – ev	with porous nal to the distribution of the di	ransp food rators,	chang ds, fo oort e ds ar heat	and tage. Fire ods we see the ods we	an nito vit
Unit - III Modeling of the content	Modeling of Cooling are of Cooling and Freezing Processes odel. Modeling product heat load do nodels and element model. Model ole skin and frozen foods. Modeling of Thermal P of Thermal Process: Types, base of equations, complex models for particulates. Models for microwave s. Soft Tools for Modeling for Modeling of Food Processes:	Freezing Processes: Introduction, modeling product heat loading freezing. Numerical solution of heat cong of combined heat and mass transfections: equations - Microbiological and qualing non-uniformity and convective flows, and ohmic heating. Models for heat transfection from the processes:	during onduction er - positive kin steriliz fer equi	cooling - sir on equation v prous, non-p etics, therm ration of lice ipments – ev	with porous nal to the distribution of the di	ransp food rators,	chang ds, fo oort e ds ar heat	and tage. Fire ods we see the ods we	an nite vit
Modeling of network modifferent mimpermeab Unit - IV Modeling of Conduction containing exchangers Unit - V Soft Tools tools and so	Modeling of Cooling are of Cooling and Freezing Processes odel. Modeling product heat load do nodels and element model. Model ole skin and frozen foods. Modeling of Thermal P of Thermal Process: Types, base of equations, complex models for particulates. Models for microwave s. Soft Tools for Modeling of Modeling of Food Processes: Software.	Freezing Processes: Introduction, modeling product heat loading freezing. Numerical solution of heat cong of combined heat and mass transfections: equations - Microbiological and qualinon-uniformity and convective flows, and ohmic heating. Models for heat transfections for Sensory analysis, Mathematical for Sensory analysis, Mat	during onduction er - positive kin sterilizater equi-	cooling - sir on equation v prous, non-p etics, therm ration of lic ipments – ev lysis, data tre	with porous	ransp food ators,	chang ds, fo oort e ds ar heat	and tage. Firods we get quation for get	anl nite vitl
Modeling of network modifferent mimpermeab Unit - IV Modeling of Conduction containing exchangers Unit - V Soft Tools tools and so	Modeling of Cooling are of Cooling and Freezing Processes odel. Modeling product heat load do nodels and element model. Model ole skin and frozen foods. Modeling of Thermal P of Thermal Process: Types, base of equations, complex models for particulates. Models for microwave s. Soft Tools for Modeling of Modeling of Food Processes: Software.	Freezing Processes: Introduction, modeling product heat loading freezing. Numerical solution of heat cong of combined heat and mass transfections: equations - Microbiological and qualing non-uniformity and convective flows, and ohmic heating. Models for heat transfection from the processes:	during onduction er - positive kin sterilizater equi-	cooling - sir on equation v prous, non-p etics, therm ration of lic ipments – ev lysis, data tre	with porous	ransp food ators,	chang ds, fo oort e ds ar heat	and tage. Firods we get quation for get	an nite vit
Modeling of network modifferent mimpermeab Unit - IV Modeling of Conduction containing exchangers Unit - V Soft Tools tools and so	Modeling of Cooling are of Cooling and Freezing Processes odel. Modeling product heat load de nodels and element model. Modeling services and frozen foods. Modeling of Thermal Process: Types, base of equations, complex models for particulates. Models for microwaves. Soft Tools for Modeling for Modeling of Food Processes: Software. OK: Skens L.M.M., Hertog T.M. & Nicola	Freezing Processes: Introduction, modeling product heat loading freezing. Numerical solution of heat cong of combined heat and mass transfections: equations - Microbiological and qualinon-uniformity and convective flows, and ohmic heating. Models for heat transfections for Sensory analysis, Mathematical for Sensory analysis, Mat	during onduction er - positive kin sterilizater equi-	cooling - sir on equation v prous, non-p etics, therm ration of lic ipments – ev lysis, data tre	with porous	ransp food ators,	chang ds, fo oort e ds ar heat	and tage. Firods we get quation for get	an nite vit

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	interpret the concepts of modeling in food processing	Understanding (K2)
CO2	illustrate the modeling concepts in fermentation and MAP	Understanding (K2)
CO3	choose suitable mathematical models in cooling and freezing processes of foods	Applying (K3)
CO4	select the models to be used in thermal processing of foods	Applying (K3)
CO5	make use of appropriate software for modeling processes	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	1					1		1	1	2
CO2	3	3	2	3	2					1		1	1	2
CO3	3	3	2	3	2					1		3	1	2
CO4	3	3	2	3	2					1		3	1	2
CO5	3	3	3	3	3					1		3	1	3

^{1 –} Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

		/100200III2I11 I	, _				
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

D							1
Programme & Branch	B.Tech &Food Technology	Sem.	Category	L	Т	Р	Credi
Prerequisites	Food Process Engineering I, Food Chemistry	7	PE	3	0	0	3
Preamble	To gain knowledge on process involved in development of	of different beverag	es and quality	assess	sment.		
Unit - I	Introduction and Traditional Beverages:						9
Raw materials - \	f beverage industry in India- Types of beverages- Non-Ald Water, Sweeteners, Bulking agents, Acidulants, Emulsifiers era, Sugar cane juice, Tender coconut water and Herbal w	, Stabilizers, Flavor	ic. Nutritional ing and Color	and thing age	erapeut nts. Tra	ic bend ditiona	efits.
Unit - II	Non Alcoholic Beverages:						9
beverages- Prop	ased beverages, Fermented non alcoholic beverages (k perties of carbon dioxide, carbonation — carbonators. P ry based beverages – whey based beverages and flavored	reparation of syru					
Unit - III	Alcoholic Beverages:						9
	key, Rum, Gin – Production and defects.						
Unit - IV	Specialty Beverages:						9
Coffee and Insta Production of Te	Specialty Beverages: Int Coffee production. Recent trends in coffee based beverage based beverages – Instant Tea, Tea Concentrates, RTD a Based Beverages. Sportbeverages – Physiological need	Tea beverages. M					
Coffee and Insta Production of Te	nt Coffee production. Recent trends in coffee based bevera a based beverages – Instant Tea, Tea Concentrates, RTD	Tea beverages. M					
Coffee and Insta Production of Te in market. Cocoa Unit - V Effective applicat	ant Coffee production. Recent trends in coffee based bevera based beverages – Instant Tea, Tea Concentrates, RTD a Based Beverages. Sportbeverages – Physiological need	Tea beverages. Ms and formulation. industries. Quality	lalt beverages	– Bran	ded ma	It beve	rages
Coffee and Insta Production of Te in market. Cocoa Unit - V Effective applicat	nt Coffee production. Recent trends in coffee based bevera a based beverages – Instant Tea, Tea Concentrates, RTD a Based Beverages. Sportbeverages – Physiological need Quality Assurance in Beverage Industry: tion of quality controls- Sanitation and Hygiene in Beverage	Tea beverages. Ms and formulation. industries. Quality	lalt beverages	– Bran	ded ma	shold li	rages
Coffee and Instal Production of Te in market. Cocoa Unit - V Effective applicat ingredients according	nt Coffee production. Recent trends in coffee based bevera a based beverages – Instant Tea, Tea Concentrates, RTD a Based Beverages. Sportbeverages – Physiological need Quality Assurance in Beverage Industry: tion of quality controls- Sanitation and Hygiene in Beverage	Tea beverages. Ms and formulation. industries. Quality	lalt beverages	– Bran	ded ma	shold li	rages 9 mits of
Coffee and Instal Production of Te in market. Cocoa Unit - V Effective applicating redients according to the Text Book:	nt Coffee production. Recent trends in coffee based bevera a based beverages – Instant Tea, Tea Concentrates, RTD a Based Beverages. Sportbeverages – Physiological need Quality Assurance in Beverage Industry: tion of quality controls- Sanitation and Hygiene in Beverage	Tea beverages. Mean services and formulation. industries. Quality erages and recent	of water in betrends.	everage	s. Thres	It beve	rages 9 mits of Total:45
Coffee and Instal Production of Te in market. Cocoa Unit - V Effective applicating redients according to the Text Book: 1. Philip R.	nt Coffee production. Recent trends in coffee based beverage a based beverages – Instant Tea, Tea Concentrates, RTD a Based Beverages. Sportbeverages – Physiological need Quality Assurance in Beverage Industry: tion of quality controls- Sanitation and Hygiene in Beverage rding to FSSAI, EFSA & FDA. Packaging standards for beverage in the product of	Tea beverages. Mean services and formulation. industries. Quality erages and recent	of water in betrends.	everage	s. Thres	It beve	rages 9 mits of Total:45
Coffee and Instal Production of Te in market. Cocoa Unit - V Effective applicating ingredients according to the Installation of Te in market. Cocoa Unit - V Effective applicating redients according to the Installation of Text BOOK: 1. Philip R. REFERENCES: Paquin and	nt Coffee production. Recent trends in coffee based beverage a based beverages – Instant Tea, Tea Concentrates, RTD a Based Beverages. Sportbeverages – Physiological need Quality Assurance in Beverage Industry: tion of quality controls- Sanitation and Hygiene in Beverage rding to FSSAI, EFSA & FDA. Packaging standards for beverage in the product of	Tea beverages. Mean services and formulation. industries. Quality erages and recent and recent uit Juices", 2nd Edi	of water in betrends.	everage	ded ma	It beve	rages 9 mits of Total:45

	SE OUTCOMES: npletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	outline the ingredients for production of beverages	Understanding (K2)
CO2	make use of suitable techniques for development of non-alcoholic beverages	Applying (K3)
CO3	explain the production of alcoholic beverages and identify the defects	Applying (K3)
CO4	apply the knowledge of processing specialty beverages	Applying (K3)
CO5	apply the regulatory aspects for the quality control in beverage industry	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1							1			2	1
CO2	3	2	2			1				1		1	3	2
CO3	3	2	2							1		1	3	2
CO4	3	2	2							1		1	3	2
CO5	3	2	3			2				1		2	3	3

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

		ASSESSIVIENT	PALIERN-	INEUKI			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6)	Total %
CAT1	20	60	20				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Programme & Branch	B.Tech & Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	NIL	7	PE	3	0	0	3
D 11	T+ 11 111 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		1 6 6 1				
Preamble	To provides an insight on role of agricultural practices on pro-	oduction of field and	norticultural c	rops.			
Unit - I	Agronomy: griculture and agronomy – Factors affecting crop growth						9
Major Crops. I Systems, Crop Unit - II	ops – Classification, Crop adaptation and Distribution – Principal representation of P	tistoried cropping.	Crop Rotation	n, Čre	oppin	g Pat	terns &
	Liquid, Solid, Gaseous. Properties of soils – Physical Prope Soils, Red soils, Desert soils, Tarai soils, Saline and acid soils			r. Ma	jor so	oils in	India –
Unit - III	Tillage and Seeds Sowing:						9
Characteristics (of good tillage - Types of tillage - Modern Concepts of tillage	- Tillage implement	c Drimary S	'ocon	danı	intor (rultural
	pose. Seeds - Seed rate - Sowing methods - Germination - Crop					iiitei t	Juliurai
						iiitei t	9
unit - IV Source of water	pose. Seeds - Seed rate - Sowing methods - Germination - Cro	p stand establishme n requirement. Meth	nt - Planting go	eome	try		9
and special purp Unit - IV Source of water Lift irrigation. Irr Unit - V	lrrigation and water management: Surface and sub- surface. Crop water requirement, Irrigation igation schedule and management. Nutrient Management:	p stand establishme n requirement. Meth Soil moisture consta	nt - Planting go ods of irrigation	eome	ery Gravit	y, Tan	9 k and 9
and special purp Unit - IV Source of water Lift irrigation. Irr Unit - V Classification of Role, Deficiency	lrrigation and water management: Surface and sub- surface. Crop water requirement, Irrigation igation schedule and management. Measurement of irrigation.	n requirement. Meth Soil moisture consta cal Nature, General lanure and Green Le	ods of irrigation ants. Function, Mobaf Manure - Fo	eome	Gravit	y, Tan	9 k and 9 utrients-
and special purp Unit - IV Source of water Lift irrigation. Irr Unit - V Classification of Role, Deficiency Bio Fertilizers -	Irrigation and water management: Surface and sub-surface. Crop water requirement, Irrigation igation schedule and management. Measurement of irrigation. Nutrient Management: Essential Elements - Based on the Relative Quantity, Chemical, Method of Control and Toxicity - Organic Manures - Green Measurement.	n requirement. Meth Soil moisture consta cal Nature, General lanure and Green Le	ods of irrigation ants. Function, Mobaf Manure - Fo	eome	Gravit	y, Tan nts. Nu Classii rated	9 k and 9 utrients- ication Nutrien
and special purp Unit - IV Source of water Lift irrigation. Irr Unit - V Classification of Role, Deficiency Bio Fertilizers - Management.	Irrigation and water management: Surface and sub-surface. Crop water requirement, Irrigation igation schedule and management. Measurement of irrigation. Nutrient Management: Essential Elements - Based on the Relative Quantity, Chemical, Method of Control and Toxicity - Organic Manures - Green Measurement.	n requirement. Meth Soil moisture consta cal Nature, General lanure and Green Le	ods of irrigation ants. Function, Mobaf Manure - Fo	eome	Gravit	y, Tan nts. Nu Classii rated	9 k and 9 utrients- ication Nutrien
and special purp Unit - IV Source of water Lift irrigation. Irr Unit - V Classification of Role, Deficiency Bio Fertilizers - Management. TEXT BOOK:	Irrigation and water management: - Surface and sub- surface. Crop water requirement, Irrigation igation schedule and management. Measurement of irrigation. Nutrient Management: Essential Elements - Based on the Relative Quantity, Chemical Method of Control and Toxicity - Organic Manures - Green Method Factors Affecting Manures and Fertilizers Use - Time of Agraement assekaran, B., K. Annadurai and E. Somasundaram, "A Text botal research and service of the servi	n requirement. Meth Soil moisture constance cal Nature, General lanure and Green Le Application - Methor	ods of irrigation ods of irrigation ods. Function, Mobaf Manure - Fod of Application	on – Consility in ertiliza	Planers - (Integ	y, Tan nts. Nu Classii rated	9 k and 9 utrients- ication Nutrien
and special purp Unit - IV Source of water Lift irrigation. Irr Unit - V Classification of Role, Deficiency Bio Fertilizers Management. TEXT BOOK:	Irrigation and water management: - Surface and sub- surface. Crop water requirement, Irrigation igation schedule and management. Measurement of irrigation. Nutrient Management: Essential Elements - Based on the Relative Quantity, Chemic Management of Control and Toxicity - Organic Manures - Green Management of Factors Affecting Manures and Fertilizers Use - Time of American Seekaran, B., K. Annadurai and E. Somasundaram, "A Text boom, 2005	n requirement. Meth Soil moisture constance cal Nature, General lanure and Green Le Application - Methor	ods of irrigation ods of irrigation ods. Function, Mobaf Manure - Fod of Application	on – Consility in ertiliza	Planers - (Integ	y, Tan nts. Nu Classii rated	9 k and 9 utrients- ication Nutrien
and special purp Unit - IV Source of water Lift irrigation. Irr Unit - V Classification of Role, Deficiency Bio Fertilizers - Management. TEXT BOOK: 1. Chandr Jodhpu REFERENCES:	Irrigation and water management: - Surface and sub- surface. Crop water requirement, Irrigation igation schedule and management. Measurement of irrigation. Nutrient Management: Essential Elements - Based on the Relative Quantity, Chemic Management of Control and Toxicity - Organic Manures - Green Management of Factors Affecting Manures and Fertilizers Use - Time of American Seekaran, B., K. Annadurai and E. Somasundaram, "A Text boom, 2005	n requirement. Meth Soil moisture constant cal Nature, General lanure and Green Le Application - Methodo	ods of irrigation ants. Function, Mobaf Manure - Fod of Application tt Edition, Scie	nn – C	Plan Plan Integ	y, Tannts. Nu Classii grated	9 k and 9 utrients-

	SE OUTCOMES: npletion of the course, the students will be able to	BT Mapped (Highest Level)				
CO1	explain the crop characteristics and crop production					
CO2	select soils type suitable for particular crop production					
CO3	identify the tillage methods and sowing methods	Applying (K3)				
CO4	construct irrigation plan as per crop water requirement	Applying (K3)				
CO5	select suitable measures for management of nutrients	Understanding (K2)				

						_								
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3			1				1		1	1	1
CO2	3	2	3			1				1		1	1	1
CO3	3	2	3			1				1		1	1	2
CO4	3	2	3			1				1		1	1	2
CO5	3	2	3			1				1		1	1	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	40	40				100
CAT3	20	60	20				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22FTE24- CANE SUGAR TECHNO	DLOGY					
Programme & Branch	B.Tech &Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Heat transfer operations, Food Process Engineering I, Food Process Engineering II	7	PE	3	0	0	3
Preamble	To provides the knowledge on various unit operations involved in	n the sugar c	ane processir	ng an	d its l	oy-prod	ducts
Unit - I	Introduction and Pre-processing Operation:		•				9
manufacturing	Pre-processing Operation: Overview of sugar industry - composition or composition or sugarcane juice, types of cane sugar, terminology. Insportation, Cane conveyor, Washing, Shredding.						
Unit - II	Juice Extraction:						9
Maceration. The	n: Crushing -Types of crushers, crushing efficiency. Extractively of cane diffusivity. Types of diffusers. Factors influencing Extractors extraction, Weighing of juice - Maxwell Boulogne Scale and	action of car	ne juice. Oper				
Unit - III	Juice Clarification and Concentration:						9
construction an	Ilphur -specification and storage, production of sulphur dioxide gas. d working of tubular heater, Direct Contact Heater (DCH), Plate es-performance measures. Crystallization and Refining:						
Crystallization a	nd Refining: Sugar boiling, Nucleation and crystal growth, super s	aturation and	d meta stable	stac	ne. se	edina	- shock
seeding, true se	eding. Crystallizers. Refining - Brown sugar, importance of refining lecolorization, centrifugation - dewatering of sugar. Drying. Baggi	, Affination, o	clarification, c	arbo	natio	n, sulpl	hitation,
Unit - V	Manufacturing of Jaggery/ Gur and other by products:						9
grading of Gur,	of Jaggery/ Gur and other by products: Extraction of Juice, Clarif Storage of Gur. Byproducts - Drying and uses of Bagasse - Back s lasses - Distilling Industries - Applications in animal feed – Biogas –	strap Molass	es - Characte	eristic	s of I	Molass	
							Total:4
TEXT BOOK:							
1. Kulkarn	i D.P, "Cane Sugar Manufacture in India", 1st Edition, The Sugar Te	chnologists A	Association of	f India	a, 20	09.	
REFERENCES:							
1. Heriot	T.H.P, "The Manufacture of Sugar from the Cane and Beet", 1st Edit	ion, Read Bo	ooks, New Yo	rk, 20	008.		
2. Peter R	ein, "Cane Sugar Engineering", 2nd Edition, Verlag Dr. Albert Barte	ns KG, Germ	nany, 2017.				

	SE OUTCOMES: npletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	outline sugarcane constituents and pre-processing operations	Understanding (K2)
CO2	make use of suitable sugarcane juice extraction process	Applying (K3)
CO3	choose appropriate clarification and concentration methods for sugarcane juice	Applying (K3)
CO4	plan sequential steps involved in sugar crystallization and refining	Applying (K3)
CO5	apply the acquired knowledge for manufacturing of cane sugar by-products	Applying (K3)

						<u> </u>								
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1							1		1	2	1
CO2	3	2	1							1		1	3	2
CO3	3	2	1							1		1	3	2
CO4	3	2	1							1		1	3	2
CO5	3	2	1				2			1		2	3	1

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

		ASSESSIVIEN	NI PALIEKNI-I	HEUR I			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	(Common to All BE/BT	Tech branches)					
Programme & Branch		Sem.	Category	L	Т	P	Credit
Prerequisites	s Nil	7	GE	3	0	0	3
Preamble	This course familiarizes the fundamental conce also disseminate the process involved in collect a presentable form using latest tools.						
Unit – I	Introduction to Research						9
	o Research: Types and Process of Research - Outcomes of a Good Research Problem - Errors in Selecting a R					em -	
Unit – II	Literature Review			•			9
Literature Rev	view: Literature Collection - Methods - Analysis - Citation	n Study - Gap Analysis -	Problem For	mula	tion -	Гесhn	iques.
Unit – III	December Mathedalam						
	Research Methodology ethodology: Appropriate Choice of Algorithms/Methodology	ogies/Methods – Data	Collection -	Prim	ary [Data A	9 Analysis -
Research Mer Experimental Limitations. Unit – IV Journals and	thodology: Appropriate Choice of Algorithms/Methodology Methods and Result Analysis - Investigation of Solution Journals and Papers Papers: Journals in Science/Engineering - Indexing and	ns for Research Proble	m - Interpreta	tion	- Řes	earch	Analysis -
Research Met Experimental Limitations. Unit – IV Journals and Types of Rese	ethodology: Appropriate Choice of Algorithms/Methodology Methods and Result Analysis - Investigation of Solution Journals and Papers Papers: Journals in Science/Engineering - Indexing and earch Papers - Original Article/Review Paper/Short Com	ns for Research Proble	m - Interpreta	tion	- Řes	earch	Analysis -
Research Met Experimental Limitations. Unit – IV Journals and Types of Rese Unit – V	ethodology: Appropriate Choice of Algorithms/Methodology Methods and Result Analysis - Investigation of Solution Journals and Papers Papers: Journals in Science/Engineering - Indexing and earch Papers - Original Article/Review Paper/Short Com Reports and Presentations	ns for Research Proble	m - Interpreta nals. Plagiaris /.	m ar	- Řes	search	Analysis - 9 ch Ethics.
Research Met Experimental Limitations. Unit – IV Journals and Types of Reseturit – V How to Write a	Papers: Journals and Papers Papers: Journals in Science/Engineering - Indexing and earch Papers - Original Article/Review Paper/Short Come Reports and Presentations a Report - Language and Style - Format of Project Reports - Tables and Figures - Appendix - Bibliog	d Impact factor of Journ numerication/Case Study	m - Interpreta	m ar	- Řes	search	Analysis - 9 ch Ethics. 9 adings and
Research Met Experimental Limitations. Unit – IV Journals and Types of Reseturit – V How to Write a Sub-Headings PPTs. Resear	Papers: Journals and Papers Papers: Journals in Science/Engineering - Indexing and earch Papers - Original Article/Review Paper/Short Come Reports and Presentations a Report - Language and Style - Format of Project Report Foods - Tables and Figures - Appendix - Bibliograph Tools.	d Impact factor of Journ numerication/Case Study	m - Interpreta	m ar	- Řes	search	Analysis - 9 ch Ethics. 9 adings an
Research Met Experimental Limitations. Unit – IV Journals and Types of Research V How to Write Sub-Headings PPTs. Research	Papers: Journals and Papers Papers: Journals in Science/Engineering - Indexing and earch Papers - Original Article/Review Paper/Short Come Reports and Presentations a Report - Language and Style - Format of Project Reports - Tables and Figures - Appendix - Bibliograph Tools.	d Impact factor of Journ nmunication/Case Study oort - Title Page - Abstra graphy etc - Different F	m - Interpretanals. Plagiaris /. act - Table of Reference For	m ar	- Řes	esearch esearch - Hea	9 ch Ethics. 9 adings anation using
Research Met Experimental Limitations. Unit – IV Journals and Types of Research Unit – V How to Write Sub-Headings PPTs. Research TEXT BOOK: 1. Wallin	ethodology: Appropriate Choice of Algorithms/Methodology. Methods and Result Analysis - Investigation of Solution Journals and Papers	d Impact factor of Journ nmunication/Case Study oort - Title Page - Abstra graphy etc - Different F	m - Interpretanals. Plagiaris /. act - Table of Reference For	m ar	- Řes	esearch esearch - Hea	9 ch Ethics. 9 adings anation using
Research Met Experimental Limitations. Unit – IV Journals and Types of Research Unit – V How to Write Sub-Headings PPTs. Research TEXT BOOK: 1. Wallin	ethodology: Appropriate Choice of Algorithms/Methodology. Methods and Result Analysis - Investigation of Solution Journals and Papers	d Impact factor of Journ nmunication/Case Study oort - Title Page - Abstra graphy etc - Different F	m - Interpretanals. Plagiaris /. act - Table of Reference For	m ar	- Řes	esearch esearch - Hea	9 ch Ethics. 9 adings anation using
Research Met Experimental Limitations. Unit – IV Journals and Types of Rese Unit – V How to Write Sub-Headings PPTs. Resear TEXT BOOK: 1. Wallir REFERENCE	ethodology: Appropriate Choice of Algorithms/Methodology. Methods and Result Analysis - Investigation of Solution Journals and Papers	d Impact factor of Journ numerication/Case Study oort - Title Page - Abstra graphy etc - Different F	m - Interpretanals. Plagiaris /. act - Table of Reference For	m ar	- Řes	esearch esearch - Hea	9 ch Ethics. 9 adings an
Research Met Experimental Limitations. Unit – IV Journals and Types of Research Meters of Research Meters of Research Text Book: 1. Walling REFERENCE 1. Mishra 2. Kuma	pethodology: Appropriate Choice of Algorithms/Methodology Methods and Result Analysis - Investigation of Solution Journals and Papers	ns for Research Problems d Impact factor of Journ nmunication/Case Study port - Title Page - Abstra graphy etc - Different F ition, Routledge, 2017., gy" Educreation Publishi of or beginners". SAGE I	m - Interpretanals. Plagiaris /. act - Table of Reference For Units I, II, ng, 2017 Publications L	m ar Con	- Reserved And Reserved And Reserved And Reserved And Reserved And Reserved And Andrews Andrew	esearches	9 ch Ethics. 9 adings an ation usin

COUR	SE OUTCOMES:	BT Mapped
On co	mpletion of the course, the students will be able to	(Highest Level)
CO1	list the various stages in research and categorize the quality of journals	Applying (K3)
CO2	formulate a research problem from published literature/journal papers	Evaluating (K5)
CO3	write, present a journal paper/ project report in proper format	Creating (K6)
CO4	select suitable journal and submit a research paper	Applying (K3)
CO5	compile a research report and the presentation	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	1	1	3	3	1	1	3	3	3
CO2	3	3	3	3	2	1	1	3	3	3	3	3	3	3
CO3	3	3	3	3	3	1	1	3	3	3	1	3	3	3
CO4	3	2	1	1	2	1	1	3	2	1	1	3	3	3
CO5	3	3	2	2	3	1	1	3	3	3	1	3	3	3

1-Slight, 2-Moderate, 3-Substantial, BT-Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		40	50	10			100
CAT2		30	50	10	10		100
CAT3		20	30	30	10	10	100
ESE		40	40	10	10		100

* $\pm 3\%$ may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Programme & Branch	B.Tech &Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisite	s Nil	8	PE	3	0	0	3
December	To provide an incide an utilization of food industrial control			4-			
Preamble Unit – I	To provide an insight on utilization of food industrial waste for Introduction on Waste and disposal strategies:	developing v	aluable produc	is			9
of developing waste, magr waste treatment an	Different Sources of waste from Food Industries and their availability in group by products in India. Characteristics of Industrial Waste and dispossibilitude of waste generation in different food processing industries, im disposal, Strategies for minimizing waste, Application of 3R's and Life	sal strategies nportance of	s : Classificatio waste manag	n of war ement,	ste, ch	aracteri	zation c spects c
	Waste utilization in Cereal Food Industries: tion in Cereal Food Industries: Waste utilization from rice mill – thermation of rice husk- cement preparation and different thermal application n.						
Unit – III	By Products from Oil Seed and Tuber Processing Industri	ies:					9
fertilizer, bio	from Oil Seed and Tuber Processing Industries: Oil processing industries sorbents, waxes, soap stock, cocoa butter replacer. Tuber processing industries are processing industries.	sing industr	ies- Introduction			idi icco	',
•	logas, bakers yeast, bio-ethanol, animal feed, corn syrup, organic acids	s, nutraceutio	cals.				•
Unit - IV	By Products from Animal Product based Industries:						9
Unit - IV By Products bacteriocin.N		opportunitie	s — whey, bio heparin, pepsir	, bio mo	lecule		one
Unit - IV By Products bacteriocin.Nand blood, ke	By Products from Animal Product based Industries: from Animal Product based Industries: Dairy industry - Introduction-leat, fish, poultry processing industries- bio active peptide, protein extra	opportunitie act, gelatin, lualene, fish o	s — whey, bio heparin, pepsir	, bio mo	lecule		one
Unit - IV By Products bacteriocin. And blood, ke pigments. Unit - V Utilization of antioxidants,	By Products from Animal Product based Industries: from Animal Product based Industries: Dairy industry - Introduction- fleat, fish, poultry processing industries- bio active peptide, protein extra eratinform animal hair, bone meal, meat meal, chondroitin sulfate, squ	opportunitie act, gelatin, ualene, fish o te: ts and veget	s — whey, bio heparin, pepsir bil, micro nutrie able industries ats of sugar ind	, bio mo ents- vita –Pectin	olecule amins a a, esser	nd mino	one erals,
Unit - IV By Products bacteriocin. A and blood, ke pigments. Unit - V Utilization of antioxidants,	By Products from Animal Product based Industries: from Animal Product based Industries: Dairy industry - Introduction- fleat, fish, poultry processing industries- bio active peptide, protein extra eratinform animal hair, bone meal, meat meal, chondroitin sulfate, squ Utilization of Fruits, Vegetables and Food Packaging Was Fruits and Vegetables waste: processes for waste utilization from fruit and organic acids. Distillation for production of alcohol, SCP production	opportunitie act, gelatin, ualene, fish o te: ts and veget on, by produc	s — whey, bio heparin, pepsir bil, micro nutrie able industries ats of sugar ind	, bio mo ents- vita –Pectin	olecule amins a a, esser	nd mine	oone erals, 9
Unit - IV By Products bacteriocin. A and blood, ke pigments. Unit - V Utilization of antioxidants,	By Products from Animal Product based Industries: from Animal Product based Industries: Dairy industry - Introduction- fleat, fish, poultry processing industries- bio active peptide, protein extra eratinform animal hair, bone meal, meat meal, chondroitin sulfate, squ Utilization of Fruits, Vegetables and Food Packaging Was Fruits and Vegetables waste: processes for waste utilization from fruir and organic acids. Distillation for production of alcohol, SCP production fraste: Handling and treatment, far waste, incineration of solid food was	opportunitie act, gelatin, ualene, fish o te: ts and veget on, by produc	s — whey, bio heparin, pepsir bil, micro nutrie able industries ats of sugar ind	, bio mo ents- vita –Pectin	olecule amins a a, esser	nd mine	oone erals, 9
By Products bacteriocin. A and blood, ke pigments. Unit - V Utilization of antioxidants, Packaging W TEXT BOOK	By Products from Animal Product based Industries: from Animal Product based Industries: Dairy industry - Introduction- fleat, fish, poultry processing industries- bio active peptide, protein extra eratinform animal hair, bone meal, meat meal, chondroitin sulfate, squ Utilization of Fruits, Vegetables and Food Packaging Was Fruits and Vegetables waste: processes for waste utilization from fruir and organic acids. Distillation for production of alcohol, SCP production fraste: Handling and treatment, far waste, incineration of solid food was	opportunitie act, gelatin, ualene, fish o te: ts and veget on, by produc te and its dis	s — whey, bio neparin, pepsir bil, micro nutrie table industries cts of sugar ind sposal.	, bio mo ents- vita —Pectir ustry. Ha	elecule amins a a, esser andling	nd mine	one erals, 9 s, d
By Products bacteriocin. A and blood, ke pigments. Unit - V Utilization of antioxidants, Packaging W TEXT BOOK	By Products from Animal Product based Industries: from Animal Product based Industries: Dairy industry - Introduction- fleat, fish, poultry processing industries- bio active peptide, protein extra eratinform animal hair, bone meal, meat meal, chondroitin sulfate, squ Utilization of Fruits, Vegetables and Food Packaging Was Fruits and Vegetables waste: processes for waste utilization from fruit and organic acids. Distillation for production of alcohol, SCP production fraste: Handling and treatment, far waste, incineration of solid food was Eso Oreopoulou & Winfried Russ, "Utilization of By-Products and Treatmence and Business Media, USA, 2006.	opportunitie act, gelatin, ualene, fish o te: ts and veget on, by produc te and its dis	s — whey, bio neparin, pepsir bil, micro nutrie table industries cts of sugar ind sposal.	, bio mo ents- vita —Pectir ustry. Ha	elecule amins a a, esser andling	nd mine	one erals, 9 s, d
By Products bacteriocin. A and blood, ke pigments. Unit - V Utilization of antioxidants, Packaging W TEXT BOOK 1. Vas Science REFERENCI	By Products from Animal Product based Industries: from Animal Product based Industries: Dairy industry - Introduction- fleat, fish, poultry processing industries- bio active peptide, protein extra eratinform animal hair, bone meal, meat meal, chondroitin sulfate, squ Utilization of Fruits, Vegetables and Food Packaging Was Fruits and Vegetables waste: processes for waste utilization from fruit and organic acids. Distillation for production of alcohol, SCP production fraste: Handling and treatment, far waste, incineration of solid food was Eso Oreopoulou & Winfried Russ, "Utilization of By-Products and Treatmence and Business Media, USA, 2006.	opportunitie act, gelatin, ualene, fish o te: ts and veget on, by produc te and its dis	s — whey, bio neparin, pepsir bil, micro nutrie able industries able industries ats of sugar indusposal.	n, bio mo ents- vita —Pectin ustry. Ha	elecule amins a a, esser andling	nd mine	one erals, 9 s, d

COURSE On comple		_	ırse, the s	tudents w	/ill be ab	le to							BT Mappe (Highest Le		
CO1	classif	y food wa	aste and ex	xplain the	strategie	s for waste	minimiz	ation				U	nderstandin	g (K2)	
CO2	utilize	utilize the wastes from cereal industries for developing byproducts											Applying (K3)		
CO3	make	use of wa	astes from	oilseeds a	nd tuber	processing	g industri	ies for d	evelopii	ng byprod	ducts		Applying (ł	(3)	
CO4	utilize	the anim	al processi	ng industr	ies waste	e for develo	oping by	oroducts	6				Applying (ł	(3)	
CO5	apply	the conce	ept of wast	e utilizatio	n of fruit a	and vegeta	able, sug	ar and p	ackagir	ng industi	ies		Applying (F	(3)	
					Мар	ping of Co	Os with	POs an	d PSOs	,					
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	1	1	1			1			1		2	2	2	
CO2	3	2	1			2	2			1		2	3	2	
CO3	3	2	1			2	2			1		2	3	2	
CO4	3	2	1			2	2			1		2	3	2	
CO5	3	2	1			2	2			1		2	3	2	

		ASSESSMENT	PATTERN -	THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	40	40				100
CAT3	20	60	20				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

1 – Slight, 2 – Moderate, 3 – Substantial, BT-Bloom's Taxonomy

D		ı					
Programme & Branch	B.Tech &Food Technology	Sem.	Category	L	T	Р	Credi
Prerequisites	Nil	8	PE	3	0	0	3
Preamble	To give the knowledge about the plant layout and de	esign considerations, diffe	rent hazards a	and In	dustri	al safety	
Unit - I	Introduction and Plant Location:						9
considerations - planning of the feasibility report alternate location	assifications of food industries - Plant design concepts differences in design of food processing and non-forstudy - collection of information - information flow disceptant location: Factors affecting plant location, the ons. Plant size: Economic plant size - factors affecting market - return on investments. Procedures for expringes	ood processing plants. For agrams — market analys ir interaction with plant for ting the plant size - raw	easibility studis, technical ocation, theo materials a	ly: Sto analy ry mo ivailat	eps in sis an odels f pility, i	volved i d prepa or evalu market o	ncludin ration on ation of demand
Unit - II	Plant Layout, Equipment selection and Utilities:						9
controls- consider water closets, somethic series of the control, and sanitization, CIF construction marks Code, Roof Inspector of the construction of the constructio	titilities: Process equipment - material handling equipment involved in equipment selection. Services and sinks, parking lots, exercise area. Office Layout. Linguistic Food Plant Building and Construction: ding: General requirements and considerations for consult prevention, illumination in food plants. Requirer eyesystem, dust removal and fire protection. Material terial: Stainless steel, Aluminum, Nickel and Monel, Placetion, Care of Concrete floors. Colour Coding: Colour Scheme for pipes. Industrial Safety and Safety Performance:	Utilities: Estimation of See Balancing and Line bastruction, materials and florents of the steam, refiles of construction and coastic Materials. Maintenar	rvices such a alancing Tech cors. Drains a rigeration, wa blour coding: nce of Food F	and drater, Char	feteria s rain lay electric racteris Buildin	yout. Vecity, Clestics of	9 ntilation aning suitably Colou
	: Process industries, potential hazards, toxic chemicals	s and physical safety anal	vsis high nre	esure	hiah	tempera	_
operation, radioa	active materials, safe handling and operation of maching procedures, periodic inspection and safety procedures.	neries. Safety Performanc	e: Safety App	raisa	l, effe	ctive step	os to
Unit - V	Accidents, Health Hazards and Legal Aspects:						9
causes of injury protection. Hea	istrial accidents-accident costs-identification of accident machines – accident prevention – accident Hazards And Legal Aspects: Health hazards – oworking environments – parliamentary legislation pensation Act.	cident proneness – voca occupational – industrial	tional guidan health hazar	ce, fi ds – I	re pre health	vention standaı	and fire
							Total:4
TEXT BOOK:							
1. Sean M	loran , "Process plant layout", 2nd Edition, Butterworth-	Helnemann, New York, 20)17.				
REFERENCES:							
	ev panda , "Industrial Safety Health Environment and S	and with all the first and the same			D - II- :	0040	
1. Basude	ev panua , industriai Salety Health Environment and S	ecurity, 1st Edition, Laxin	i publications	, New	Deini,	2013.	
George	e D.Saravacor, Athanasios E.Kostropoulos, "Design Foer,New York , 2012.		•				

Antonio Lopez-Gomez, Gustavov.Barbosa-Canovas, "Food Plant Design", 1st Edition, CRC Press, New Delhi, 2005.

3.

	SE OUTCOMES: uppletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	identify suitable plant location and feasibility for food Industries.	Applying (K3)
CO2	select suitable plant layout for food processing industries	Applying (K3)
CO3	infer the requirements of food industry and food process equipment construction	Understanding (K2)
CO4	apply the acquired knowledge for prevention of industrial hazards	Applying (K3)
CO5	outline the health hazards and legal aspects in industries	Understanding (K2)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3			1	1			1		1	1	3
CO2	3	2	3			1	2			1		1	1	3
CO3	3	2	3			3	2			1		2	1	3
CO4	3	1	3			3	3			1		1	1	3
CO5	3	1	2			3	2			1		3	1	2

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

		ASSESSIVIEN	I PALIENN - I	HEORI			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluati ng(K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	60	20				100
CAT3	20	40	40				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Programme Branch	B.Tech &Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisite	es Nil	8	PE	3	0	0	3
Dragonahla	To use describes of the second contract of a second contract.	turnal harain ann ann a matail					
Preamble	To understand the management aspects of agricult	turai business and retail (operations.				
Unit - I	Introduction on Agribusiness and Marketing:						9
Marketing ar of productio	Structure, Features of agribusiness, Importance of agribusi and distribution in Agribusiness: Marketing of agriculture inpon, consumption and marketable surplus of agribusiness on management of agricultural products; marketing agencie Export and Financial in Agribusiness:	puts, models and theorie in India. Distribution m	s of agricultura	al mark	eting, (Chara	acteristics
	of pricing policies, Marketing policies and practice for agr						
requirement agribusiness banks, regio	ts, steps and issues, Selection of market and channels to fagribusiness unit, Working capital management - concess, inventory for agribusiness. agribusiness financing system on al rural banks, NABARD	ept and components of w	orking capital	, need t	for wor	king	capital in ercial
Unit - III	Small scale Agribusiness and Retailing:						9
modern agrifor retailers,	e Industry in Indian Economy, Development: definition, in iculture. Overview of retailing: Concept of retailing, importa , types of retail markets, Forms of retailing: direct mark	ance of developing and a	pplying retail	strateg	y, strat	egic	options
modern agri- for retailers, demographic Unit - IV Retail mana importance, planning ret	iculture. Overview of retailing: Concept of retailing, importate, types of retail markets, Forms of retailing: direct markings and lifestyles, consumer decision making process. Retail Management and Planning: agement: definition, importance and elements, functions classification of retail planning, steps in planning, identificatil strategy mix, food-oriented retailers. Managing retail by	ance of developing and a keting, electronic retailing as of retail manager, R fication of consumer cha	pplying retail g, Retailing i etail planning racteristics ar	strategy mplicat : defin	y, strations o	egic f con chara	options sumer 9 cteristics rations in
modern agrifor retailers, demographic Unit - IV Retail mana importance, planning retasset manag	iculture. Overview of retailing: Concept of retailing, importate, types of retail markets, Forms of retailing: direct markings and lifestyles, consumer decision making process. Retail Management and Planning: agement: definition, importance and elements, functions classification of retail planning, steps in planning, identification.	ance of developing and a keting, electronic retailing as of retail manager, R fication of consumer cha	pplying retail g, Retailing i etail planning racteristics ar	strategy mplicat : defin	y, strations o	egic f con chara	options sumer 9 cteristics rations in
modern agrifor retailers, demographic Unit - IV Retail mana importance, planning retasset manag Unit - V Organization	iculture. Overview of retailing: Concept of retailing, important, types of retail markets, Forms of retailing: direct markings and lifestyles, consumer decision making process. Retail Management and Planning: agement: definition, importance and elements, functions classification of retail planning, steps in planning, identificatil strategy mix, food-oriented retailers. Managing retail by gement, blueprint of retail business operation.	ance of developing and a keting, electronic retailings of retail manager, R fication of consumer chabusiness: Setting up ret	etail planning racteristics ar ail organizatio	strategy mplicat : defin nd need n, Stra	y, strations o	egic f con chara nside Profit	options sumer 9 cteristics rations in model of 9 nctions
modern agrifor retailers, demographic Unit - IV Retail mana importance, planning ret asset manaç Unit - V Organization of leader, typ	iculture. Overview of retailing: Concept of retailing, important, types of retail markets, Forms of retailing: direct markings and lifestyles, consumer decision making process. Retail Management and Planning:	ance of developing and a keting, electronic retailings of retail manager, R fication of consumer chabusiness: Setting up ret	etail planning racteristics ar ail organizatio	strategy mplicat : defin nd need n, Stra	y, strations o	egic f con chara nside Profit	options sumer 9 cteristics rations in model of
modern agrifor retailers, demographic Unit - IV Retail mana importance, planning retasset manag Unit - V Organization of leader, typ	iculture. Overview of retailing: Concept of retailing, importate, types of retail markets, Forms of retailing: direct markings and lifestyles, consumer decision making process. Retail Management and Planning: agement: definition, importance and elements, functions classification of retail planning, steps in planning, identificatily strategy mix, food-oriented retailers. Managing retail trail strategy mix, food-oriented retailers. Managing retail trail gement, blueprint of retail business operation. Retail Organization and Directing: n-definition, characteristics, importance, steps in retail organizes of communication, Nature of communication.	ance of developing and a keting, electronic retailing as of retail manager, R fication of consumer chabusiness: Setting up retailing anization process, Direction	etail planning racteristics ar ail organization	strateg mplicat : defin nd need n, Stra ion, lea	y, strations o	egic f con chara nside Profit	9 cteristics rations in model of 9 nctions
modern agrifor retailers, demographic Unit - IV Retail manaimportance, planning retasset manag Unit - V Organization of leader, typ	iculture. Overview of retailing: Concept of retailing, important, types of retail markets, Forms of retailing: direct markings and lifestyles, consumer decision making process. Retail Management and Planning:	ance of developing and a keting, electronic retailing as of retail manager, R fication of consumer chabusiness: Setting up retailing anization process, Direction	etail planning racteristics ar ail organization	strateg mplicat : defin nd need n, Stra ion, lea	y, strations o	egic f con chara nside Profit	9 cteristics rations in model of 9 nctions
modern agrifor retailers, demographic Unit - IV Retail mana importance, planning retasset manac Unit - V Organization of leader, type	iculture. Overview of retailing: Concept of retailing, importary, types of retail markets, Forms of retailing: direct markings and lifestyles, consumer decision making process. Retail Management and Planning:	ance of developing and a keting, electronic retailing as of retail manager, R fication of consumer chabusiness: Setting up retailing anization process, Direction	etail planning racteristics ar ail organization	strateg mplicat : defin nd need n, Stra ion, lea	y, strations o	egic f con chara nside Profit	9 cteristics rations in model of 9 nctions
modern agrifor retailers, demographic Unit - IV Retail manaimportance, planning retasset manag Unit - V Organization of leader, type TEXT BOOK 1. Da Lea REFERENC	iculture. Overview of retailing: Concept of retailing, importary, types of retail markets, Forms of retailing: direct markings and lifestyles, consumer decision making process. Retail Management and Planning:	ance of developing and a keting, electronic retailing as of retail manager, R fication of consumer chabusiness: Setting up retailing anization process, Directors, Directors, Principles of Manager, R	etail planning racteristics ar ail organization ting: Supervis	strateg mplicat : defin nd need in, Stra ion, lea	y, strations o	egic f con Chara Chara nside Profit p, fur	options sumer 9 cteristics rations in model of 9 nctions Total:45
modern agrifor retailers, demographic Unit - IV Retail mana importance, planning retasset manag Unit - V Organization of leader, typ TEXT BOOK 1. Da Lea REFERENC 1. Ba 20 2	iculture. Overview of retailing: Concept of retailing, importary, types of retail markets, Forms of retailing: direct markings and lifestyles, consumer decision making process. Retail Management and Planning:	ance of developing and a keting, electronic retailing as of retail manager, R fication of consumer chabusiness: Setting up retailing anization process, Directors, Directors, Principles of Management, 11th Edition	etail planning retail planning racteristics ar ail organization ting: Supervise anagement", 1	strateg mplicat : defin nd need n, Stra ion, lea	y, strations o ition, cds, Contegic Fadershi	egic f con chara chara nside Profit p, fur	options sumer 9 cteristics rations ir model of partions Total:45

	SE OUTCOMES: upletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	outline the importance of agribusiness industry, working of retailing works and factors influencing it	Understanding (K2)
CO2	summarize the contribution of small scale agri-industry and sustainable competitive advantage throughoptimization of available resources	Understanding (K2)
CO3	plan and identifying more insight about consumer buying segment	Applying (K3)
CO4	make use of good communication, team-building, leadership and applied management skills to developa business	Applying (K3)
CO5	develop management skills relevant for human capital use and plan merchandise presentation to influence customer's buying decision	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2								1	1	2		2
CO2	3	2								2	1	2		2
CO3	3	2	1							1	1	2		2
CO4	3	2	1							2	2	2		2
CO5	3	2	2							2	2	2		2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

		AGGEGGMENT	I AI I EININ -	IIILOINI			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70					100
CAT2	20	60	20				100
CAT3	20	40	40				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Programme & Branch	B.Tech &Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	8	PE	3	0	0	3
Preamble	To provide knowledge on treatment of different industrial e	effluents					
Unit - I	Physical Methods:						9
Physical Metho	assification and characterization of wastes from different ds: Principles of Screening – Mixing, Equalization – Sedir vaporation- Adsorption– Principles, - Membrane separation-	mentation - Filtra	tion, back wa	ashin	g – A	ccelera	ated gravit
Unit - II	Chemical Methods:						9
	ds: Principles of Chemical treatment – Coagulation, floccular extraction, ozonation, advances oxidation/reduction –disinf		n, floatation.	lon e	xchan	ge, El	ectrolytic
Unit - III	Aerobic Biological Treatment:						9
process: aerobio	ment - Aerobic: Objectives of biological treatment – signific suspended growth treatment process-activated sludge produced growth treatment process-trickling filters.						
process: aerobic aerobic attache Unit - IV Biological Treatr	c suspended growth treatment process-activated sludge produced growth treatment process-trickling filters. Anaerobic Biological Treatment: nent- Anaerobic: Suspended growth treatment process-anaerobic suspended growth treatment process-anaerobic.	cess, aerated lag	oons, stabiliz	ation	ponds	s, oxid	ation ditch
process: aerobic aerobic attache Unit - IV Biological Treatr	suspended growth treatment process-activated sludge produced growth treatment process-trickling filters. Anaerobic Biological Treatment:	cess, aerated lag robic digestion, U anded bed.	oons, stabiliz	ation	ponds	s, oxid	ation ditch
process: aerobic aerobic attache Unit - IV Biological Treatr treatment proces Unit - V Solid Waste Mathermal reduction	suspended growth treatment process-activated sludge product growth treatment process-trickling filters. Anaerobic Biological Treatment: nent- Anaerobic: Suspended growth treatment process-anaeross-Rotating biological contactors anaerobic, filter process exp	robic digestion, Upanded bed. Plant: sludge digestion be, Briquetting. De	SAB reactors , sludge conesign Aspects	Anae	erobic ing, section	attach	9 edgrowth 9 dewatering
process: aerobic aerobic attache Unit - IV Biological Treatr treatment proces Unit - V Solid Waste Mathermal reduction	c suspended growth treatment process-activated sludge product growth treatment process-trickling filters. Anaerobic Biological Treatment: nent- Anaerobic: Suspended growth treatment process-anaeros-Rotating biological contactors anaerobic, filter process exp Solid Waste Management and Design of Wastewater Panagement: Sludge treatment process- sludge thickening, n and disposal of sludge. Composting, incineration, Pyrolysi	robic digestion, Upanded bed. Plant: sludge digestion be, Briquetting. De	SAB reactors , sludge conesign Aspects	Anae	erobic ing, section	attach	g edgrowth g dewatering t operation
process: aerobic aerobic attache Unit - IV Biological Treatr treatment proces Unit - V Solid Waste Mathermal reductio and processes -	c suspended growth treatment process-activated sludge product growth treatment process-trickling filters. Anaerobic Biological Treatment: nent- Anaerobic: Suspended growth treatment process-anaeros-Rotating biological contactors anaerobic, filter process exp Solid Waste Management and Design of Wastewater Panagement: Sludge treatment process- sludge thickening, n and disposal of sludge. Composting, incineration, Pyrolysi	robic digestion, Upanded bed. Plant: sludge digestion being, Briquetting. Dein, clarifier, filters, o	SAB reactors , sludge conesign Aspects	Anae	erobic ing, s ection ckene	attach	g edgrowth g dewatering t operation
process: aerobic aerobic attache Unit - IV Biological Treatr treatment proces Unit - V Solid Waste Mathermal reduction and processes - TEXT BOOK: 1. Metcalf REFERENCES:	suspended growth treatment process-activated sludge product growth treatment process-trickling filters. Anaerobic Biological Treatment: nent- Anaerobic: Suspended growth treatment process-anaeross-Rotating biological contactors anaerobic, filter process exposolid Waste Management and Design of Wastewater Panagement: Sludge treatment process- sludge thickening, in and disposal of sludge. Composting, incineration, Pyrolysi Design of water treatment plant units — aerators, flocculation	robic digestion, Upanded bed. Plant: sludge digestion is, Briquetting. Dean, clarifier, filters, of	SAB reactors , sludge conesign Aspects	Anaedition: Selend thi	ponds erobic ing, s ection ckene	attach	9 edgrowth 9 dewatering t operation Total:4
process: aerobic aerobic attache Unit - IV Biological Treatr treatment proces Unit - V Solid Waste Mathermal reduction and processes - TEXT BOOK: 1. Metcalf REFERENCES: Qasim	suspended growth treatment process-activated sludge product growth treatment process-trickling filters. Anaerobic Biological Treatment: nent- Anaerobic: Suspended growth treatment process-anaeros-Rotating biological contactors anaerobic, filter process exp Solid Waste Management and Design of Wastewater Panagement: Sludge treatment process- sludge thickening, in and disposal of sludge. Composting, incineration, Pyrolysi Design of water treatment plant units — aerators, flocculation	robic digestion, Upanded bed. Plant: sludge digestion is, Briquetting. Dean, clarifier, filters, of	SAB reactors , sludge conesign Aspects	Anaedition: Selend thi	ponds erobic ing, s ection ckene	attach	edgrowth 9 dewatering toperation Total:4

	E OUTCOMES: upletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	identify different industrial wastes and choose appropriate physical method of treatment	Applying (K3)
CO2	select suitable chemical method for waste water treatment	Applying (K3)
CO3	outline waste water treatment by aerobic method	Understanding (K2)
CO4	interpret anaerobic treatment of industrial effluent	Understanding (K2)
CO5	plan a wastewater treatment unit and manage solid waste	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1		2	3			1		1	1	2
CO2	3	1	1	1		2	3			1		1	1	2
CO3	3	2	1	1		2	3			1		1	1	2
CO4	3	2	1	1		2	3			1		1	1	2
CO5	3	1	2	2		2	3			1		2	1	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	50	30				100
CAT3	20	50	30				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22FTE29- ANALYTICAL INSTRUMENTS IN	אטטאו שטטא	KIES				
Programme Branch	e & B.Tech &Food Technology	Sem.	Category	L	Т	Р	Credi
Prerequisit	tes Food chemistry	8	PE	3	0	0	3
Preamble	To provide knowledge on role of analytical instruments in fo	od industries.					
Unit - I	Spectrometry:						9
electromagi	etry: Classification of Instrumental methods— Electromagnetic netic radiation with matter. Colorimetry and Visible spectrometry as. Ultra violet spectroscopy — Theory, instrumentation - Single and amental Vibrations, Instrumentation, Applications.	- Theory, Block of	liagram aspe	cts of	Instr	umenta	tion and
Unit - II	NMR spectroscopy, Flame photometery and Thermal me	ethods:					9
photometer	etroscopy &Flame photometery: NMR spectroscopy - Principle, r: Principle, Instrumentation and applications. Thermal method I Scanning Calorimetry, Instrumentation and Applications.	, Chemical shift, ds — Thermogra	Instrumenta vimetry, Diffe	tion, erentia	applical the	cations ermal a	. Flame malysis
Unit - III	XRD, Atomic Absorption Spectroscopy, Polarimetry and	d Refractometry:					9
Atomic Abs	omic Absorption Spectroscopy: X-ray diffraction Principle, Instrume sorption Spectroscopy: Theory, Instrumentation, applications. Postical activity, refractive index. Principle and instrumentation, Saccha	olarimetry and R	efractometry:				
Atomic Absorbtain, op: Unit - IV Conductant	sorption Spectroscopy: Theory, Instrumentation, applications. Policical activity, refractive index, Principle and instrumentation. Saccha Conductance, Potential measurements and Electrophoree, Potential measurements and Electrophoresis: Definitions, conductance, Potential measurements and Electrophoresis: Definitions and Potential measurements and Electrophoresis: Definitions and Electrophoresis: Definitions and Potential measurements and Electrophoresis: Definitions and Potential measurements and Electrophoresis: Definitions and Potential measurements and Potential measurements and Potential measurements and Potential measurements and P	olarimetry and Rarimetry- Analysis resis: uctance measure	efractometry: of Sugar. ments, applic	Intro	duction	es, adv	specifi 9 vantage
Atomic Absorbation, op Unit - IV Conductand and disadva	sorption Spectroscopy: Theory, Instrumentation, applications. Policical activity, refractive index, Principle and instrumentation. Saccha Conductance, Potential measurements and Electrophore	olarimetry and Rarimetry- Analysis resis: uctance measure determination, Po	efractometry: of Sugar. ments, applic otentiometric	Intro ations Titration	duction	es, adv	specifi 9 vantage
Atomic Absorbation, op Unit - IV Conductand and disadva	sorption Spectroscopy: Theory, Instrumentation, applications. Potentical activity, refractive index, Principle and instrumentation. Saccha Conductance, Potential measurements and Electrophorece, Potential measurements and Electrophoresis: Definitions, conductances of Conductometric titrations. Potential measurements: pH	olarimetry and Rarimetry- Analysis resis: uctance measure determination, Po	efractometry: of Sugar. ments, applic otentiometric	Intro ations Titration	duction	es, adv	specifion specifion specification specificat
Atomic Absorbed Total To	sorption Spectroscopy: Theory, Instrumentation, applications. Political activity, refractive index, Principle and instrumentation. Saccha Conductance, Potential measurements and Electrophorese, Potential measurements and Electrophoresis: Definitions, conductances of Conductometric titrations. Potential measurements: pH iples of electrophoresis, theory and application of paper, starch gel,	olarimetry and Rarimetry- Analysis resis: uctance measure determination, Po agarose, PAGE a	efractometry: of Sugar. ments, applic otentiometric and SDS –PA	Intro ations Titrations GE.	s, Typons. E	es, adv	9 vantage phoresis
Atomic Absorber of Atomic Absorber of Absorber of Absorber of Atomic Absorber of Atomic Atomic Atomic Atomic Absorber of Atomic Atomic Atomic Atomic Atomic Atomic Atomic Absorber of Atomic Absorber of Atomic Atom	sorption Spectroscopy: Theory, Instrumentation, applications. Policical activity, refractive index, Principle and instrumentation. Saccha Conductance, Potential measurements and Electrophorese, Potential measurements and Electrophoresis: Definitions, conductantages of Conductometric titrations. Potential measurements: pH iples of electrophoresis, theory and application of paper, starch gel, Chromatographic Techniques: Iraphic Techniques: Paper chromatography, Thin Layer Chromatography	olarimetry and Rarimetry- Analysis resis: uctance measure determination, Po agarose, PAGE a	efractometry: of Sugar. ments, applic otentiometric and SDS –PA	Intro ations Titrations GE.	s, Typons. E	es, adv Electrop	specifi 9 vantage phoresis
Atomic Absorber of Atomic Absorber of Absorber of Absorber of Atomic Absorber of Atomic Atomic Atomic Atomic Absorber of Atomic Atomic Atomic Atomic Atomic Atomic Atomic Absorber of Atomic Absorber of Atomic Atom	sorption Spectroscopy: Theory, Instrumentation, applications. Policical activity, refractive index, Principle and instrumentation. Saccha Conductance, Potential measurements and Electrophores. Definitions, conductantages of Conductometric titrations. Potential measurements: pH iples of electrophoresis, theory and application of paper, starch gel, Chromatographic Techniques: Iraphic Techniques: Paper chromatography, Thin Layer Chromatography, Gas chromatography, HPLC- Principle, Reverse and Normal	olarimetry and Rarimetry- Analysis resis: uctance measure determination, Po agarose, PAGE a	efractometry: of Sugar. ments, applic otentiometric and SDS –PA	Intro ations Titrations GE.	s, Typons. E	es, adv Electrop	specifi 9 vantage phoresis
Atomic Absorber rotation, op Unit - IV Conductand and disadva Basic princi Unit - V Chromatogram of Chromatogr	sorption Spectroscopy: Theory, Instrumentation, applications. Policical activity, refractive index, Principle and instrumentation. Saccha Conductance, Potential measurements and Electrophores. Definitions, conductantages of Conductometric titrations. Potential measurements: pH iples of electrophoresis, theory and application of paper, starch gel, Chromatographic Techniques: Iraphic Techniques: Paper chromatography, Thin Layer Chromatography, Gas chromatography, HPLC- Principle, Reverse and Normal	olarimetry and Rarimetry- Analysis resis: uctance measure determination, Po agarose, PAGE a raphy, Column Ch Phase, Instrumer	efractometry: of Sugar. ments, applic otentiometric and SDS –PA romatography tation and Ap	ations Titrations GE.	s, Typons. I	es, adv Electrop	9 vantage phoresis 9 Total:4
Atomic Absorber rotation, op Unit - IV Conductand and disadva Basic princi Unit - V Chromatogram of Chromatogr	sorption Spectroscopy: Theory, Instrumentation, applications. Potical activity, refractive index, Principle and instrumentation. Saccha Conductance, Potential measurements and Electrophore. ce, Potential measurements and Electrophoresis: Definitions, conductantages of Conductometric titrations. Potential measurements: pH iples of electrophoresis, theory and application of paper, starch gel, Chromatographic Techniques: Irraphic Techniques: Paper chromatography, Thin Layer Chromatography, Gas chromatography, HPLC- Principle, Reverse and Normal McK: Inatwal, Gurdeep R & Anand, Sham K, "Instrumentation Methods of Co. 103.	olarimetry and Rarimetry- Analysis resis: uctance measure determination, Po agarose, PAGE a raphy, Column Ch Phase, Instrumer	efractometry: of Sugar. ments, applic otentiometric and SDS –PA romatography tation and Ap	ations Titrations GE.	s, Typons. I	es, adv Electrop	specifi 9 vantage phoresis 9 Total:4
Atomic Absorber Atomic Absorber Aborber Absorber	Sorption Spectroscopy: Theory, Instrumentation, applications. Potical activity, refractive index, Principle and instrumentation. Saccha Conductance, Potential measurements and Electrophorece, Potential measurements and Electrophoresis: Definitions, conductant and Electrophoresis: Definitions, et al. (Electrophoresis, theory and application of paper, starch gel, Chromatographic Techniques: Chromatographic Techniques: Traphic Techniques: Paper chromatography, Thin Layer Chromatography, Gas chromatography, HPLC- Principle, Reverse and Normal Methods of Co. CES: Koog Douglas A., West Donald M., Holler F James & Crouch Stardition, South-Western, Australia, 2000.	olarimetry and Rarimetry- Analysis resis: uctance measure determination, Po agarose, PAGE a raphy, Column Ch Phase, Instrumer Chemical Analysis	efractometry: of Sugar. ments, applicate of SDS – PA romatography tation and Ap ", Himalaya P	ations Titratic GE. - Ge plicat ublica	rypons. I	es, adv Electrop neation Bomba	9 vantage phoresis 9 Total:4
Atomic Abstrotation, op Unit - IV Conductant and disadva Basic princi Unit - V Chromatograthrom	sorption Spectroscopy: Theory, Instrumentation, applications. Portical activity, refractive index, Principle and instrumentation. Saccha Conductance, Potential measurements and Electrophorice, Potential measurements and Electrophoresis: Definitions, conductant and Electrophoresis: Definiti	olarimetry and Rarimetry- Analysis resis: uctance measure determination, Po agarose, PAGE a raphy, Column Ch Phase, Instrumer Chemical Analysis	efractometry: of Sugar. ments, applicate of SDS – PA romatography tation and Ap ", Himalaya P	ations Titratic GE. - Ge plicat ublica	rypons. I	es, adv Electrop neation Bomba	9 vantage phoresis 9 Total:4

	SE OUTCOMES: npletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	summarize the interaction of electromagnetic radiation with matter and UV-Visible, IR usage	Understanding (K2)
CO2	apply AAS, NMR & Thermal techniques to analyze different food materials.	Applying (K3)
CO3	utilize X- ray diffraction, flame photometery and Polarimetry techniques to analyse food materials	Applying (K3)
CO4	make use of conductance, potential measurement and electrophoresis for analysis and separation of components.	Applying (K3)
CO5	outline analysis of food materials by different chromatographic techniques	Understanding (K2)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		3	2					1		2	1	3
CO2	3	3		2	2					1		2	1	3
CO3	3	3		3	2					1		2	1	3
CO4	3	3		2	2					1		2	1	3
CO5	3	3		3	2					1		2	1	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

		ASSESSMEN	I PATTERN - I	HEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	20	60				100
CAT3	20	60	20				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

		22FTX01- BAKING TECHNOLO	GY					
		(Offered by Department of Food Tech	nology)					
Progra Branci	amme & h	All BE/BTech Engineering & Technology branches except Food Technology	Sem.	Category	L	Т	Р	Credit
Prereq	Juisites	Nil	5	OE	3	0	2	4
Pream	hle	To gain knowledge on science and technology of various bakery	products					
Unit -		Science Behind Baking:	products					9
functio		Baking: Current status of Bakery Industry in India, Classification east, sugar, fat, egg, water, salt, coloring agents, flavoring agents, moreover						nd their
Unit -		Bakery Equipment:						9
		ling of ingredients- dough mixers, dividers, rounder, sheeter, lamin ovens and slicers. Rheology of dough-Farinograph, Amylograph, A					sures	and
Unit -		Bread Making Process:						9
dough,	, activated	ocess: Chemistry of dough development. Bread making methods dough development, Chorley wood bread process. No time prors. Bread defects/faults and remedies. Spoilage of bread-Causes,	cess Chara	acteristics of	good			
Unit -	IV	Biscuit and cookies:						9
modifie	ed dough a	es: Comparison of Biscuits and Cookies, Types of Dough - Deve nd batters. Methods of biscuit and cookie manufacture. Stability o						
manuf	V and other acture, Fau	Cakes and other bakery products: bakery products: Cake — Types, Cake making- Ingredients and tilts in cake manufacture, Miscellaneous bakery products producti						
Unit - Cakes manufa bakery	vand other acture, Fau	Cakes and other bakery products: bakery products: Cake — Types, Cake making- Ingredients and t						of cakes
Unit - Cakes manufa bakery	and other acture, Fau products, (Cakes and other bakery products: bakery products: Cake — Types, Cake making- Ingredients and talts in cake manufacture, Miscellaneous bakery products production Quality attributes of bakery products.						of cakes
Unit - Cakes manufabakery	and other acture, Fau products, (Cakes and other bakery products: bakery products: Cake — Types, Cake making- Ingredients and talts in cake manufacture, Miscellaneous bakery products production Quality attributes of bakery products. See / Experiments:						of cakes
Unit - Cakes manufabakery List of	and other acture, Fau products, (Cakes and other bakery products: bakery products: Cake — Types, Cake making- Ingredients and talts in cake manufacture, Miscellaneous bakery products production Quality attributes of bakery products. Pes / Experiments: On of quality parameters of bakery ingredients.						of cakes
Unit - Cakes manufabakery List of 1.	and other acture, Fau products, (f Exercise Estimation Determin	Cakes and other bakery products: bakery products: Cake — Types, Cake making- Ingredients and talts in cake manufacture, Miscellaneous bakery products production Quality attributes of bakery products. Pes / Experiments: On of quality parameters of bakery ingredients. On of wet and dry gluten content of wheat flour.						of cakes
Unit - Cakes manufabakery List of 1. 2.	and other acture, Fau products, (acture) f Exercise Estimation Determine	Cakes and other bakery products: bakery products: Cake — Types, Cake making- Ingredients and talts in cake manufacture, Miscellaneous bakery products production Quality attributes of bakery products. es / Experiments: on of quality parameters of bakery ingredients. on of wet and dry gluten content of wheat flour. nation of dough rising capacity of yeast.	on - Wafers	s, puff pastry,				of cakes
Unit - Cakes manufabakery List of 1. 2. 3. 4.	and other acture, Fau products, (see Estimation Determine Estimation Estimati	Cakes and other bakery products: bakery products: Cake — Types, Cake making- Ingredients and talts in cake manufacture, Miscellaneous bakery products production Quality attributes of bakery products. es / Experiments: on of quality parameters of bakery ingredients. on of wet and dry gluten content of wheat flour. nation of dough rising capacity of yeast. on of diastatic activity and maltose value of flour	on - Wafers	s, puff pastry,				of cakes
Unit - Cakes manufabakery List of 1. 2. 3. 4. 5.	and other acture, Fau products, of Exercise Estimation Determine Estimation Estimation Estimation Estimation Preparate	Cakes and other bakery products: bakery products: Cake — Types, Cake making- Ingredients and talts in cake manufacture, Miscellaneous bakery products production Quality attributes of bakery products. es / Experiments: on of quality parameters of bakery ingredients. on of wet and dry gluten content of wheat flour. nation of dough rising capacity of yeast. on of diastatic activity and maltose value of flour on of water absorption power, alkaline water retention and sediment	on - Wafers	s, puff pastry,				of cakes
Unit - Cakes manufabakery List of 1. 2. 3. 4. 5.	and other acture, Fau products, of Exercise Estimation Determine Estimation Estimation Preparate	Cakes and other bakery products: bakery products: Cake — Types, Cake making- Ingredients and talts in cake manufacture, Miscellaneous bakery products production Quality attributes of bakery products. Pas / Experiments: On of quality parameters of bakery ingredients. On of wet and dry gluten content of wheat flour. Ination of dough rising capacity of yeast. On of diastatic activity and maltose value of flour on of water absorption power, alkaline water retention and sedimention and analysis of bread.	on - Wafers	s, puff pastry,				of cakes
Unit - Cakes manufabakery List of 1. 2. 3. 4. 5. 6.	and other acture, Fau products, of Exercise Estimation Determine Estimation Estimation Preparate Preparate	Cakes and other bakery products: bakery products: Cake — Types, Cake making- Ingredients and talts in cake manufacture, Miscellaneous bakery products production Quality attributes of bakery products. Pes / Experiments: In of quality parameters of bakery ingredients. In of wet and dry gluten content of wheat flour. Ination of dough rising capacity of yeast. In of diastatic activity and maltose value of flour In of water absorption power, alkaline water retention and sediment ion and analysis of bread. It is not a making to the products of the pr	on - Wafers	s, puff pastry,				of cakes
List of 1. 2. 3. 4. 5. 6.	and other acture, Fau products, of Exercise Estimation Determine Estimation Preparate Preparate Preparate Preparate	Cakes and other bakery products: bakery products: Cake — Types, Cake making- Ingredients and talts in cake manufacture, Miscellaneous bakery products production Quality attributes of bakery products. Pes / Experiments: On of quality parameters of bakery ingredients. On of wet and dry gluten content of wheat flour. Ination of dough rising capacity of yeast. On of diastatic activity and maltose value of flour On of water absorption power, alkaline water retention and sedimention and analysis of bread. It ion and analysis of biscuits. It ion and analysis of cake.	on - Wafers	s, puff pastry,				of cakes
Unit - Cakes manufabakery List of 1. 2. 3. 4. 5. 6. 7. 8. 9.	and other acture, Fau products, of Exercise Estimation Determine Estimation Preparate Preparate Preparate Preparate	Cakes and other bakery products: bakery products: Cake — Types, Cake making- Ingredients and talts in cake manufacture, Miscellaneous bakery products production Quality attributes of bakery products. Pes / Experiments: In of quality parameters of bakery ingredients. In of wet and dry gluten content of wheat flour. In ation of dough rising capacity of yeast. In of diastatic activity and maltose value of flour In of water absorption power, alkaline water retention and sediment ion and analysis of bread. It ion and analysis of cake. It ion and analysis of cookies. It ion and analysis of puff pastry.	tation value	s, puff pastry,	and	chem	cally le	of cakes
List of 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	and other acture, Fau products, of Exercise Estimation Determine Estimation Preparate Preparate Preparate Preparate	Cakes and other bakery products: bakery products: Cake — Types, Cake making- Ingredients and talts in cake manufacture, Miscellaneous bakery products production Quality attributes of bakery products. Pes / Experiments: In of quality parameters of bakery ingredients. In of wet and dry gluten content of wheat flour. In ation of dough rising capacity of yeast. In of diastatic activity and maltose value of flour In of water absorption power, alkaline water retention and sediment ion and analysis of bread. It ion and analysis of cake. It ion and analysis of cookies. It ion and analysis of puff pastry.	tation value	e of flour.	and	chem	cally le	of cakes
List of 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	and other acture, Fau products, of Exercise Estimation Determine Estimation Preparate	Cakes and other bakery products: bakery products: Cake — Types, Cake making- Ingredients and talts in cake manufacture, Miscellaneous bakery products production Quality attributes of bakery products. Pes / Experiments: In of quality parameters of bakery ingredients. In of wet and dry gluten content of wheat flour. In ation of dough rising capacity of yeast. In of diastatic activity and maltose value of flour In of water absorption power, alkaline water retention and sediment ion and analysis of bread. It ion and analysis of cake. It ion and analysis of cookies. It ion and analysis of puff pastry.	tation value	e of flour.	and	chem	cally le	of cakes
Unit - Cakes manufabakery List of 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	and other acture, Fau products, of Exercise Estimation Determine Estimation Preparate	Cakes and other bakery products: bakery products: Cake — Types, Cake making- Ingredients and talts in cake manufacture, Miscellaneous bakery products production Quality attributes of bakery products. es / Experiments: on of quality parameters of bakery ingredients. on of wet and dry gluten content of wheat flour. nation of dough rising capacity of yeast. on of diastatic activity and maltose value of flour on of water absorption power, alkaline water retention and sedimention and analysis of bread. ion and analysis of biscuits. ion and analysis of cookies. ion and analysis of puff pastry.	tation value	e of flour.	and	chem	cally le	of cakes
Unit - Cakes manufabakery List of 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. TEXT I	and other acture, Fau products, of Exercise Estimation Determine Estimation Preparate	Cakes and other bakery products: bakery products: Cake — Types, Cake making- Ingredients and talts in cake manufacture, Miscellaneous bakery products production Quality attributes of bakery products. es / Experiments: on of quality parameters of bakery ingredients. on of wet and dry gluten content of wheat flour. nation of dough rising capacity of yeast. on of diastatic activity and maltose value of flour on of water absorption power, alkaline water retention and sedimention and analysis of bread. ion and analysis of biscuits. ion and analysis of cookies. ion and analysis of puff pastry.	tation value	e of flour.	and l:15,	chem	cally le	of cakes

	SE OUTCOMES:	BT Mapped
On cor	npletion of the course, the students will be able to	(Highest Level)
CO1	outline the role of ingredients for production of bakery products	Understanding (K2)
CO2	select appropriate equipment for baking process	Applying (K3)
CO3	identify and apply processing techniques for bread manufacturing process	Applying (K3)
CO4	choose suitable processing techniques for preparation of biscuits and cookies	Applying (K3)
CO5	make use of various methods for cakes, wafers and pastry	Applying (K3)
CO6	analyze the quality of ingredients used for in preparation of bakery products	Analyzing (K4), Precision (S3)
CO7	evaluate the quality of flour based on gluten content, sedimentation value and diastatic activity	Evaluating (K5), Precision (S3)
CO8	prepare bakery product and evaluate it sensory characteristics	Evaluating (K5), Precision (S3)

COs/POs	PO1	PO2	PO3	PO4	PO5	P06	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1									2		
CO2	3	2	1		1	1						2		
CO3	3	3	2	1	1	1						2		
CO4	3	3	2	1	1	1						2		
CO5	3	3	2	1	1	1						2		
CO6	3	3	2	3		1			3	2	2	1		
CO7	3	3	2	3		1			3	2	2	2		
CO8	3	3	3	3		1			3	2	2	2		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	30	35	35				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	(Offered by Department of Food T	Technology)					
Programme & Branch	All BE/BTech Engineering & Technology branches except Food Technology	Sem.	Category	L	Т	Р	Credi
Prerequisites	Nil	5	OE	3	1	0	4
Preamble	To provide insight about the processing and preservation me	thods used for	r various food	mate	rials.		
Unit - I	Introduction:						9+3
	science and technology, Food - Definitions and functions, Sonstituents of foods, RDA, malnutrition and balanced diet. period.						
Unit - II	Ambient Temperature Processing:						9+3
Size reduction of theory and equip	of solids, size reduction of liquids, mixing, forming, separation- oments.	centrifugation	n, filtration, ex	tracti	on, con	centra	tion -
Unit - III	High Temperature preservation:						9+3
Sterilization - in	inciples and methods - Canning& retorting, — flowsheet, blar- container and UHT sterilization, evaporation and distillation - the						
Sterilization - in mechanism and Unit - IV Introduction-nee	-container and UHT sterilization, evaporation and distillation - the	eory and equorinciple and e	ipments, dryir	ng an	d dehyd	dration	9+3
Sterilization - in- mechanism and Unit - IV Introduction-nee cold storage. Co Unit - V	-container and UHT sterilization, evaporation and distillation - the types. Low Temperature preservation: d &methods - Chilling and Freezing - theory and equipments, portrolled atmosphere and modified atmosphere storage, Freeze or Food Fermentation and Irradiation	eory and equorinciple and econcentration.	ipments, dryir	ng and	d dehyd	dration	9+3 d and 9+3
Sterilization - in- mechanism and Unit - IV Introduction-nee cold storage. Co Unit - V Theory of fermer vinegar - role in	-container and UHT sterilization, evaporation and distillation - the types. Low Temperature preservation: d &methods - Chilling and Freezing - theory and equipments, portrolled atmosphere and modified atmosphere storage, Freeze or Food Fermentation and Irradiation ntation, Types of Fermentation, equipments, effect on foods, equipments, effect on foods, equipments, equipments	principle and econcentration.	effect on food products - soy ect on food ma	quali	ity, refrigere, curd,	gerated	9+3 d and 9+3
Sterilization - in- mechanism and Unit - IV Introduction-nee cold storage. Co Unit - V Theory of fermer vinegar - role in Theory and mec	-container and UHT sterilization, evaporation and distillation - the types. Low Temperature preservation: d &methods - Chilling and Freezing - theory and equipments, portrolled atmosphere and modified atmosphere storage, Freeze or Food Fermentation and Irradiation Intation, Types of Fermentation, equipments, effect on foods, fermentation, health.	principle and econcentration.	effect on food products - soy ect on food ma	quali	ity, refrigere, curd,	gerated	9+3 d and 9+3 kraut,
Sterilization - in- mechanism and Unit - IV Introduction-nee cold storage. Co Unit - V Theory of fermer vinegar - role in Theory and mec Total:60 TEXT BOOK:	-container and UHT sterilization, evaporation and distillation - the types. Low Temperature preservation: d &methods - Chilling and Freezing - theory and equipments, portrolled atmosphere and modified atmosphere storage, Freeze or Food Fermentation and Irradiation Intation, Types of Fermentation, equipments, effect on foods, fermentation, health.	principle and econcentration. mented food particles in foods, effe	effect on food products - soy ect on food ma	quali saud sterial	ity, refrig ee, curd, s.	gerated	9+3 d and 9+3 kraut,
Sterilization - in mechanism and Unit - IV Introduction-nee cold storage. Co Unit - V Theory of fermed vinegar - role in Theory and mechanism and mechanism. Total:60 TEXT BOOK:	-container and UHT sterilization, evaporation and distillation - the types. Low Temperature preservation: d &methods - Chilling and Freezing - theory and equipments, portrolled atmosphere and modified atmosphere storage, Freeze of Food Fermentation and Irradiation Intation, Types of Fermentation, equipments, effect on foods, fer human health. thanism of action, sources of irradiation, equipments, applications	principle and econcentration. mented food particles in foods, effe	effect on food products - soy ect on food ma	quali saud sterial	ity, refrig ee, curd, s.	gerated	9+3 d and 9+3 kraut,
Sterilization - in mechanism and Unit - IV Introduction-nee cold storage. Co Unit - V Theory of fermed vinegar - role in Theory and mechanism and mechanism and mechanism and mechanism are sterile in Fellows REFERENCES:	-container and UHT sterilization, evaporation and distillation - the types. Low Temperature preservation: d &methods - Chilling and Freezing - theory and equipments, portrolled atmosphere and modified atmosphere storage, Freeze of Food Fermentation and Irradiation Intation, Types of Fermentation, equipments, effect on foods, fer human health. thanism of action, sources of irradiation, equipments, applications	eory and equential equenti	effect on food products - soy ect on food ma L	quali sauc	ity, refrig ee, curd, s. re: 45,	gerated sauer Tutor	9+3 d and 9+3 kraut, ial:15,

	SE OUTCOMES: uppletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	classify different sources and types of food products	Understanding (K2)
CO2	explain various ambient temperature processing of foods	Understanding(K2)
CO3	select suitable high temperature preservation techniques	Applying (K3)
CO4	make use of various low temperature food preservation techniques	Applying (K3)
CO5	classify the types of fermentation, irradiation and interpret their role on food quality	Understanding (K2)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1		1				1		1		
CO2	3	3	1	1		1				1		1		
CO3	3	3	2	1		1				1		1		
CO4	3	3	2	1		1				1		1		
CO5	3	3	1	1		1				1		1		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

		/ 100 L 0 0 111 L 1 1 1					
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6)	Total %
CAT1	40	60					100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	60	20				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

		(Offered by Department of Food	Technology)					
Progran	mme &	All BE/BTech Engineering & Technology branches						
Branch		except Food Technology	Sem.	Category	L	T	Р	Credit
Prerequ	uisites	Nil	6	OE	3	0	2	4
Preamb	ole	To impart the knowledge on milk processing and to exploit ne	ew uses for milk a	nd its compor	nents			
Unit - I		Processing of market milk:						9
		eption, chilling, clarification, and storage of raw milk. Homogeniz synchronization of homogenization with HTST; Pasteurization o						oriesof
Unit - II	l	Manufacture of special milks:						9
		d recombined milks, Flavoured milks, homogenized/ vitaminized ing approaches for sterilization of packages. Filling systems.	d milks. Lactose-	hydrolysed m	ilk. As	eptic p	oackag	ing:
Unit - II	II	Manufacture of Coagulated products:						9
approac channa Unit - I \	ches and I V	eer: Preparation and preservation; Prospects for mechanization integration with emerging technologies, Physico-chemical chemical chemical of technology of fat-rich dairy products: Butter manufacturing, over-run in butter, control of fat loss, defe	nanges during m	anufacture a	nd st	orage	of par	neer and
		nnovations in ghee manufacturing process, packaging of ghee; N						,
Unit - V	/	Manufacture of Cheese:						9
osses	Exercise Preparat	, Swiss, Mozzarella, Cottage cheese, Changes during manufact coessing and handling; Manufacture of processed Cheese, Cheeses / Experiments: ion of homogenized market milk. ion of sterilized milk.						
List of 1. 2. 3. 4. 5. 6. 7.	Exercise Preparate Preparate Preparate Preparate Preparate Preparate Preparate Preparate	es / Experiments: ion of homogenized market milk. ion of sterilized milk. ion of flavoured milk ion of fermented milk ion of yoghurt. ion of channa.						
List of 1. 2. 3. 4. 5. 6. 7. 8.	Exercise Preparate	es / Experiments: ion of homogenized market milk. ion of sterilized milk. ion of flavoured milk ion of fermented milk ion of yoghurt. ion of khoa. ion of paneer.						
List of 1. 2. 3. 4. 5. 6. 7.	Exercise Preparate	es / Experiments: ion of homogenized market milk. ion of sterilized milk. ion of flavoured milk ion of fermented milk ion of yoghurt. ion of khoa. ion of paneer. ion of butter.						
List of 1. 2. 3. 4. 5. 6. 7. 8. 9.	Exercise Preparate	es / Experiments: ion of homogenized market milk. ion of sterilized milk. ion of flavoured milk ion of fermented milk ion of yoghurt. ion of khoa. ion of paneer.						
List of 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	Exercise Preparate	es / Experiments: ion of homogenized market milk. ion of sterilized milk. ion of flavoured milk ion of fermented milk ion of yoghurt. ion of channa. ion of paneer. ion of ghee. actical:15, Total:60	ese spread and P	rocessed Che	eese f			
List of 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. Lecture	Exercise Preparate	es / Experiments: ion of homogenized market milk. ion of sterilized milk. ion of flavoured milk ion of fermented milk ion of yoghurt. ion of khoa. ion of paneer. ion of butter. ion of ghee.	ese spread and P	rocessed Che	eese f			
List of 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. Lecture TEXT B 1.	Exercise Preparate	es / Experiments: ion of homogenized market milk. ion of sterilized milk. ion of flavoured milk ion of fermented milk ion of yoghurt. ion of channa. ion of paneer. ion of ghee. actical:15, Total:60	ese spread and P	rocessed Che	eese f			
List of 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. Lecture TEXT B 1. REFER	Exercise Preparate	es / Experiments: ion of homogenized market milk. ion of sterilized milk. ion of flavoured milk ion of fermented milk ion of yoghurt. ion of channa. ion of paneer. ion of ghee. actical:15, Total:60	ese spread and P	rocessed Che	eese f			
List of 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. Lecture TEXT B 1.	Exercise Preparate	es / Experiments: ion of homogenized market milk. ion of sterilized milk. ion of flavoured milk ion of fermented milk ion of yoghurt. ion of channa. ion of paneer. ion of butter. ion of ghee. actical:15, Total:60	Jniversity Press,	New Delhi, 20	olon.			

COURS	SE OUTCOMES:	BT Mapped
On con	pletion of the course, the students will be able to	(Highest Level)
CO1	understand various aspects of milk process operations and physico-chemical properties of milk	Understanding (K2)
CO2	make use of technical knowledge in manufacture of special milks.	Applying (K3)
CO3	utilize technical knowledge in manufacture of coagulated milk products.	Applying (K3)
CO4	apply the technical knowledge in manufacture of fat rich dairy products.	Applying (K3)
CO5	make use of technical knowledge in manufacture of cheese and cheese products.	Applying (K3)
CO6	utilize the technical knowledge in preparation of homogenized milk	Applying (K3)
CO7	utilize the technical knowledge in preparation of paneer.	Applying (K3)
CO8	utilize the technical knowledge in preparation of butter.	Applying (K3)

	Mapping of COS with FOS and FSOS													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1			1						1	2	1
CO2	3	2	2		2	1						2	3	2
CO3	3	2	2		2	2		1				2	3	3
CO4	3	2	2			2		1				2	3	2
CO5	3	2	2			2		1				2	3	2
CO6	3	2							3	2		1	3	2
CO7	3	2							3	2		1	3	2
CO8	3	2	1			1		1	3	2		1	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

	ASSESSMENT FATTERN - THEORT												
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %						
CAT1	40	40	20				100						
CAT2	40	40	20				100						
CAT3	40	40	20				100						
ESE	40	40	20				100						

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

		(Offered by Department of Food T	echnology)					
Progr Branc	amme & h	All BE/BTech Engineering & Technology branches except Food Technology	Sem.	Category	L	Т	Р	Credi
Prere	quisites	Nil	6	OE	3	0	2	4
Prean	nble	To provide the outline about physiology, post harvest change vegetables products	s, preservation	and processir	ng of va	ariou	s fruits	and
Unit -	ı	Physiology and post harvest changes of fruits and vegeta	ables:					9
	ological Dev	and Vegetables Processing Industry in India and World-preservelopment, Harvesting methods, Postharvest changes of fruits a						
Unit -	II	Preprocessing Operations and Storage Methods:						9
		orative Cooling, Washing, Peeling, Grading, Blanching. Storagens, low temperature storage.	methods: Stora	ige of fruit and	d veget	able	s - und	er
Unit -		Preservation of Fruits and Vegetables products:	0			(0.1	0) 14 1	9
Atmos	pheric Stor	g, Pasteurization, Sterilization, Irradiation, Waxing, Edible coating (MAS).	ng, Controlled A	tmospheric S	torage	(CA	S),Mod	-1
Unit -		Fruit beverages: fruit beverages, Juice, Squash, cordial, Juice concentrate,	nectar Ready	to Serve (PT	rs) F	rme	nted fr	9 uit
bever	ages – Wir	ne, vinegar production. Juice making equipment.	nectar, ready	to derve (it	10). 1 6	,,,,,	inted ii	uit
Unit -		Processing of fruits and vegetables products:	<u> </u>					9
		ermediate Moisture Foods (IMF) - jam, jellies and marmalades, owder, Fermented vegetables products – Pickle, sauerkraut.	Defects in Jam	and Jelly. Ca	andled	pres	erve, 11	uitbar,
		<u> </u>						
List c	f Exercise	es / Experiments :						
1.	Studies o	on blanching treatment on the fruits and vegetables						
1. 2.		on blanching treatment on the fruits and vegetables ation and comparison of peeling efficiency of different peeling m	ethods					
	Determin		ethods					
2.	Determin Studies o	ation and comparison of peeling efficiency of different peeling m	ethods					
2.	Determin Studies o	ation and comparison of peeling efficiency of different peeling mon waxing /edible coating of fruits and vegetables	ethods					
2. 3. 4.	Determin Studies of Preparati	ation and comparison of peeling efficiency of different peeling mon waxing /edible coating of fruits and vegetables on and analysis of squash	ethods					
2. 3. 4. 5.	Determin Studies of Preparati Determin Preparati	ation and comparison of peeling efficiency of different peeling mon waxing /edible coating of fruits and vegetables ion and analysis of squash ation of juice extraction efficiency of screw press and pulper	ethods					
 2. 3. 4. 5. 6. 	Determin Studies of Preparati Determin Preparati	ation and comparison of peeling efficiency of different peeling mon waxing /edible coating of fruits and vegetables ion and analysis of squash ation of juice extraction efficiency of screw press and pulper ion of jam and comparison with commercial product	ethods					
 2. 3. 4. 5. 6. 7. 	Determin Studies of Preparati Determin Preparati Preparati Preparati	ation and comparison of peeling efficiency of different peeling mon waxing /edible coating of fruits and vegetables on and analysis of squash ation of juice extraction efficiency of screw press and pulper on of jam and comparison with commercial product on of jelly	ethods					
2. 3. 4. 5. 6. 7. 8.	Determin Studies of Preparati Determin Preparati Preparati Preparati	ation and comparison of peeling efficiency of different peeling mon waxing /edible coating of fruits and vegetables ion and analysis of squash lation of juice extraction efficiency of screw press and pulper ion of jam and comparison with commercial product ion of jelly ion of fruit bar	ethods					
2. 3. 4. 5. 6. 7. 8. 9.	Determin Studies of Preparati Determin Preparati Preparati Preparati Preparati	ation and comparison of peeling efficiency of different peeling mon waxing /edible coating of fruits and vegetables ion and analysis of squash ation of juice extraction efficiency of screw press and pulper ion of jam and comparison with commercial product ion of jelly ion of fruit bar ion and study on characteristics of sauce.	ethods	Le	ecture	: 45	, Prac	ctical:1
2. 3. 4. 5. 6. 7. 8. 9. 10.	Determin Studies of Preparati Determin Preparati Preparati Preparati Preparati	ation and comparison of peeling efficiency of different peeling mon waxing /edible coating of fruits and vegetables ion and analysis of squash ation of juice extraction efficiency of screw press and pulper ion of jam and comparison with commercial product ion of jelly ion of fruit bar ion and study on characteristics of sauce.	ethods	Le	ecture	: 45	i, Prac	ctical:1
2. 3. 4. 5. 6. 7. 8. 9. 10. Total	Determin Studies of Preparati Determin Preparati Preparati Preparati Preparati Preparati Preparati Studies of Preparati	ation and comparison of peeling efficiency of different peeling mon waxing /edible coating of fruits and vegetables ion and analysis of squash ation of juice extraction efficiency of screw press and pulper ion of jam and comparison with commercial product ion of jelly ion of fruit bar ion and study on characteristics of sauce.						
2. 3. 4. 5. 6. 7. 8. 9. 10. Total TEXT 1.	Determin Studies of Preparati Determin Preparati Preparati Preparati Preparati Preparati Preparati Studies of Preparati	ation and comparison of peeling efficiency of different peeling mon waxing /edible coating of fruits and vegetables from and analysis of squash fruits and screw press and pulper from of juice extraction efficiency of screw press and pulper from of jam and comparison with commercial product from of jelly from of fruit bar from and study on characteristics of sauce. It is a sample of the fruit powder fruit						
2. 3. 4. 5. 6. 7. 8. 9. 10. Total TEXT 1. REFE	Determin Studies of Preparati Determin Preparati Preparati Preparati Preparati Preparati Preparati Preparati Preparati RENCES: Rajarat	ation and comparison of peeling efficiency of different peeling mon waxing /edible coating of fruits and vegetables from and analysis of squash fruits and screw press and pulper from of juice extraction efficiency of screw press and pulper from of jam and comparison with commercial product from of jelly from of fruit bar from and study on characteristics of sauce. It is a sample of the fruit powder fruit	rinciples and Pr	actices", 3rd E	Edition,	CBS	S Publis	shers &
2. 3. 4. 5. 6. 7. 8. 9. 10. Total TEXT 1. REFE 1.	Determin Studies of Preparati Determin Preparati Preparati Preparati Preparati Preparati Preparati Preparati Preparati Rences: Rences:	ation and comparison of peeling efficiency of different peeling mean waxing /edible coating of fruits and vegetables from and analysis of squash fruits and screw press and pulper from of juice extraction efficiency of screw press and pulper from of jam and comparison with commercial product from of jelly from of fruit bar from and study on characteristics of sauce. In and analysis of fruit powder In and analysis of fruit powder In and R.P & Sanjeev Kumar, "Fruit and Vegetable Preservation: Petors, New Delhi, 2014. In and S & Ramteke R.S, "Advances in Preservation and Process, New India Publishing Agency, New Delhi, 2011.	rinciples and Pr	actices", 3rd E	Edition,	CBS getal	S Publis	shers &

CO2	select suitable storage and pre processing for fruits and vegetables	Applying (K3)
CO3	choose suitable preservation techniques employed for fruits and vegetables	Applying (K3)
CO4	make use of techniques to process different fruit beverages	Applying (K3)
CO5	develop various fruits and vegetable products	Applying (K3)
CO6	interpret the changes of fruits and vegetables upon blanching	Analyzing (K4), Manipulation (S2)
CO7	assess the performance of fruit processing equipments	Evaluating (K5), Precision (S3)
CO8	prepare and evaluate the characteristics of fruit/ vegetable based products	Evaluating (K5), Precision (S3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1			1						1	2	1
CO2	3	2	2		2	1						2	3	2
CO3	3	2	2		2	2		1				2	3	3
CO4	3	2	2			2		1				2	3	2
CO5	3	2	2			2		1				2	3	2
CO6	3	2							3	2		1	3	2
CO7	3	2							3	2		1	3	2
CO8	3	2	1			1		1	3	2		1	3	2

^{1 -} Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	40	20				100
CAT2	40	40	20				100
CAT3	40	40	20				100
ESE	40	40	20				100

^{* ±3%} may be varied (CAT 1,2,3 - 50 marks & ESE - 100 marks)

	(Offered by Department of Food T	echnology)					
Programme & Branch	All BE/BTech Engineering & Technology branches except Food Technology	Sem.	Category	L	т	Р	Credit
Prerequisites	NIL	7	OE	3	0	0	3
	T						
Preamble	To give insight on food hazards, safety aspect in food proces	sing and regula	itions on food	safety	•		1
chemical and bid	Introduction: Introd	s of food spoilag					
Unit - II	Physical and Chemical food hazard :						9
Major pathways	(soil, engine oil, stones), plant (leaves, twigs, pods and skins) by which chemical residues and contaminants enter the food as equipment and ingredient impurities. Food Adulterants, Food	chain, Agroche	micals and ve	eterina	ry dru	igs, pa	ackaging
Unit - III	Safety operations in Food processing :						9
	 Sanitizers, Cleaning chemistry CIP, Sanitation equipment. Per r Food Safety. HACCP-Concepts, implementation. Safety and regione. 						
Unit - IV	Safety Aspects of Water:						9
contaminated w	of drinking water (microbiological and chemical) - the epidemiater, risks and advantages of chlorination of water, bottled water of guideline values (microbiological and chemical), Regulations	ter - origin of w	ater- nutrition				
Unit - V	Food Safety Regulations:						9
	Safety Regulation. Food safety and Standards Act (FSSAI) – followed - Enforcement of the act – Licensing and registration						
principles to be powers. Food s						r and	
principles to be powers. Food s TEXT BOOK:	followed - Enforcement of the act – Licensing and registration afety Management Systems.	n of food busir	ess – Food s	afety	office	r and f	their
rext Book: Schmid	followed - Enforcement of the act - Licensing and registration	n of food busir	ess – Food s	afety	office	r and f	their
TEXT BOOK: 1. Schmid REFERENCES:	followed - Enforcement of the act – Licensing and registration afety Management Systems. dt, R.H. and Rodrick, G.E. "Food Safety Handbook" 2nd Edition, C.	n of food busin	ons Inc, New	Jersy,	2005.	Tot	al:45
TEXT BOOK: 1. Schmid REFERENCES: 1. Kees A CRC F	followed - Enforcement of the act – Licensing and registrational fety Management Systems. At, R.H. and Rodrick, G.E. "Food Safety Handbook" 2nd Edition, C. A. van der Heijden "International Food Safety Handbook: Science Press, 1999.	n of food busin John Wiley & S e, International	ons Inc, New Regulation, a	Jersy,	2005.	Tot	al:45
TEXT BOOK: 1. Schmid REFERENCES: 1. Kees A CRC F Rajesh	followed - Enforcement of the act – Licensing and registration afety Management Systems. St, R.H. and Rodrick, G.E. "Food Safety Handbook" 2nd Edition, C.A. van der Heijden "International Food Safety Handbook: Science	n of food busin John Wiley & S e, International	ons Inc, New Regulation, a	Jersy,	2005.	Tot	al:45
TEXT BOOK: 1. Schmid REFERENCES: 1. Kees A CRC F 2. Rajest Editior	followed - Enforcement of the act – Licensing and registration afety Management Systems. At, R.H. and Rodrick, G.E. "Food Safety Handbook" 2nd Edition, C. A. van der Heijden "International Food Safety Handbook: Science Press, 1999. Mehta and J. George "Food Safety Regulation Concerns and Total, Macmillan India Ltd., New Delhi, 2005. OMES:	n of food busin John Wiley & S e, International	ons Inc, New Regulation, a	Jersy,	2005. ntrol",	Tot 1st Ec	al:45
TEXT BOOK: 1. Schmid REFERENCES: 1. Kees A CRC F 2. Rajesh Editior COURSE OUTC On completion	followed - Enforcement of the act – Licensing and registrational fety Management Systems. Att, R.H. and Rodrick, G.E. "Food Safety Handbook" 2nd Edition, Cares, 1999. Mehta and J. George "Food Safety Regulation Concerns and Total Macmillan India Ltd., New Delhi, 2005.	n of food busin John Wiley & S e, International Frade- The Dev	ons Inc, New Regulation, a	Jersy,	2005. ntrol", specti	Tot 1st Ec ve", 1s Mapp mest Le erstan	dition, st
TEXT BOOK: 1. Schmid REFERENCES: 1. Kees A CRC F 2. Rajest Edition COURSE OUTC On completion CO1 outline	followed - Enforcement of the act – Licensing and registration afety Management Systems. At, R.H. and Rodrick, G.E. "Food Safety Handbook" 2nd Edition, C.A. van der Heijden "International Food Safety Handbook: Science Press, 1999. Mehta and J. George "Food Safety Regulation Concerns and Total Macmillan India Ltd., New Delhi, 2005. OMES: of the course, the students will be able to	n of food busin John Wiley & S e, International Frade- The Dev	ons Inc, New Regulation, a	Jersy,	2005. ntrol", specti High Und	Tot 1st Eco ve", 1st Mapp nest Loerstan (K2) erstan	dition, st ed evel) ding
TEXT BOOK: 1. Schmid REFERENCES: 1. Kees A CRC F 2. Rajest Edition COURSE OUTC On completion CO1 outline CO2 interpr	followed - Enforcement of the act – Licensing and registration afety Management Systems. At, R.H. and Rodrick, G.E. "Food Safety Handbook" 2nd Edition, Concerns and Topics, 1999. Mehta and J. George "Food Safety Regulation Concerns and Topics, Macmillan India Ltd., New Delhi, 2005. OMES: of the course, the students will be able to the concept of food safety and appraise on microbial food safety	n of food busing John Wiley & Se, International Trade- The Dev	ons Inc, New Regulation, a	Jersy,	2005. ntrol", specti BT (High Und	Tot Tot 1st Ec ve", 1s Mapphest Le erstan (K2) erstan (K2) pplyin	dition, st ed evel) ding ding
TEXT BOOK: 1. Schmid REFERENCES: 1. Kees A CRC F 2. Rajest Edition COURSE OUTC On completion CO1 outline CO2 interpr CO3 identify	followed - Enforcement of the act – Licensing and registration afety Management Systems. At, R.H. and Rodrick, G.E. "Food Safety Handbook" 2nd Edition, C.A. van der Heijden "International Food Safety Handbook: Science Press, 1999. Mehta and J. George "Food Safety Regulation Concerns and Total Macmillan India Ltd., New Delhi, 2005. OMES: of the course, the students will be able to the concept of food safety and appraise on microbial food safety et physical and chemical food hazards	n of food busing John Wiley & Se, International Trade- The Dev	ons Inc, New Regulation, a	Jersy,	2005. ntrol", specti High Und Und	Tot Tot 1st Eco ve", 1st Mapphest Leerstan (K2) erstan (K2) erstan (K3) erstan	dition, st ed evel) ding ding
TEXT BOOK: 1. Schmid REFERENCES: 1. Kees A CRC F 2. Rajest Edition COURSE OUTC On completion CO1 outline CO2 interpr CO3 identify CO4 infer the	followed - Enforcement of the act – Licensing and registrational fety Management Systems. At, R.H. and Rodrick, G.E. "Food Safety Handbook" 2nd Edition, C.A. van der Heijden "International Food Safety Handbook: Science Press, 1999. Mehta and J. George "Food Safety Regulation Concerns and Total, Macmillan India Ltd., New Delhi, 2005. OMES: of the course, the students will be able to the concept of food safety and appraise on microbial food safety et physical and chemical food hazards y implementation of suitable safety protocols in food processing	n of food busing John Wiley & Se, International Trade- The Dev	ons Inc, New Regulation, a	Jersy,	2005. ntrol", specti High Und Und	Tot Tot 1st Eco ve", 1st Mapp nest Loerstan (K2) erstan (K3) erstan (K2) erstan (K2) erstan	dition, st ed evel) ding ding g ding
TEXT BOOK: 1. Schmid REFERENCES: 1. Kees A CRC F 2. Rajest Edition COURSE OUTC On completion CO1 outline CO2 interpr CO3 identify CO4 infer the	followed - Enforcement of the act – Licensing and registration afety Management Systems. At, R.H. and Rodrick, G.E. "Food Safety Handbook" 2nd Edition, Ch. van der Heijden "International Food Safety Handbook: Science Press, 1999. Mehta and J. George "Food Safety Regulation Concerns and Total Macmillan India Ltd., New Delhi, 2005. OMES: of the course, the students will be able to the concept of food safety and appraise on microbial food safety et physical and chemical food hazards y implementation of suitable safety protocols in food processing the safety aspects of water	n of food busing John Wiley & Se, International Trade- The Dev	ons Inc, New Regulation, a	Jersy,	2005. ntrol", specti High Und Und	Tot Tot 1st Eco ve", 1st Mapp nest Leerstan (K2) erstan (K2) applyin (K3) erstan (K2)	dition, st ed evel) ding ding g ding
TEXT BOOK: 1. Schmid REFERENCES: 1. Kees A CRC F 2. Rajest Edition COURSE OUTC On completion CO1 outline CO2 interpr CO3 identify CO4 infer the	followed - Enforcement of the act – Licensing and registration afety Management Systems. At, R.H. and Rodrick, G.E. "Food Safety Handbook" 2nd Edition, Ch. van der Heijden "International Food Safety Handbook: Science Press, 1999. Mehta and J. George "Food Safety Regulation Concerns and Total Macmillan India Ltd., New Delhi, 2005. OMES: of the course, the students will be able to the concept of food safety and appraise on microbial food safety et physical and chemical food hazards y implementation of suitable safety protocols in food processing the safety aspects of water	n of food busing John Wiley & Se, International Trade- The Dev	ons Inc, New Regulation, a	Jersy,	2005. ntrol", specti High Und Und	Tot Tot 1st Eco ve", 1st Mapp nest Loerstan (K2) erstan (K3) erstan (K2) erstan (K2) erstan	dition, st ed evel) ding ding g ding

CO1	3	1	3		3	1	1	1	1	
CO2	3	1	3		3	1	2	1	2	
CO3	3	2	3		3	1	2	1	2	
CO4	3	2	3		3	1	2	1	2	
CO5	3	2	3		3	1	2	1	2	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	20	60	20				100
CAT3	40	60					100
ESE	20	60	20				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

			22FTO0	3- FUND	AMENT	ALS OF	FOOD	PACK	AGING A	AND S	TORAGE	į			
				((Offered b	y Depa	rtment o	f Food	Technol	ogy)					
Programn	ne &		BTech En			nology l	oranches	S	5	Sem.	Category	L	Т	Р	Credit
Branch Prerequis	ites	NIL	Food Ted	miology						7	OE	3	0	0	3
Preamble		-				od packa	ging mate	erials, me	ethods a	nd food	storage pı	actices			1
Unit - I			Packaging				anina Da	li		la a.a.d.4h		Damar			9
Definitions Metal pack												- Paper-	oased	раскад	jing,
Unit - II			Packaging												9
Closures Knife Sea Cold Seal	iling. Pe	elable S	Seals - Ad	lhesive, (Cohesive	and De	laminatio	on Peels	s, Heat S	Seal Co					
Unit - III		Packag	ging mate	rials per	formanc	e:									9
ntegration of Packag	issues	. Distribu erials. Ba	tion perfo	rmance te	esting. Pa						to foods. Processes				
Unit - IV	, .		storage e					1				••			9
Storage o affecting preventive	losses,	storage	requiren	nents, ba	ag and b	ulk stora	age – ra	at proof							
Unit - V			/IA & CA												9
			nd Modifie etermination			rage – e	ffects of	nitrogen,	oxygen,	and car	bon dioxid	de on sto	rage o	of durab	le and
· (CRC pre Narayar House,	ess, USA nasamy F	, 2011 (1-	3 units). S and A	Awaknava						dition, Bla				
		na H. "Ini	novations	in Food F	Dackaging	r" 2nd F	dition Ac	ademic	Droce II	SA 2013	2				
	Roberts	on Go	ordon	L, "Pa	ckaging:	Princ			Practice			on, M	larcel	Dek	ker
3.	Nair K.F		c,USA, 20 ated Prod		d Pest Ma	anageme	nt", 1st E	dition, G	Sene-Tec	h Books	s publishe	r, Delhi, 2	2007.		
COURSE On compl	OUTCO	MES:									•		B1	Γ Mapp hest Le	
CO1 6	explain a	about the	functions	and type	s of food	packagin	ng						Under	standin	g (K2)
			able sealin											plying (
			on betwee											standin	
			e storage				neasures	tor pests	5					plying (
CO5 8	adapt st	utadie sto	orage met	nous for (grain stor	age							Ар	plying (NJ)
	T _	_	_	T _	1	oing of C		1		T _	T				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2
CO1	3	2	1					1		1		1			
CO2	3	3	2			1				'		1			

CO3	3	3	2			1	1	1	1	
CO4	3	3	2			1		1	1	
CO5	3	3	2	1	1	1		1	2	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

		ASSESSMEN	IT PATTERN -	THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	60	20				100
CAT3	20	40	40				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

					22FTO04- FC	OD ING	DEDIE	NITC						
				(Off	fered by Depa				oav)					
Program	ıme &	All BE	/BTech Eng		& Technology					0.1		_	_	0 114
Branch		excep	t Food Tech						Sem.	Category		Т	Р	Credit
Prerequi	isites	Nil							8	OE	3	0	0	3
Preamble	e	To pro	vide the kno	owledge a	bout the differe	nt types of	food in	gredient	s used	n food pro	ducts			
Unit - I			Nutrients:											9
Importan	nt carboh	ydrates	as ingredie	ents in foo	es: classification od application. Classification –	Protein a	nd Amir	no acids	s: class	ification, e	ssential	amino		
Unit - II		Food	Additives-I:	:										9
sweetene	ers; Heal cessing;	th implic leavenir	cations; Role	e in food flour impr	cation of food a processing. Stroving agents.	abilizers,	Thicken	ers and	Emuls	ifiers: Intro	duction;	types	; applic	ations in
	lditives-II				ypes; Role in f	ood proce	essina I	Preserva	atives.	ntroduction	n. Clase	ificatio	n- Nati	_
chemical Mode of	l preserva action in	atives; M foods; (lode of actio Chelating ag	on; Role in gents- Nat	n Food processi turally & synthe ole- application	ng. Antiox tic; Mode	idants: I	ntroduct	tion; Ty	oes of anti-	oxidants	-natur	al & syr	nthetic;
Unit - IV			Colorant ar				-	-			-		-	9
application	on in food	ds proce	ssing. Flavo	oring ager	etic food colora nts: Introduction ole of flavoring	n; Classific	ation of	flavors-	natura					ects-
Unit - V		r	ceuticals ar				•							
			hemicals: D	Definition,	Classification. [
Natural o	occurrenc	e of cer	hemicals: D	Definition, nemicals.		avonoids,	omega -	-3 fatty	acids, (arotenoids	, dietary	fiber,	phytoes nutrace	n claims, strogens;
Natural o	occurrenc uticals for	e of cer	hemicals: D	Definition, nemicals.	Classification. I Antioxidants, fla	avonoids,	omega -	-3 fatty	acids, (arotenoids	s, dietary	fiber,	phytoes nutrace	n claims, strogens; uticals.
Natural o Nutraceu	occurrence uticals for DOK:	e of ceri effective	chemicals: D tain phytoch e control of c	Definition, nemicals. Adisease. R	Classification. I Antioxidants, fla	avonoids, iticals on h	omega - nealth. S	-3 fatty a	acids, d	arotenoids effect and i	, dietary nteractic	fiber, ons of r	phytoes nutraced	n claims, strogens; uticals.
Natural of Nutraceu TEXT BC 1.	DOK: Shakunt	e of ceri effective	chemicals: D tain phytoch e control of c	Definition, nemicals. Adisease. R	Classification. I Antioxidants, fla Role of nutraceu	avonoids, iticals on h	omega - nealth. S	-3 fatty a	acids, d	arotenoids effect and i	, dietary nteractic	fiber, ons of r	phytoes nutraced	n claims, strogens; uticals.
TEXT BC 1. REFERE	DOK: Shakunt NewDel	ee of ceri effective tala Man hi, 2008	chemicals: D tain phytoch e control of c ay, N. & Sh	Definition, nemicals. A disease. R	Classification. I Antioxidants, fla Role of nutraceu	avonoids, iticals on h	omega - nealth. S	-3 fatty afety, ad	acids, dverse	arotenoids effect and i	ge Intern	fiber, ons of r	phytoes nutraced	n claims, strogens; uticals.
TEXT BC 1. REFERE 1.	DOK: Shakunt NewDell ENCES: Branen, Wildman	tala Manhi, 2008	chemicals: D tain phytoch e control of c ay, N. & Sh avidson, P.M	Definition, nemicals. A disease. R nadakshar M. & Salmi	Classification. I Antioxidants, fla Role of nutraceu raswamy, "Food inen S, "Food A	avonoids, iticals on h	omega - nealth. S nd Princi	-3 fatty afety, ad ples", 3i	acids, diverse	arotenoids effect and i on, New Ag	ge Intern	fiber, ons of r ationa	phytoes nutraceu 1	n claims, strogens; uticals. Total:45 mited,
TEXT BC 1. REFERE 1. 2.	DOK: Shakunt NewDell ENCES: Branen, Wildman 2nd Edit	tala Man hi, 2008 A.L., Da n, Robertion, CR	chemicals: D tain phytoch e control of c hay, N. & Sh havidson, P.M rt E.C., Rob C Press, Ne	Definition, perintion,	Classification. I Antioxidants, fla Role of nutraceu raswamy, "Food inen S, "Food A	avonoids, iticals on h	omega - nealth. S nd Princi	-3 fatty afety, ad ples", 3i	acids, diverse	arotenoids effect and i on, New Ag	ge Intern	ationa O1. BT	phytoes nutraceu 1	n claims, strogens; aticals. Total:45 mited,
TEXT BO 1. REFERE 1. 2. COURSE On comp	DOK: Shakunt NewDell ENCES: Branen, Wildman 2nd Edit	tala Manhi, 2008 A.L., Dann, Robertion, CRo	chemicals: D tain phytoch e control of c hay, N. & Sh havidson, P.M rt E.C., Rob C Press, Ne	Definition, nemicals. A disease. R nadakshar nadakshar Dert Wildmew York, 2	Classification. I Antioxidants, fla Role of nutraceur raswamy, "Food inen S, "Food A nan & Taylor Coor.	avonoids, iticals on h	omega - nealth. S nd Princi	-3 fatty afety, ad ples", 3i	acids, diverse	arotenoids effect and i on, New Ag	ge Intern	ationa O1. BT (High	phytoes nutraced T I (P) Lir	n claims, strogens; aticals. Total:45 mited, oods",
TEXT BC 1. REFERE 1. 2. COURSE On comp	DOK: Shakunt NewDell ENCES: Branen, Wildman 2nd Edit	tala Manhi, 2008 A.L., Dann, Robertion, CRimacro n	chemicals: Ditain phytochese control of cont	Definition, nemicals. A disease. R nadakshar nadakshar w York, 2 nert Wildman York, 2 nert wildman York, 2 nemts w York, 2 nemts w H infer their	Classification. I Antioxidants, fla Role of nutraceur raswamy, "Food inen S, "Food A nan & Taylor Coor.	d Facts and distinctions on h	omega - nealth. S nd Princi	-3 fatty afety, ad ples", 3i	acids, diverse	arotenoids effect and i on, New Ag	ge Intern	ationa O1. BT (High	phytoes nutraced T I (P) Lir	n claims, strogens; aticals. Fotal:45 mited, oods", ed vel)
TEXT BC 1. REFERE 1. 2. COURSE On comp CO1 CO2	DOK: Shakunt NewDell ENCES: Branen, Wildman 2nd Edit E OUTCO pletion of classify	tala Manhi, 2008 A.L., Dan, Robeltion, CRomacro nee food and	chemicals: Ditain phytoche control of contro	Definition, nemicals. And alsease. Ranadakshar M. & Salmi Deert Wildman York, 2 Sudents was a sude	Classification. I Antioxidants, fla Role of nutraceu raswamy, "Food inen S, "Food A nan & Taylor C 2007. rill be able to r nature	d Facts and distinctions on the distribution of the distribution o	omega - nealth. S ad Princi 2nd Edit (Eds),	-3 fatty afety, ad ples", 3i	acids, diverse	arotenoids effect and i on, New Ag	ge Intern	ationa O1. Funct High Unders	phytoes nutraced T I (P) Lir ional Fe imappe hest Le	n claims, strogens; uticals. Total:45 mited, oods", ed vel) g (K2)
TEXT BC 1. REFERE 1. 2. COURSE On comp CO1 CO2 CO3	DOK: Shakunt NewDell ENCES: Branen, Wildman 2nd Edit E OUTCO pletion of classify apply the	tala Manhi, 2008 A.L., Dan, Robeltion, CRomacro nee food action	chemicals: Detain phytochese control of cont	Definition, nemicals. A disease. R disease.	Classification. I Antioxidants, fla Role of nutraceu raswamy, "Food inen S, "Food A nan & Taylor C 2007. rill be able to r nature e quality of food	d Facts and ditives", C. Wallace	omega - nealth. S d Princi 2nd Edit (Eds),	-3 fatty afety, ad ples", 3r	rd Editi	arotenoids effect and i on, New Ag	ge Intern	ationa O1. Funct (High Unders	phytoes nutraced T I (P) Lir ional F ional F ional F ional F ional F	n claims, strogens; uticals. Fotal:45 mited, oods", ed vel) g (K2) (3)
TEXT BC 1. REFERE 1. 2. COURSE On comp CO1 CO2 CO3 CO4	DOK: Shakunt NewDell ENCES: Branen, Wildman 2nd Edit E OUTCO pletion of classify apply the choose the select the control of the select the control of the select the choose the control of the select the choose the control of the select the control of the choose the choos	tala Manhi, 2008 A.L., Dan, Robertion, CRimacro nue food and the food one	chemicals: Detain phytochese control of cont	Definition, nemicals. A disease. R disease.	Classification. I Antioxidants, fla Role of nutraceu raswamy, "Food inen S, "Food A nan & Taylor C 2007. rill be able to r nature e quality of food the shelf life of the	d Facts and distinct and distin	omega - nealth. S d Princi 2nd Edit (Eds),	-3 fatty afety, ad ples", 3r	rd Editi	arotenoids effect and i on, New Ag	ge Intern	ationa O1. Funct High Unders App App	phytoes nutraced T I (P) Lir Mappe hest Le standing blying (k	n claims, strogens; aticals. Fotal:45 mited, poods", ed vel) g (K2) (3) (3)
TEXT BC 1. REFERE 1. 2.	DOK: Shakunt NewDell ENCES: Branen, Wildman 2nd Edit E OUTCO pletion of classify apply the choose the select the control of the select the control of the select the choose the control of the select the choose the control of the select the control of the choose the choos	tala Manhi, 2008 A.L., Dan, Robertion, CRimacro nue food and the food one	chemicals: Detain phytochese control of cont	Definition, nemicals. A disease. R disease.	Classification. I Antioxidants, fla Role of nutraceural raswamy, "Food inen S, "Food Anan & Taylor Croot. Fill be able to reactive acute acute the shelf life of the prove the acceurance acute acute the shelf life of the prove the acceurance acute acut	d Facts and ditives", C. Wallace di product food product eptability o	omega - nealth. S d Princi 2nd Edit (Eds),	-3 fatty afety, ad ples", 3i ion, Mai "Handbo	rd Editi	arotenoids effect and i on, New Ag	ge Intern	ationa O1. Funct High Unders App App	phytoes nutraced I (P) Lir Mappe hest Le standing blying (k	n claims, strogens; aticals. Fotal:45 mited, poods", ed vel) g (K2) (3) (3)
TEXT BC 1. REFERE 1. 2. COURSE On comp CO1 CO2 CO3 CO4	DOK: Shakunt NewDell ENCES: Branen, Wildman 2nd Edit E OUTCO pletion of classify apply the choose	tala Manhi, 2008 A.L., Dan, Robertion, CRimacro nue food and the food one	chemicals: Detain phytochese control of cont	Definition, nemicals. A disease. R disease.	Classification. I Antioxidants, fla Role of nutraceural raswamy, "Food inen S, "Food Anan & Taylor Coor. Fill be able to requality of food the shelf life of function and nutraceutical radiation."	d Facts and diditives", Wallace diproduct food product eptability of	omega - nealth. S d Princi 2nd Edit (Eds),	-3 fatty afety, ad ples", 3i ion, Mai "Handbo	rd Editi	arotenoids effect and i	ge Intern	ationa O1. Funct High App App Unders	phytoes nutraced I (P) Lir Mappe hest Le standing blying (k	n claims, strogens; aticals. Fotal:45 mited, poods", ed vel) g (K2) (3) (3)
TEXT BC 1. REFERE 1. 2. COURSE On comp CO1 CO2 CO3 CO4 CO5	DOK: Shakunt NewDell ENCES: Branen, Wildman 2nd Edit E OUTCO pletion of classify apply the choose	tala Manhi, 2008 A.L., Dann, Robertion, CRimacro number food and the food contract various and the food contract various various and the food contract various various and the food contract various	chemicals: Detain phytoches control of contr	Definition, nemicals. And adakshar madakshar madakshar madakshar mert Wildmert Wildmer York, 2 mert wild mere york, 2 mere the material infer their material foods are all foods are made and foods are made and foods are mere to improve the material foods are made and foods are mere and foods are me	Classification. I Antioxidants, fla Role of nutraceural raswamy, "Food Anan & Taylor Coor. Fill be able to requality of food the shelf life of the prove the acceural nutraceutical mapping of Coors.	d Facts and diditives", Wallace diproduct food product eptability of	omega - nealth. S ad Princi 2nd Edit (Eds), uct f the foo	-3 fatty afety, adely, adely, adely, adely, adely, adely afety, adely afety, adely afety and adely ade	acids, diverse	arotenoids effect and i	ge Intern York, 200 cals and	ationa O1. Funct High App App Unders	phytoes nutraced I (P) Lir ional Fe Mappe hest Le standing blying (k blying (k	n claims, strogens; uticals. Fotal:45 mited, oods", ed vel) g (K2) (3) (3)

CO3	3	1	2		2		1	1	
CO4	3	1	2		2	1	1	2	
CO5	3	1	2		2	1	1	2	

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSI	MENIT	DATTED	м ти	
AOOFOOI	VI (IV I	PALIFR	1 4 - 1 \square	CUR I

		ACCECCINENT	I ATTENN	····EOIX ·			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6)	Total %
CAT1	20	60	20				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

							RITION						
			(C	Offered by D	Department	of Food	Techno	logy)					
Programm Branch		BE/BTech E			logy branche	es	S	Sem.	Category	L	Т	Р	Credit
Prerequisi	ites Nil							8	OE	3	0	0	3
Preamble		mpart know	ledge on in	mportance of	f nutrients an	d its assi	milation,	, ener	gy in humar	n nutritio	n and	nutrition	during
Unit - I		oduction to											9
Recomme	nded Dietary	Allowances	s for Indiar	ns, Uses an	s of Deriving Ind Imitations If disease. Full	of RDA.	Nutritio	nal st	atus and its	s assess	ment,		on,
Unit - II	Dig	estion, abso	orption and	d Transport	of Carbohy	drates :							9
intolerance		and Non-gly			e, intestine. D recommenda								se
Unit - III	Dig	estion, abso	orption and	d Transport	t of Lipids a	nd Prote	ins:						9
acids; tran	ns fatty acid	, Health eff	ects and re	ecommende	Functions of the Functi	lipids. Di	gestion a	and al	osorption of	fproteins	3;		fatty
Unit - IV	Ene	rgy in Hum	an nutritio	on:									9
					ergy Require			y and	excess, De	eterminat	ion of	Energy	infood,
		, specific dy	namic action	on of foods,	Obesity and	BMI calcu	ılations.						
supplemer supplemer	be consideration, Lactary foods.	rition during lered in matrit nutritional n	g life cycle eal/menu ional requi eeds of too	planning. Firements, broddlers, preso	Obesity and Pregnancy -Pregnancy	lutritiona infant fo going c	l require	Infanc	y - nutrition	al requi	emen	ts. Intro	duction of
Factors to supplemer supplemer Nutrition -	be consider thation, Lacta tary foods. Factors affect	rition during lered in matrit nutritional n	g life cycle eal/menu ional requi eeds of too	planning. Firements, broddlers, preso	Pregnancy -Neast feeding, chool, schoo	lutritiona infant fo going c	l require	Infanc	y - nutrition	al requi	emen	ts. Intro agemen	diet and
Factors to supplemer supplemer Nutrition -	be considered by the considered by the constant of the constan	rition during lered in multion - nutrit Nutritional nutrit nutritional nutritional nutriti	g life cycle eal/menu ional requi eeds of too ake and nu	planning. Firements, broddlers, presoutrients use,	Pregnancy -Neast feeding, chool, schoo	Nutritiona infant fo going c s.	l require ormula, l hildren-	Infanc and a	y - nutritior dolescents	al requi	remen / man	ts. Intro agemen	diet and
Factors to supplement supplement Nutrition -	o be considered by the conside	rition during lered in multion - nutrit Nutritional nutrit nutritional nutritional nutriti	g life cycle eal/menu ional requi eeds of too ake and nu	planning. Firements, broddlers, presoutrients use,	Pregnancy -Pregnancy -	Nutritiona infant fo going c s.	l require ormula, l hildren-	Infanc and a	y - nutritior dolescents	al requi	remen / man	ts. Intro agemen	diet and
Factors to supplement supplement Nutrition -	o be considered by the conside	rition during lered in mition - nutrit Nutritional niting food intering food intering ,M. "Handboundame",M. "Handboundame",	g life cycle eal/menu ional requi eeds of too ake and nu ook of Food	planning. Firements, broddlers, presoutrients use,	Pregnancy -Pregnancy -	Nutritiona infant fo going c s.	l require ormula, l hildren-	Infanc and a	y - nutrition dolescents , 2018	nal requi - Dietary To	remen / man	ts. Intro	diet and duction of it. Geriatio
Factors to supplement supplement Nutrition -	o be considered by the consideration, Lactary foods. Factors affectors affectors affectors. DK: Swaminathar CES: Gumanti R. M. Publishers, N.	rition during lered in montion - nutrith Nutritional notiting food into	g life cycle eal/menu ional requi eeds of too ake and nu ook of Food agopal, M.\)	planning. Firements, broddlers, presoutrients use,	Pregnancy -Pregnancy -	Nutritiona infant fo going c s. n, The Ba	I require requ	Press	y - nutrition dolescents , 2018 erapy", 6th	To:	remen / man	ts. Intro	diet and duction of it. Geriatio
Factors to supplement supplement Nutrition -	D be considered by the consideration, Lactary foods. Factors affect by the construction of the constructio	rition during ered in mution - nutrit Nutritional nutritional nutriting food interesting food in the food i	g life cycle eal/menu ional requi eeds of too ake and nu ook of Food agopal, M. 18 Science", 6	planning. Firements, broddlers, presoutrients use,	Pregnancy -Pregnancy -	Nutritiona infant fo going c s. n, The Ba	I require requ	Press	y - nutrition dolescents , 2018 erapy", 6th	To:	remen/ man	ts. Intro	diet and duction of it. Geriation
TEXT BOO 1. S REFEREN 2. S COURSE (On comple	D be considered that the content of the considered that the content of the conten	rition during lered in multion - nutrith Nutritional nutritional nutriting food into the secourse, the rition Secourse, the	g life cycle eal/menu ional requi eeds of too ake and nu ook of Food agopal, M.' 18 Science", 6	planning. Firements, broddlers, presoutrients use, dand Nutrition. V., "Fundam Sth Edition, Nutrition will be able."	Pregnancy -Pregnancy -	Nutritiona infant fo going c s. n, The Ba	I require requ	Press	y - nutrition dolescents , 2018 erapy", 6th	To:	New A	agemen	diet and duction of the detection of the
Factors to supplement supplement Nutrition - TEXT BOO 1. S REFERENT 2. S COURSE (On completed)	D be considered that the content of	rition during ered in mution - nutrit Nutritional nutritional nutriting food into the second with the second secon	g life cycle eal/menu ional requi eeds of too ake and nu ook of Food agopal, M. 18 Science", 6	planning. Firements, broddlers, presoutrients use, and Nutrition. V., "Fundaments below the Edition, Nutrition of the Edition of th	Pregnancy -Pregnancy -	Nutritiona infant for going c s. n, The Band, Nutritional F	I require requ	Press	y - nutrition dolescents , 2018 erapy", 6th	To:	New A	agemen	diet and duction of the duction of the decision of the decisio
Factors to supplement supplement Nutrition - TEXT BOC 1. S REFERENT 2. S COURSE CON completed CO1 in completed CO2 s	D be considered by the consideration, Lactary foods. Factors affect of the construction of the constructio	rition during lered in montion - nutrith Nutritional nutritional nutrition food into the second seco	g life cycle eal/menu ional requi eeds of too ake and nu ook of Food agopal, M. 18 Science", 6 students v and metab	planning. Firements, broddlers, presoutrients use, and Nutrition. V., "Fundam of Edition, Nutrition of Edition of Edition, Nutrition of Edition	Pregnancy -Pregnancy -	Nutritiona infant for going c s. n, The Band, Nutritional Feature of the control	I require requ	Press	y - nutrition dolescents , 2018 erapy", 6th	To:	New A Grant High High High High High High High High	T Mapperstandin	diet and duction of the detection of the
Factors to supplement supplement Nutrition - TEXT BOC 1. S REFERENT 2. S COURSE CON completed CO1 in CO2 in CO2 in CO3 completed CO3 comp	D be considered by the consideration, Lactary foods. Factors affect of the construction of the constructio	rition during lered in mution - nutrit Nutritional nutritional nutriting food into the nudambi, Rajew Delhi, 20, "Nutrition Secourse, the hysiological riate carbohymoose lipids	g life cycle eal/menu ional requi eeds of too ake and nu ook of Food agopal, M.\' 18 Science", 6 students v and metab ydrate diet and proteir	planning. Firements, broddlers, presoutrients use, and Nutrition. V., "Fundam of Edition, Nutrition of Edition of Edition, Nutrition of Edition	Pregnancy -Pregnancy -	Nutritiona infant for going c s. n, The Band, Nutritional Feature of the control	I require requ	Press	y - nutrition dolescents , 2018 erapy", 6th	To:	New A High	T Mappophest Le	diet and duction of the Geriational edevel) eg(K2) K3)
Factors to supplement supplement Nutrition - TEXT BOC 1. S REFERENT 1. S COURSE CON comple CO1 in CO2 s CO3 c CO4 e	D be considered that the content of	rition during lered in mution - nutrit Nutritional nutritional nutriting food into the nutriting food into the nutrition Secourse, the hysiological riate carbohymoose lipids by requirements.	g life cycle eal/menu ional requi eeds of too ake and nu ook of Food agopal, M.' 18 Science", 6 students v and metab ydrate diet and proteir	planning. Firements, broddlers, presoutrients use, and Nutrition V., "Fundam Sth Edition, Nutrition based on the based on the last based o	Pregnancy -Pregnancy -	Nutritiona infant for going c s. n, The Band, Nutritional Feature of the control	I require requ	Press	y - nutrition dolescents , 2018 erapy", 6th	To:	Remen / man	T Mapposerstandin	diet and duction of the control of t
Factors to supplement supplement Nutrition - TEXT BOC 1. S REFERENT 1. S COURSE CON comple CO1 in CO2 s CO3 c CO4 e	D be considered that the content of	rition during lered in mution - nutrit Nutritional nutritional nutriting food into the nutriting food into the nutrition Secourse, the hysiological riate carbohymoose lipids by requirements.	g life cycle eal/menu ional requi eeds of too ake and nu ook of Food agopal, M.' 18 Science", 6 students v and metab ydrate diet and proteir	planning. Firements, broddlers, presoutrients use, and Nutrition V., "Fundam Sth Edition, Nutrition based on the based on the land based on land life cycle	Pregnancy -Pregnancy -	Nutritional infant for going of s. n, The Band, Nutritional Factorial for the second of the second	I require primula, I hildren-	Press	y - nutrition dolescents , 2018 erapy", 6th	To:	Remen / man	T Mappophest Leaplying (International International Intern	diet and duction of the control of t
Factors to supplement supplement Nutrition - TEXT BOC 1. S REFERENT 1. S COURSE CON comple CO1 in CO2 s CO3 c CO4 e	D be considered that the content of	rition during lered in mation - nutrit Nutritional nating food into the nutrit Nutrition Interest in the nutrition Interes	g life cycle eal/menu ional requi eeds of too ake and nu ook of Food agopal, M.' 18 Science", 6 students v and metab ydrate diet and proteir	planning. Firements, broddlers, presoutrients use, atrients use, atrients use, and Nutrition V., "Fundam Sth Edition, Nutrition based on the based on the based on the life cycle Mapping	Pregnancy -Pregnancy -	Nutritional infant for going of s. n, The Band, Nutritional For the partial of t	I require primula, I hildren-	Press	y - nutrition dolescents , 2018 erapy", 6th	To:	New A High	T Mappophest Leaplying (International International Intern	diet and duction of the control of t

CO2	3	3	2		2		1	1	
CO3	3	3	2		2		1	1	
CO4	3	3	2		1		1	1	
CO5	3	2	3		2		1	2	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

		/ 100 L 00 III L 11					
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	40	20				100
CAT2	20	40	40				100
CAT3	40	60					100
ESE	20	60	20				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Progra Branch		B.E. & CIVIL ENGINEERING	Sem.	Category	L	Т	Р	Credit
Prereq		NIL	5	OE	3	0	2	4
			1		1			
Preamb	ole	This course gives the knowledge on the remote processing techniques using GIS for real tin relevant fields.	sensing and its workine applications whic	ng principles. I h motivates to	t also ward	des s inr	cribes	s the Image ions in the
Unit – I		Principles of Remote Sensing:						9
		ents of Remote sensing - EMR Spectrum - EMR urves of Earth surface features – Concept of Pho						
Unit – I	I	Orbits and Platforms:						9
planeta	ry motion - O Airborne pla	nd satellites – Newton's law of gravitation - Gravitation strict elements and types – Orbital perturbations at the strict and Space borne platforms – Classifications.	and maneuvers – Typ	es of remote s	ensir	ıg pla	atforn	ns - Groun
Unit – I	III	Sensing Techniques:						9
and ac	ross track sca	ote sensors – Resolution concept : spatial, spec anners – Optical-infrared sensors – Thermal se LIDAR, UAV –Orbital and sensor characteristic	ensors - microwave	sensors - Cal	ibrati	on o		
Unit – I		Data products and interpretation:						9
Visual		gital products – Types, levels and open source : basic elements and interpretation keys – Dig						
enhanc			gital interpretation					_
	ement and In	nage classification.	gital interpretation					9
Unit – V Urban <i>A</i>	ement and Im V Area Definition	nage classification. Remote Sensing for Urban Planning: n and Characterization–Base Map Preparation –	- Urban Land use Clas	ssification –Vis				
Unit - V Urban A for Land Detection	ement and Im V Area Definition d use Mappin on – Sprawl D	Remote Sensing for Urban Planning: n and Characterization–Base Map Preparation – g - Urban Structure and Patterns– Urban Land Detection and Characterization - Mapping of Urba	- Urban Land use Clas Cover Classification -	ssification –Vis -Feature Extra				Technique
Unit - V Urban / for Land Detection	ement and Im V Area Definition d use Mappin on – Sprawl D	Remote Sensing for Urban Planning: n and Characterization—Base Map Preparation—g - Urban Structure and Patterns— Urban Land Detection and Characterization - Mapping of Urban Land Office (NTS / EXERCISES:	- Urban Land use Clas Cover Classification an Morphology –Build	ssification –Vis -Feature Extra				Technique
Unit - V Urban A for Land Detection	Perment and Importance of the	Remote Sensing for Urban Planning: n and Characterization—Base Map Preparation— g - Urban Structure and Patterns— Urban Land Octection and Characterization - Mapping of Urban Land Characterization - Mapping Orban Land Characterization - Mapping Orban Land Characterization - Mapping	- Urban Land use Clas Cover Classification - an Morphology –Build ges.	ssification –Vis -Feature Extra ling Typology				Technique
Unit - \ Urban A for Land Detection LIST 0 1.	Area Definition d use Mappin on – Sprawl D F EXPERIME Study of T Data Inpu	Remote Sensing for Urban Planning: n and Characterization—Base Map Preparation—g - Urban Structure and Patterns— Urban Land Detection and Characterization - Mapping of Urban Structure and Patterns— Urban Land Detection and Characterization - Mapping of Urban Structure Structure and Patterns— Urban Land Detection and Characterization - Mapping of Urban Structure Alerial Photographs and Satellite Image to Onscreen Digitisation — Creation of Point, Line	- Urban Land use Clas Cover Classification - an Morphology –Build ges.	ssification –Vis -Feature Extra ling Typology				Technique
Unit – V Urban A for Land Detection 1. 2. 3.	Area Definition d use Mappin on – Sprawl D F EXPERIME Study of T Data Input Geo-refere	Remote Sensing for Urban Planning: n and Characterization—Base Map Preparation— g - Urban Structure and Patterns— Urban Land Obtection and Characterization - Mapping of Urban Structure ENTS / EXERCISES: Toposheet ,Aerial Photographs and Satellite Image t — Onscreen Digitisation — Creation of Point, Lineacing the base image.	Urban Land use Clas Cover Classification an Morphology –Build ges. ne and Polygon layers	ssification –Vis -Feature Extra ling Typology				Technique
Unit - \ Urban A for Land Detection LIST 0 1.	F EXPERIME Study of T Data Inpu Geo-reference Preparation	Remote Sensing for Urban Planning: n and Characterization—Base Map Preparation—g - Urban Structure and Patterns— Urban Land Detection and Characterization - Mapping of Urban Structure and Patterns— Urban Land Detection and Characterization - Mapping of Urban Structure and Photographs and Satellite Image to Onscreen Digitisation—Creation of Point, Linearing the base image. In of Base Map from Survey of India Toposheets	Urban Land use Clas Cover Classification an Morphology –Build ges. ne and Polygon layers	ssification –Vis -Feature Extra ling Typology				Technique
Unit – V Urban A for Land Detection 1. 2. 3. 4.	F EXPERIME Study of T Data Input Geo-reference Extracting	Remote Sensing for Urban Planning: n and Characterization—Base Map Preparation— g - Urban Structure and Patterns— Urban Land Obtection and Characterization - Mapping of Urban Structure and Patterns— Urban Land Obtection and Characterization - Mapping of Urban Structure ENTS / EXERCISES: Toposheet ,Aerial Photographs and Satellite Image to Onscreen Digitisation — Creation of Point, Linearing the base image. Ton of Base Map from Survey of India Toposheets area of Interest (AOI).	Urban Land use Clas Cover Classification an Morphology –Build ges. ne and Polygon layers	ssification –Vis -Feature Extra ling Typology				Technique
Unit – V Urban A for Land Detection 1. 2. 3. 4. 5.	rement and Im V Area Definition d use Mappin on – Sprawl D F EXPERIME Study of T Data Input Geo-referent Preparation Extracting Preparation	Remote Sensing for Urban Planning: n and Characterization—Base Map Preparation—g - Urban Structure and Patterns— Urban Land Detection and Characterization - Mapping of Urban Structure and Patterns— Urban Land Detection and Characterization - Mapping of Urban Structure and Photographs and Satellite Image to Onscreen Digitisation—Creation of Point, Linearing the base image. In of Base Map from Survey of India Toposheets	Urban Land use Clas Cover Classification an Morphology –Build ges. ne and Polygon layers	ssification –Vis -Feature Extra ling Typology				Technique
Unit – V Urban A for Land Detection 1. 2. 3. 4. 5. 6.	F EXPERIME Study of T Data Input Geo-reference Preparation Preparation Preparation Preparation	Remote Sensing for Urban Planning: n and Characterization—Base Map Preparation— g - Urban Structure and Patterns— Urban Land of Detection and Characterization - Mapping of Urban Structure and Patterns— Urban Land of Detection and Characterization - Mapping of Urban Structure and Patterns— Urban Land of Urban Structure and Patterns— Urban Structure and Characterization - Mapping of Urban Structure Apping of Urban Structure and Satellite Image to Onscreen Digitisation— Creation of Point, Linguistic Englishment (AOI). In of Base Map from Survey of India Toposheets area of Interest (AOI). In of Land use map using Satellite Data. In of Land cover map using Satellite Data.	Urban Land use Clas Cover Classification an Morphology –Build ges. ne and Polygon layers s.	ssification –Vis -Feature Extra ling Typology				Technique
Unit – V Urban A for Land Detection 1. 2. 3. 4. 5. 6. 7.	rement and Im V Area Definition d use Mappin on – Sprawl D F EXPERIME Study of T Data Input Geo-refere Preparation Extracting Preparation Preparation Testing st	Remote Sensing for Urban Planning: n and Characterization—Base Map Preparation— g - Urban Structure and Patterns— Urban Land Obtection and Characterization - Mapping of Urban Structure and Patterns— Urban Land Obtection and Characterization - Mapping of Urban Structure and Photographs and Satellite Image to Onscreen Digitisation— Creation of Point, Linearing the base image. On of Base Map from Survey of India Toposheets area of Interest (AOI). On of Land use map using Satellite Data.	Urban Land use Clas Cover Classification an Morphology –Build ges. he and Polygon layers s.	ssification –Vis -Feature Extra ling Typology				Technique
Unit – V Urban A for Land Detection 1. 2. 3. 4. 5. 6. 7.	F EXPERIME Study of T Data Input Geo-refer Preparation	Remote Sensing for Urban Planning: n and Characterization—Base Map Preparation— g - Urban Structure and Patterns— Urban Land Obtection and Characterization - Mapping of Urban Structure and Patterns— Urban Land Obtection and Characterization - Mapping of Urban Structure and Photographs and Satellite Image to Onscreen Digitisation — Creation of Point, Linear and Stereoster (AOI). In of Base Map from Survey of India Toposheets area of Interest (AOI). In of Land use map using Satellite Data. In of Land cover map using Satellite Data. In of Land cover map using Satellite Data.	Urban Land use Clas Cover Classification an Morphology –Build ges. he and Polygon layers s.	ssification –Vis -Feature Extra ling Typology				Technique
Unit – V Urban A for Land Detection 1. 2. 3. 4. 5. 6. 7. 8.	F EXPERIME Study of T Data Input Geo-refer Preparation	Remote Sensing for Urban Planning: n and Characterization—Base Map Preparation— g - Urban Structure and Patterns— Urban Land Detection and Characterization - Mapping of Urban ENTS / EXERCISES: Toposheet ,Aerial Photographs and Satellite Image t — Onscreen Digitisation — Creation of Point, Line encing the base image. On of Base Map from Survey of India Toposheets area of Interest (AOI). On of Land use map using Satellite Data. On of Land cover map using Satellite Data. Detection with test card and Stereoscopic acquite reoscope- base lining and orientation of aerial pheroscope-	Urban Land use Clas Cover Classification an Morphology –Build ges. he and Polygon layers s.	ssification –Vis -Feature Extra ding Typology	ction	tech	nique	Technique es –Chang
Unit – V Urban A for Land Detection 1. 2. 3. 4. 5. 6. 7. 8. 9.	rement and Im V Area Definition d use Mappin on – Sprawl D F EXPERIME Study of T Data Input Geo-refere Preparation Extracting Preparation Preparation Testing st Mirror stell Use of par	Remote Sensing for Urban Planning: n and Characterization—Base Map Preparation— g - Urban Structure and Patterns— Urban Land Detection and Characterization - Mapping of Urban ENTS / EXERCISES: Toposheet ,Aerial Photographs and Satellite Image t — Onscreen Digitisation — Creation of Point, Line encing the base image. On of Base Map from Survey of India Toposheets area of Interest (AOI). On of Land use map using Satellite Data. On of Land cover map using Satellite Data. Detection with test card and Stereoscopic acquite reoscope- base lining and orientation of aerial pheroscope-	Urban Land use Clas Cover Classification an Morphology –Build ges. he and Polygon layers s.	ssification –Vis -Feature Extra ding Typology	ction	tech	nique	Technique es –Chang
Unit – V Urban A for Land Detection 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	rement and Im V Area Definition d use Mappin on – Sprawl D F EXPERIME Study of T Data Input Geo-refert Preparation Extracting Preparation Testing st Mirror ster Use of pate	Remote Sensing for Urban Planning: n and Characterization—Base Map Preparation— g - Urban Structure and Patterns— Urban Land Detection and Characterization - Mapping of Urban ENTS / EXERCISES: Toposheet ,Aerial Photographs and Satellite Image t — Onscreen Digitisation — Creation of Point, Line encing the base image. On of Base Map from Survey of India Toposheets area of Interest (AOI). On of Land use map using Satellite Data. On of Land cover map using Satellite Data. Detection with test card and Stereoscopic acquite reoscope- base lining and orientation of aerial pheroscope-	Urban Land use Clas Cover Classification an Morphology –Build ges. ne and Polygon layers s. ity. notographs.	Selfication –Vise –Feature Extra ding Typology Lecture:	45, P	ract	nique	Technique es –Chang
Unit – V Urban A for Land Detection 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. TEXT E	rement and Im V Area Definition d use Mappin on – Sprawl D F EXPERIME Study of T Data Input Geo-refere Preparation Extracting Preparation Preparation Testing st Mirror stell Use of pair	Remote Sensing for Urban Planning: n and Characterization—Base Map Preparation—g - Urban Structure and Patterns— Urban Land Detection and Characterization - Mapping of Urban Structure and Patterns— Urban Land Detection and Characterization - Mapping of Urban Structure and Patterns— Urban Land Detection and Characterization - Mapping of Urban Structure Aerial Photographs and Satellite Image to Onscreen Digitisation— Creation of Point, Lindencing the base image. Son of Base Map from Survey of India Toposheets area of Interest (AOI). Son of Land use map using Satellite Data. Son of Land cover map using Satellite Data. Sereovision with test card and Stereoscopic acquire reoscope- base lining and orientation of aerial pharallax bar to find the height of point.	Urban Land use Clas Cover Classification an Morphology –Build ges. ne and Polygon layers s. ity. notographs.	Selfication –Vise –Feature Extra ding Typology Lecture:	45, P	ract	nique	Technique es –Chang
Unit – V Urban A for Land Detection 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. TEXT E	F EXPERIME Study of T Data Input Geo-refer Preparation	Remote Sensing for Urban Planning: n and Characterization—Base Map Preparation—g - Urban Structure and Patterns— Urban Land Detection and Characterization - Mapping of Urban Structure and Patterns— Urban Land Detection and Characterization - Mapping of Urban Structure and Patterns— Urban Land Detection and Characterization - Mapping of Urban Structure Aerial Photographs and Satellite Image to Onscreen Digitisation— Creation of Point, Lindencing the base image. Son of Base Map from Survey of India Toposheets area of Interest (AOI). Son of Land use map using Satellite Data. Son of Land cover map using Satellite Data. Sereovision with test card and Stereoscopic acquire eoscope- base lining and orientation of aerial phorallax bar to find the height of point. Sesand, Ralph W. Kiefer, Jonathan ChipmanThomed Image Interpretation", 7th Edition, Willey Publication Publication Sesand, Paganathan C, "Fundamentals of Remote Septimental Sesand Ses	Urban Land use Clas Cover Classification an Morphology –Build ges. ne and Polygon layers s. ity. notographs. mas Lillesand, Ralph vations, United States	Lecture: N. Kiefer & Jor., 2015.	45, P	ract	ical:3	Technique es –Chang 60, Total:7

	SE OUTCOMES: npletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	associate the principles of EM spectrum to categories the earth features in an image and the sensor properties for various applications of remote sensing	Understanding (K2) Precision (S3)
CO2	classify the usage about different types of satellites and their orbits	Understanding (K2)
CO3	discuss the different types of remote sensors	Understanding (K2)
CO4	demonstrate the concepts of interpretation of satellite imagery	Applying (K3) Precision (S3)
CO5	organize Remote Sensing procedure for Mapping of Urban Elements and their Processes	Applying (K3) Precision (S3)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		3		3			1			1		
CO2	2	1		3		3			1			1		
CO3	2	1		3		3			1			1		
CO4	3	2	1	3		3			1			1		
CO5	3	2	1	3		3			1			1		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

		,	_				
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	40	30				100
CAT2	30	40	30				100
CAT3	10	40	50				100
ESE	30	40	30				100

 $^{^{\}star}$ ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Programme& B.E. & CIVIL ENGINEERING Sem. Category L T								
Prerequisites	NIL	6	OE	3	1	0	4	
Preamble	To get idea about the various natural hazards like Eart the mitigation measures.	hquakes, slope stabili	y, floods, dro	ughts	and	Tsun	ami and	
Unit – I	Introduction to Disasters:						9+3	
Forest Fire, Indu	ster, Hazard, Vulnerability, Resilience, Risks - Disasters: Type Istrial and Technological Disasters, Climate Change- Classif disasters: urban disasters, pandemics, complex emergencies	ication, Causes, Impa						
Unit – II	Pre and Post Disaster Risk Reduction Strategies: Phases of Disaster - Disaster Mapping - Predictability, foreca						9+3	
Evacuation - She Damage Assess Unit - III	ster Management - Preparing Community through IEC - letter for Victims - Livestock and Relief Measures - Clearancement -Rehabilitation: Social and economic Aspects - Recons Inter-Relationship between Disasters and Developm	e of Debris and Dispos struction and Rehabilita ent:	sal of the Dea ation as mean	d - C s of [ontro Devel	ol of S opme	ituation nt. 9+3	
Costoro offostica	Vulnerabilities, differential impacts, impact of Development	projecte euch as dame	emhankmer	nte cl	anac	es in I	anduse	
	nange Adaptation - IPCC Scenario and Scenarios in the conti		, embankmen	ito, ci	iariye	JO 111 E	anaaoo	
etc Climate Ch Unit – IV	nange Adaptation - IPCC Scenario and Scenarios in the conti Disaster Management in India:	ext of India.					9+3	
etc Climate Ch Unit - IV Disaster Manage Institutions/Urba	nange Adaptation - IPCC Scenario and Scenarios in the control Disaster Management in India: ement Act 2005 - Hazard and Vulnerability profile of India n Local Bodies (PRIs/ULBs), NGO's States, Centre - Disaste	ext of India. , Roles and responsilers of India and Lessor	pilities of com	nmun			9+3 ayat Raj	
etc Climate Ch Unit - IV Disaster Manage Institutions/Urbar Unit - V	nange Adaptation - IPCC Scenario and Scenarios in the contemporaries Disaster Management in India: ement Act 2005 - Hazard and Vulnerability profile of India n Local Bodies (PRIs/ULBs), NGO's States, Centre - Disaste Applications of Science and Technology for Disaste	ext of India. , Roles and responsilers of India and Lessorer Management:	oilities of com	mun	ity, P	ancha	9+3 ayat Raj 9+3	
etc Climate Ch Unit - IV Disaster Manage Institutions/Urbar Unit - V Geo-informatics	nange Adaptation - IPCC Scenario and Scenarios in the contemporaries Disaster Management in India: ement Act 2005 - Hazard and Vulnerability profile of India in Local Bodies (PRIs/ULBs), NGO's States, Centre - Disaste Applications of Science and Technology for Disaste in Disaster Management (RS, GIS & GPS)- Early Warning aster Safe Designs and Constructions-Structural and Non	ext of India. I, Roles and responsilers of India and Lessorer Management: and Its Dissemination-	pilities of com learnt from it	nmun i. unning Insti	ity, P	ancha I Deve	9+3 ayat Raj 9+3 elopment Disaste	
etc Climate Ch Unit - IV Disaster Manage Institutions/Urbar Unit - V Geo-informatics Regulations-Disa	nange Adaptation - IPCC Scenario and Scenarios in the contemporaries Disaster Management in India: ement Act 2005 - Hazard and Vulnerability profile of India in Local Bodies (PRIs/ULBs), NGO's States, Centre - Disaste Applications of Science and Technology for Disaste in Disaster Management (RS, GIS & GPS)- Early Warning aster Safe Designs and Constructions-Structural and Non	ext of India. I, Roles and responsilers of India and Lessorer Management: and Its Dissemination-	pilities of com learnt from it Land Use Pla of Disasters -	nmun i. unning Insti	ity, P	ancha I Deve	9+3 ayat Raj 9+3 elopmen Disaste	
etc Climate Ch Unit - IV Disaster Manage Institutions/Urbar Unit - V Geo-informatics Regulations-Disa Management in I	nange Adaptation - IPCC Scenario and Scenarios in the contemporaries Disaster Management in India: ement Act 2005 - Hazard and Vulnerability profile of India in Local Bodies (PRIs/ULBs), NGO's States, Centre - Disaste Applications of Science and Technology for Disaste in Disaster Management (RS, GIS & GPS)- Early Warning aster Safe Designs and Constructions-Structural and Non	ext of India. I, Roles and responsilers of India and Lessorer Management: and Its Dissemination-Structural Mitigation of	pilities of com learnt from it Land Use Pla of Disasters -	nmun i. unning Insti	ity, P	ancha I Deve	9+3 ayat Raj 9+3 elopmen Disaste	
etc Climate Ch Unit - IV Disaster Manage Institutions/Urbar Unit - V Geo-informatics Regulations-Disa Management in I	nange Adaptation - IPCC Scenario and Scenarios in the conton Disaster Management in India: ement Act 2005 - Hazard and Vulnerability profile of India n Local Bodies (PRIs/ULBs), NGO's States, Centre - Disaste Applications of Science and Technology for Disaste in Disaster Management (RS, GIS & GPS)- Early Warning a sater Safe Designs and Constructions-Structural and Non India. J.P., "Disaster Management", 1st Edition, Laxmi Publications	ext of India. I, Roles and responsilers of India and Lessorer Management: and Its Dissemination-Structural Mitigation of	pilities of com learnt from it Land Use Pla of Disasters -	nmun i. unning Insti	ity, P	ancha I Deve	9+3 ayat Raj 9+3 elopmen Disaste	
etc Climate Ch Unit - IV Disaster Manage Institutions/Urbar Unit - V Geo-informatics Regulations-Disa Management in I TEXT BOOK: 1. Singhal	nange Adaptation - IPCC Scenario and Scenarios in the conton Disaster Management in India: ement Act 2005 - Hazard and Vulnerability profile of India n Local Bodies (PRIs/ULBs), NGO's States, Centre - Disaste Applications of Science and Technology for Disaste in Disaster Management (RS, GIS & GPS)- Early Warning a sater Safe Designs and Constructions-Structural and Non India. J.P., "Disaster Management", 1st Edition, Laxmi Publications	ext of India. I, Roles and responsiters of India and Lessorer Management: and Its Dissemination-Structural Mitigation of	pilities of com learnt from it Land Use Pla of Disasters -	nmun i. unning Insti	ity, P	ancha I Deve	9+3 ayat Raj 9+3 elopmen Disaste	

	COURSE OUTCOMES: On completion of the course, the students will be able to					
CO1	diagnose the different forms of disaster and their causes.	Understanding (K2)				
CO2	construct a disaster management cycle with disaster risk reduction measures	Applying (K3)				
CO3	interpret the various effects of development projects	Applying (K3)				
CO4	identify the agencies involved to manage the disaster in india	Understanding (K2)				
CO5	summarize the role of technology in disaster	Understanding (K2)				

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3	1					1		
CO2	3	2	1			3	1					1		
CO3	3	2	1			3	1					1		
CO4	2	1				3	1					1		
CO5	2	1				3	1					1		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	10	30	60				100
CAT3	30	70					100
ESE	20	50	30				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22CEO02 - Introduction to 9	omant Ollies					
Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	т	Р	Credi
Prerequisites	NIL	7	OE	3	0	0	3
Preamble	To understand and explain national smart city mission o city in India.	f India, components, po	olicies, challer	nges	and f	uture	of smar
Unit – I	Introduction:						9
	olution – Features and strategies – Challenges – India 10 ancing smart cities development. Governance of smart cities			smar	t city	plann	ing and
Unit – II	Smart Urban Mobility and Smart Energy:						9
mobility systems -	nobility – multiple perspectives – objectives – components – policy priorities. Introduction to smart energy – urban den tem – strategies – smart grid – challenges.						
Unit – III	Water and Waste Management:						9
challenges. Smar	agement – definitions – water resource and cycle – functions t waste management – approaches and implementation – e						es.
challenges. Smar Unit – IV Global backgroue environment – sta	Smart Environment and Smart Buildings: nd of environmental concerns – concept of environmerakeholders – ICT framework for environmental management	existing systems – strat	tegies – challe	enges	s and	police nges	es. 9 – sma
Challenges. Smar Unit – IV Global backgroue environment – sta	Smart Environment and Smart Buildings: Indicate the second of the secon	existing systems – strat	tegies – challe	enges	s and	police nges	es. 9 – smar
Unit – IV Global backgrousenvironment – sta of smart building Unit – V Governance chall – benefits, challe	Smart Environment and Smart Buildings: nd of environmental concerns – concept of environmerakeholders – ICT framework for environmental management	existing systems – stratental resources - basic of the Intelligent buildings and objectives – ICT is	c environmen objectives -	atal c	challe npone	nges ents –	es. 9 - small system 9 structure
Unit – IV Global backgrousenvironment – sta of smart building Unit – V Governance chall – benefits, challe	Smart Environment and Smart Buildings: Ind of environmental concerns – concept of environmental cakeholders – ICT framework for environmental managemental benefits, challenges. E- Governance and ICT: lenges in new era – history of smart governance – functionsinges and future vision. Taxonomy of layers of ICT archite	existing systems – stratental resources - basic of the Intelligent buildings and objectives – ICT is	c environmen objectives -	atal c	challe npone	nges ents – infras	9 - sma system 9 structure merging
Challenges. Smar Unit – IV Global backgrousenvironment – sta of smart building Unit – V Governance chall – benefits, challe technologies in IC	Smart Environment and Smart Buildings: Ind of environmental concerns – concept of environmental cakeholders – ICT framework for environmental managemental benefits, challenges. E- Governance and ICT: lenges in new era – history of smart governance – functionsinges and future vision. Taxonomy of layers of ICT archite	existing systems – stratental resources - basic of the Intelligent buildings and objectives – ICT is	c environmen objectives -	atal c	challe npone	nges ents – infras	es. 9 - sma system 9 structure
Unit – IV Global backgrousenvironment – staof smart building Unit – V Governance chall – benefits, challe technologies in IC TEXT BOOK: Anilkuma	Smart Environment and Smart Buildings: Ind of environmental concerns – concept of environmental cakeholders – ICT framework for environmental managemental benefits, challenges. E- Governance and ICT: lenges in new era – history of smart governance – functionsinges and future vision. Taxonomy of layers of ICT archite	existing systems – stratental resources - basic nt. Intelligent buildings and objectives – ICT is ecture – major technology	c environmen – objectives – in governance ogy areas – o	enges	challe challe npone	nges ents – infras ts – er	9 - sma system 9 structure mergino
Unit – IV Global backgrousenvironment – staof smart building Unit – V Governance chall – benefits, challe technologies in IC TEXT BOOK: 1. Anilkuma 2019.	Smart Environment and Smart Buildings: Ind of environmental concerns – concept of environmental cakeholders – ICT framework for environmental managemental benefits, challenges. E- Governance and ICT: lenges in new era – history of smart governance – functions inges and future vision. Taxonomy of layers of ICT archite CT – challenges and concerns in ICT.	existing systems – stratental resources - basic nt. Intelligent buildings and objectives – ICT is ecture – major technology	c environmen – objectives – in governance ogy areas – o	enges	challe challe npone	nges ents – infras ts – er	9 - sma system 9 structure mergino
challenges. Smar Unit – IV Global backgrour environment – sta of smart building - Unit – V Governance chall – benefits, challe technologies in IC TEXT BOOK: 1. Anilkuma 2019. REFERENCES:	Smart Environment and Smart Buildings: Ind of environmental concerns – concept of environmental cakeholders – ICT framework for environmental managemental benefits, challenges. E- Governance and ICT: lenges in new era – history of smart governance – functions inges and future vision. Taxonomy of layers of ICT archite CT – challenges and concerns in ICT.	existing systems – stratental resources - basic int. Intelligent buildings and objectives – ICT in acture – major technological	c environmen - objectives - in governance ogy areas - o	enges ental c - com e – sy comp	challe challe npone vstem onent	nges ents – infras ts – el	9 - sma system 9 structure mergine

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	discuss the importance, features and case histories of smart cities in India	Understanding (K2)
CO2	describe mobility and energy in smart city	Understanding (K2)
CO3	explain water and waste management techniques in smart city	Understanding (K2)
CO4	model smart environment and smart buildings	Applying (K3)
CO5	plan e-governance and ICT in smart city	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		1										
CO2	2	1		1										
CO3	2	1		1	3									
CO4	3	2	1	1	3									
CO5	3	2	1	1	3									

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70					100
CAT2	30	70					100
CAT3	10	30	60				100
ESE	20	50	30				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22CEO03 - Environmental Health ar	nd Safety					
Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	Т	Р	Credi
Prerequisites	NIL	7	PE	3	0	0	3
Preamble	To enhance the knowledge in regulation and statutory require	monte rolovant to	Environmon	tal L	Joalth	and 9	Safaty
Unit – I	Occupation, Safety and Management:	inents relevant to	Liiviioiiiieii	tai, i	lealli	i and c	9
Occupational Sa	afety - Health and Environmental Safety Management - Principles 8 Phaviour - Human factors contributing to accident.	k practices - Role	e of Managem	nent i	n Ind	ustrial	_
Unit – II	Monitoring for Safety, Health & Environment:						9
	n Standards on Safety and Health: 14489 - 1998 and 15001 - 2000 initions - Incident - accident - injury - dangerous - occurrences - unsa	afe acts - unsafe o					
Unit – III	Education, Training and Employee Participation in Safety						9
	ing cycle - Techniques of training, design and development of traininpetence Building Techniques (CBT) - Employee Participation: Pur						es types
Unit – IV	Management Information System:						9
	mation on Safety, Health and Environment - Compilation and collat g - storing and retrieval of MIS for Safety, Health and Environm						
Unit – V	Legislation on Safety, Health & Environment:						9
	HE - The factories act, 1948 (Amended) and Rules - Contract Laboratrol of Pollution) Act 1974 and Rules - Air (Prevention & Control of l					nent P	
TEXT BOOK:							
	nan K.T., "Safety, Health and Environment Handbook", 1 st Edition, I	McGraw Hill, Nev	w Delhi, 2017				
	•	McGraw Hill, Nev	w Delhi, 2017				
1. Narayar	•	· · · · · · · · · · · · · · · · · · ·	·		to Co	omplia	nce", 1 ^s

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	apply the concept of EHS and their framework.	Applying (K3)
CO2	identify the monitoring principles in workplace systems.	Applying (K3)
CO3	choose the need of training and methods of EHS.	Applying (K3)
CO4	organize the safety auditing management systems and their prevention techniques.	Applying (K3)
CO5	identify the key steps involved in HSE legislations.	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			2	3							
CO2	3	2	1			2	3							
CO3	3	2	1			2	3							
CO4	3	2	1			2	3							
CO5	3	2	1			2	3							

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	15	40	45				100
CAT3	25	40	35				100
ESE	20	45	35				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22CEO04 - Infrastructure Planning and	Management					
Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	т	Р	Credit
Prerequisites	NA	8	PE	3	0	0	3
Preamble	To understand and explain the basic concepts of infrastruplanning and implementation.	cture and the ch	allenges to s	succe	ssful	infras	tructure
Unit – I	Basic Concepts Related to Infrastructure:						9
ntroduction to infra & Systems	astructure, Governing Features, Historical overview of Infrastruc	ture development	t in India, Infra	astru	cture	Organ	izations
Unit – II	Infrastructure Planning:						9
Multi-criteria analy	re planning steps, Planning and appraisal of major infrastructure sis for comparison of infrastructure alternatives, Procurement cture Project Budgeting and Funding, Regulatory Framework, S	strategies, Sche	eduling and m				
Unit – III	Private Involvement in Infrastructure:						9
	tructure Privatization - Benefits of Infrastructure Privatization - P		llenges in Infr	astru	cture	Priva	tization
Unit – IV	Challenges to Successful Infrastructure Planning and Im	•					9
Environmental Ris	cing the Landscape of Risks in Infrastructure Projects, Econ ks - Cultural Risks in International Infrastructure Projects - Lega d Maintenance of Infrastructure.						
Unit – V	Strategies For Successful Infrastructure Project Impleme	entation:					-
							9
Risk Management	Framework for Infrastructure Projects, Shaping the Planning Pha acts, Introduction to Fair Process and Negotiation, Negotiating w					re Pro	esigning jects.
Risk Management						re Pro	esigning
Risk Management Sustainable Contra		vith multiple Stake	eholdérs on In			re Pro	esigning jects.
Risk Management Sustainable Contra TEXT BOOK: 1. Neil S Grig	acts, Introduction to Fair Process and Negotiation, Negotiating w	vith multiple Stake	eholdérs on In			re Pro	esigning jects.
Risk Management Sustainable Contra TEXT BOOK: 1. Neil S Grig REFERENCES: Ronald Hu	acts, Introduction to Fair Process and Negotiation, Negotiating w	vith multiple Stake	eholders on In	frast	ructui	re Pro	esigning jects.

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	explain the basic concepts related to Infrastructure	Understanding (K2)
CO2	demonstrate the various analysis techniques in infrastructure planning	Applying (K3)
CO3	explain the role of private sector in infrastructure growth	Understanding (K2)
CO4	explain the challenges in infrastructure planning and management	Understanding (K2)
CO5	carry out strategic planning for successful Infrastructure Project implementation.	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1			1									
CO2	3	2	1		1									
CO3	2	1			1									
CO4	2	1			1									
CO5	3	2	1		1									

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

	7100_00		•			
Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
30	40	30				100
30	40	30				100
30	40	30				100
30	40	30				100
	(K1) % 30 30 30 30	Remembering (K1) % Understanding (K2) % 30 40 30 40 30 40	Remembering (K1) % Understanding (K2) % Applying (K3) % 30 40 30 30 40 30 30 40 30 30 40 30	Remembering (K1) % Understanding (K2) % Applying (K3) % Analyzing (K4) % 30 40 30 30 40 30 30 40 30 30 40 30	Remembering (K1) % Understanding (K2) % Applying (K3) % Analyzing (K4) % Evaluating (K5) % 30 40 30 30 40 30 40 30 40 30 40 30 40 30 40 30 40 30 40 30 40 30 40 30 40 30 40 30 40 30 40 30 40	(K1) % (K2) % (K3) % (K4) % (K5) % (K6) % 30 40 30

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22CEO05 - Environmental Laws and	l Policy					
Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	Т	Р	Credi
Prerequisites	NIL	8	PE	3	0	0	3
Preamble	To enhance the basic concepts of environmental regulations to amendments.	ensure enviror	nmental safet	y alo	ng wi	th the	
Unit – I	Overview of Environment & Law:						9
	mental Law - Indian Constitution and Environmental Protection - Mol, Kyoto agreement, Rio declaration - Environmental Protection Act		onmental agre	eeme	ents a	nd Pro	tocols
Unit – II	Environment Protection Mechanisms:						9
	ublic Interest Litigation - Forest Cases & Responses (Case Laws) - ational Green Tribunal Act, 2010.	Right to Informa	tion Act - Intro	oduc	tion to	Envi	ronmen
Environmental La Rights) Act, 2006	National Environmental Laws: aw and the Indian Constitution - The Scheduled Tribes and Othe and Forest Conservation Act, 1980 - Panchayats Extension to Sc	heduled Areas					
Rights) Act, 2006 Act, 1972 - Land Unit – IV Provisions of Ac	aw and the Indian Constitution - The Scheduled Tribes and Othes and Forest Conservation Act, 1980 - Panchayats Extension to Schedulestion Act, 1894 - Tenure & Property Rights and Community Environment (Protection) Act 1986: t - Delegation of powers - Role of state and central government	cheduled Areas Rights. t - Siting of inc	(PESA) Act 1	996 astal	- Wild	dlife P	of Forestrotection 9 ations
Environmental La Rights) Act, 2006 Act, 1972 - Land Unit – IV Provisions of Ac Responsibilities of	aw and the Indian Constitution - The Scheduled Tribes and Others and Forest Conservation Act, 1980 - Panchayats Extension to Schacquisition Act, 1894 - Tenure & Property Rights and Community For Environment (Protection) Act 1986: at - Delegation of powers - Role of state and central government of local bodies - Legislation's on Solid waste Management (MSW, B	cheduled Areas Rights. t - Siting of inc	(PESA) Act 1	996 astal	- Wild	dlife P	of Forestrotection 9 ations ste)
Environmental La Rights) Act, 2006 Act, 1972 - Land Unit - IV Provisions of Ac Responsibilities of Unit - V Sustainable Deve	aw and the Indian Constitution - The Scheduled Tribes and Othes and Forest Conservation Act, 1980 - Panchayats Extension to Schedulestion Act, 1894 - Tenure & Property Rights and Community Environment (Protection) Act 1986: t - Delegation of powers - Role of state and central government	cheduled Areas Rights. t - Siting of inc iomedical, Plas	(PESA) Act 1 dustries - Coatic, E-waste 8	996 astal & Haz	zone	regulus was	of Forestrotection 9 ations ste) 9
Environmental La Rights) Act, 2006 Act, 1972 - Land Unit - IV Provisions of Ac Responsibilities of Unit - V Sustainable Deve	aw and the Indian Constitution - The Scheduled Tribes and Othes and Forest Conservation Act, 1980 - Panchayats Extension to Schaquisition Act, 1894 - Tenure & Property Rights and Community For Environment (Protection) Act 1986: It - Delegation of powers - Role of state and central government of local bodies - Legislation's on Solid waste Management (MSW, Bole of Regulatory Boards: Role of Regulatory Boards:	cheduled Areas Rights. t - Siting of inc iomedical, Plas	(PESA) Act 1 dustries - Coatic, E-waste 8	996 astal & Haz	zone	regul us was up - T	of Forestrotection 9 ations ste) 9
Environmental La Rights) Act, 2006 Act, 1972 - Land Unit - IV Provisions of Ac Responsibilities of Unit - V Sustainable Deve	aw and the Indian Constitution - The Scheduled Tribes and Othes and Forest Conservation Act, 1980 - Panchayats Extension to Schaquisition Act, 1894 - Tenure & Property Rights and Community For Environment (Protection) Act 1986: It - Delegation of powers - Role of state and central government of local bodies - Legislation's on Solid waste Management (MSW, Bole of Regulatory Boards: Role of Regulatory Boards:	cheduled Areas Rights. t - Siting of inc iomedical, Plas	(PESA) Act 1 dustries - Coatic, E-waste 8	996 astal & Haz	zone	regul us was up - T	9 ations ste) 9 NPCB
Environmental La Rights) Act, 2006 Act, 1972 - Land Unit – IV Provisions of Ac Responsibilities of Unit - V Sustainable Deve CPCB -TWAD Bo	aw and the Indian Constitution - The Scheduled Tribes and Othes and Forest Conservation Act, 1980 - Panchayats Extension to Schaquisition Act, 1894 - Tenure & Property Rights and Community For Environment (Protection) Act 1986: It - Delegation of powers - Role of state and central government of local bodies - Legislation's on Solid waste Management (MSW, Bole of Regulatory Boards: Role of Regulatory Boards:	cheduled Areas Rights. t - Siting of inc iomedical, Plas dies - Significar	(PESA) Act 1 dustries - Coatic, E-waste 8	astal Haz	zone	regul us was up - T	ste) 9 ations ste) 9 NPCB
Environmental La Rights) Act, 2006 Act, 1972 - Land Unit – IV Provisions of Ac Responsibilities of Unit - V Sustainable Deve CPCB -TWAD Bo	aw and the Indian Constitution - The Scheduled Tribes and Othes and Forest Conservation Act, 1980 - Panchayats Extension to Schaquisition Act, 1894 - Tenure & Property Rights and Community For Environment (Protection) Act 1986: It - Delegation of powers - Role of state and central government of local bodies - Legislation's on Solid waste Management (MSW, Bound of Regulatory Boards: Role of Regulatory Boards: Elopment - Roles and functions of Regulatory bodies and Local bodies - Case Studies.	cheduled Areas Rights. t - Siting of inc iomedical, Plas dies - Significar	(PESA) Act 1 dustries - Coatic, E-waste 8	astal Haz	zone	regul us was up - T	ste) 9 ations ste) 9 NPCB
Environmental La Rights) Act, 2006 Act, 1972 - Land Unit – IV Provisions of Ac Responsibilities of Unit - V Sustainable Deve CPCB -TWAD Bo TEXT BOOK: 1. Aruna Ve REFERENCES:	aw and the Indian Constitution - The Scheduled Tribes and Othes and Forest Conservation Act, 1980 - Panchayats Extension to Schaquisition Act, 1894 - Tenure & Property Rights and Community For Environment (Protection) Act 1986: It - Delegation of powers - Role of state and central government of local bodies - Legislation's on Solid waste Management (MSW, Bound of Regulatory Boards: Role of Regulatory Boards: Elopment - Roles and functions of Regulatory bodies and Local bodies - Case Studies.	cheduled Areas Rights. t - Siting of inclination o	(PESA) Act 1 dustries - Coatic, E-waste 8 nce - Organisa w Delhi, 2011	astal k Haza	zonezardou	regulus was	f Fores rotection 9 ations ste) 9 Total:4

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	interpret the origin and behaviour of environmental protection acts.	Understanding (K2)
CO2	illustrate the environmental protection mechanisms based on environmental indicators.	Understanding (K2)
CO3	describe the national environmental policies for enhanced ecology.	Understanding (K2)
CO4	classify the significance of federal and state environmental protection acts.	Understanding (K2)
CO5	recommend the code of ethics given by pollution regulatory boards to safeguard the environment.	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1			3									
CO2	2	1			3									
CO3	2	1			3									
CO4	2	1			3									
CO5	3	2			3									

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40		100				
CAT2	40		100				
CAT3	35		100				
ESE	35		100				

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

		22MEX01 - RENEWABLE ENERGY SOU	IRCES					
Progra	ımme &		_	_				
Branch		All BE/BTech branches except Mechanical Engineering	Sem.	Category	L	Т	Р	Credit
Prereq	uisites	Nil	5	OE	3	0	2	4
Pream	ble	This course discusses various technologies behind renewable e integrating power from renewable energy plants with grid.	nergy conve	ersion process	and	the	challe	nges in
Unit -	- I	Grid Integration of Renewable Energy						9
Varia	ability – Inte	se- Energy Status in India -Lifetime of Fossil Fuels- Energy Conversio ermittency - Dispatchability - Electric Grid Infrastructure - Integrating Ren the Smart Grid.						
Unit -		Solar Energy and Wind Energy lar Radiation – Measurements of Solar Radiation and Sunshine - Solar						9
PV and Certific Wind E - Wind	d Thermal cation. Energy: Bas Turbine G	amentals of Solar Photo Voltaic Conversion – Solar PV Systems-Type Applications - Building Integrated Solar- Challenges – Economicssic Terms – Types - Horizontal Axis Wind Turbine-Vertical Axis Wind enerator and its Performance - Wind Turbine Applications - Recent D Systems - Challenges - Economics.	Leadership i Turbine - Bu	in Energy Envilliding Integrate	ironm ed Wir	ent C nd Tu	esign rbines	(LEED)
	nit – IÍI	Bioenergy						9
Deenba	ss Resourd andhu Mod enges - Ec	ces - Biomass Conversion Technologies - Factors Affecting Biogas lel - Cogeneration Plant in Rice Mill- Ethanol Production - Energy Reconomics.	Production - covery from U	Biogas Plant - Jrban Waste. ⁻	- Type Frans	es – porta	KVIC tion	Model -
Unit -	· IV	Geothermal Energy and Ocean Energy						9
		gy: Geothermal Resources-Structure of Earth's Interior - Electricity Pro	oduction - Co	onversion Tech	nolog	ју - С	haller	iges
	Energy: O	cean Thermal Plants - Types-Tidal Plants – Types - Energy Estimati nines–Types – Buoy - Dolphin - Oscillating Water Column - Duck -Cha			al Pov	wer -	Wave	Energy
Unit -	_	Direct Energy Conversion Systems and New Energy Sources	•					9
New E	nergy Soul	nversion Systems: MHD Generators – Thermoelectric Power Generat rces: Hydrogen – Generation – Storage - Transport and Utilization - A my - Safety Issues - Fuel Cell – Principle –Types.		- Power Gene	ration	– Tra	anspo	rt -
LIST O	F EXPERI	MENTS / EXERCISES:						
1. E	Evaluate th	e cut in speed of the wind turbine.						
2. A	Analyze the	e effect of the variation of Tip speed ratio on the Coefficient of power o	of wind turbin	e.				
3.	Determine t	the thermal energy gain at the focal point of a concentrating collector.						
4.	Determine t	the efficiency of solar (Liquid/Air) collector.						
5. F	Plot the effe	ect of variation of tilt angle on the PV module output.						
6. F	Plot the effe	ect of variation of Solar intensity on the PV module output.						
7.	Study on ro	ooftop Solar PV plant.						
8. 8	Study on w	eather monitoring station.						
	Study the b	pattery management system of solar PV module.						
9.								

TEXT BOOK:

1. John Twidell., "Renewable Energy Resources", 4th Edition, Routledge ,New York, 2021.

REFERENCES/ MANUAL / SOFTWARE:

- 1. Kothari D.P., Singal K.C., Rakesh Ranjan, "Renewable Energy Sources and Emerging Technologies", 3rd Edition, PHI Learning Pvt. Ltd., New Delhi, 2022.
- 2. Rai G.D., "Non-Conventional Energy Sources", 6th Edition, Khanna Publishers, New Delhi, 2022.

	E OUTCOMES: pletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	explain the concepts behind the integration of renewable energy.	Applying (K3)
CO2	describe the working and applications of solar and wind energy systems and evaluate the performance of solar and wind energy system	Applying (K3) Manipulation (S2)
CO3	illustrate the bio-energy production techniques and the challenges in energy conversion	Applying (K3)
CO4	explain the working of geothermal and Ocean energy conversion technologies along with their economics and challenges.	Applying (K3)
CO5	explain the direct energy conversion systems and new energy sources.	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2					2	3							
CO2	1		2	3	2	3	3		3					
CO3	2					2	3							
CO4	2					2	3							
CO5	2					2	3							

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
20	40	40				100
20	40	40				100
20	40	40				100
20	40	40				100
	20 20 20 20	(K1) % (K2) % 20 40 20 40 20 40	(K1) % (K2) % (K3) % 20 40 40 20 40 40 20 40 40	(K1) % (K2) % (K3) % (K4) % 20 40 40 20 40 40 20 40 40	(K1) % (K2) % (K3) % (K4) % (K5) % 20 40 40 20 40 40 20 40 40	(K1) % (K2) % (K3) % (K4) % (K5) % (K6) % 20 40 40 20 40 40 20 40 40

* ±3% may be varied (CAT 1, 2 3 – 50 marks & ESE – 100 marks)

	22MEX02 DESIGN O	F EXPERIMENTS					
Programme Branch	All BE/BTech branches except Mech Engineering	nanical Sem.	Catego ry OE	L 3	T 0	P 2	Credit
Pre requisit	e Nil	0	OL	<u> </u>	U		-
Preamble	The course explores the fundamentals of experiments, optimization techniques like ANG Taguchi Method.						
UNIT – I	Experimental Design Fundamentals						9
	of Experiments - Experimental Strategies-Basi tion - Sample Size - Normal Probability Plot - Li			nology	′ - AN	OVA	-Steps ir
UNIT – II	Multifactor Experimental Design						9
Randomizati Designs for	periments: Factorial Experiments - Terminolog on-Two Level Experimental Designs for Two Two Factors and Three Factors- Factor Effect esigns-Central Composite Designs - Illustration	Factors and Three	Factors. tions - Fra	Three actiona	Leve	Exp	erimenta
Factorial Exp	Analysis and Interpretation Methods Variability-Ranking Method-Column Effect Methods Through Numerical Examples.	ethod-Plotting Meth ession Analysis-Mat	od-Analysi hematical	s of V Mode	ariand s from	ce (Al n Exp	9 NOVA) ir erimenta
UNIT – IV	Special Experimental Designs						9
	actorial Design - Nested Designs - Split Plot Design - Split Plot				face I	Metho	odology
UNIT – V	Taguchi Methods						9
Steps in Exp S/N Ratios-F	erimentation-Design using Orthogonal Arrays-Da Parameter and tolerance design concepts - Case	ata Analysis-Robus e Studies.	t Design - C	Contro	l and l	Voise	Factors
List of Exer	cises / Experiments :						
1. Design o	f experiments for turning operations by Taguchi	i method.					
2. Design o	f experiments for milling operations by Taguchi	method.					
3. Optimize	the parameters which affects the quality of CN0	C turning operation	by Taguch	ni metl	nod.		
	the parameters which affects the quality of CN0			uchi n	nethod	l.	
5. Process	parameter optimization in turning using central of	composite design n	nethod.				
6. Process	parameter optimization in turning using the Box	–Behnken design r	nethod.				
7. Process	parameter optimization in surface grinding by R	esponse Surface N	1 ethod				
8. Mathema	atical model development for turning operation						
9. Mathema	atical model development for milling operation						
10. Mathem	atical model development for drilling operation						
			Lecture:	45 Pı	actics	1:30	Total:7
				73, 1 1	actice	41.00,	
	<u> </u>			-13 , 1 1	actice	41.00,	
TEXT BOOK	glas C. Montgomery, "Design and Analysis of E es, 2020.	experiments", 10 th E	dition, Johr				
TEXT BOOK 1. Dought State REFERENC	glas C. Montgomery, "Design and Analysis of E es, 2020. ES/MANUAL/SOFTWARE:			n Wile	y and		
TEXT BOOK 1. Dougle State REFERENC 1. Phill Nico	glas C. Montgomery, "Design and Analysis of E es, 2020.	gineering", 2 nd Editio	on, McGrav	n Wile	y and 2005.	sons	, United

COURSE OUTCOMES:	BT Mapped
On completion of the course, the students will be able to	(Highest Level)

CO1	underst	and the	fundame	ntal cor	ncepts in e	experime	ental desig	ın.				Unde	erstanding	(K2)
CO2	identify	and des	sign the s	single a	nd multifa	ctor exp	eriments.					Ap	oplying (K	3)
CO3			•		rpretation ession and		s for expe	rimental	results a	ınd also d	develop		oplying (K3 culation (S	,
CO4		ne conce method		ecial ex	periment	designs	and cond	uct expe	eriments	using res	ponse		oplying (K3 nipulation (
CO5			cepts of ing tague			ent desig	n for pract	tical prob	olems and	d conduc	t		alyzing (K ipulation (
	•				Ма	pping of	COs with	n POs a	nd PSOs	3	•			
COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2					2					
CO2	2	3	2	3	1				2					
CO3	2	3	2	3	1				2					
CO4	2	3	2	3	1				2					
CO5	2	3	2	3	1				2					
1 – Slight	, 2 – Mod	erate, 3	- Substa	ntial, B	T- Bloom	s Taxon	omy		•					
					AS	SESSME	ENT PAT	ΓERN -	THEORY	•				
	Bloom's gory*	Re	memberi (K1) %	ng	Understa (K2)		Apply (K3)		Analyzi (K4) ⁹	-	Evaluating (K5) %		reating K6) %	Total %
C	AT1		15		40		45	i						100
C	AT2		10		35		55	;						100
C	AT3		10		25		45	,	20					100
1				1			1							1

ESE

 * ±3% may be varied (CAT 1, 2 3 – 50 marks & ESE – 100 marks)

Programme & Branch	All BE/BTech branches except Mechanical Engineering	Sem.	Category	L	т.	Р	Credit
Prerequisites	Nil	7	OE	3	0	0	3
Preamble	This course provides the basic concepts of ergono involved in designing comfortable and safe workp		various tools	an	d tecl	nniqu	ies
Unit – I	Introduction to Ergonomics						9
	of Ergonomics / Human Factors - Disciplines - Physics in Workplace - Ergonomic Principles - Application						
Unit – II	Anthropometry						9
	Structure and Function - Types of Anthropometric Dric Measuring Techniques - Statistical Treatment of I						Design
Unit – III	Posture and Movement						9
Assessment((OWAS) Metho Unit – IV	RULA) – Rapid Entire Body Assessment (REBA) od. Work Counter Behavior and Perception	and Oval	ko Working	Pos	sture	Asse	essment 9
	r: Environmental Issues - Physical Work Capacity n and Cognitive Issues.	- Factors /	Affecting Wo	rk (Сара	city -	
		nes - Ment	al Workload.				
Information I Unit – V Work system Work Envelope	Processing and Perception: Interaction with Machin Work System Evaluation and Safety Evaluation: Contribution of Ergonomics to Workstates - Workplace Evaluation Tools - Case Studies.	ion Desigr	ı - Analysis d	of W	-		
Unit – V Work system Work Envelope Safety: Occup of Ergonomics	Processing and Perception: Interaction with Machin Work System Evaluation and Safety Evaluation: Contribution of Ergonomics to Workstates - Workplace Evaluation Tools - Case Studies. ational / Ergonomic Safety and Stress at Various Woin	ion Desigr	ı - Analysis d	of W	-	ules	Design -
Information I Unit – V Work system Work Envelope Safety: Occup of Ergonomics India - Case Si	Processing and Perception: Interaction with Machin Work System Evaluation and Safety Evaluation: Contribution of Ergonomics to Workstates - Workplace Evaluation Tools - Case Studies. ational / Ergonomic Safety and Stress at Various Woin	ion Desigr	ı - Analysis d	of W	-	ules	Design -
Information I Unit – V Work system Work Envelope Safety: Occup of Ergonomics India - Case Si TEXT BOOK:	Work System Evaluation and Safety Evaluation: Contribution of Ergonomics to Workstates - Workplace Evaluation Tools - Case Studies. ational / Ergonomic Safety and Stress at Various Woin tudies.	ion Desigr	ı - Analysis d	of W	ent R	ules	Design Scope Total:45
Information I Unit - V Work system Work Envelope Safety: Occup of Ergonomics India - Case Si TEXT BOOK:	Work System Evaluation and Safety Evaluation: Contribution of Ergonomics to Workstates - Workplace Evaluation Tools - Case Studies. ational / Ergonomic Safety and Stress at Various Woin tudies. T, Robert. "Introduction to Human Factors and Ergonomic Safety and Ergonomic Safety and Stress at Various Woin tudies.	ion Desigr	ı - Analysis d	of W	ent R	ules	Design Scope
Unit - V Work system Work Envelope Safety: Occup of Ergonomics India - Case Si TEXT BOOK: 1. Bridge REFERENCES 1. Pame Edition	Work System Evaluation and Safety Evaluation: Contribution of Ergonomics to Workstates - Workplace Evaluation Tools - Case Studies. ational / Ergonomic Safety and Stress at Various Workstates. Try, Robert. "Introduction to Human Factors and Ergonomic Safety and Stress at Various Workstates at Various Workstates - Workplace Evaluation Tools - Case Studies. Try, Robert. "Introduction to Human Factors and Ergonomics." Base McCauley-Bush, "Ergonomics: Foundational Principle, Taylor & Francis, CRC Press, New York, 2011.	ion Desigr rkplace - F pmics", Un iples, Appl	i - Analysis of lealth Manag ited Kingdon ications, and	of W	ent R	ress	Design Scope Total:45
Information I Unit - V Work system Work Envelope Safety: Occup of Ergonomics India - Case S TEXT BOOK: 1. Bridge REFERENCES 1. Pame Edition Dul, Ja	Work System Evaluation and Safety Evaluation: Contribution of Ergonomics to Workstates - Workplace Evaluation Tools - Case Studies. ational / Ergonomic Safety and Stress at Various Workstates. Try, Robert. "Introduction to Human Factors and Ergonomics: In McCauley-Bush, "Ergonomics: Foundational Princes."	ion Desigr rkplace - F pmics", Un iples, Appl	i - Analysis of lealth Manag ited Kingdon ications, and	of W	ent R	ress	Design Scope Total:45
Information I Unit - V Work system Work Envelope Safety: Occup of Ergonomics India - Case Si TEXT BOOK: 1. Bridge REFERENCES 1. Pame Edition 2. Dul, Ji Edition COURSE OUT	Work System Evaluation and Safety Evaluation: Contribution of Ergonomics to Workstates - Workplace Evaluation Tools - Case Studies. ational / Ergonomic Safety and Stress at Various Workstates. Tr., Robert. "Introduction to Human Factors and Ergonomic Safety and Stress at Various Workstates." Tr., Robert. "Introduction to Human Factors and Ergonomic Safety and Stress at Various Workstates at Various Workstates." Tr., Robert. "Introduction to Human Factors and Ergonomic Safety and Stress at Various Workstates." Tr., Robert. "Introduction to Human Factors and Ergonomic Safety and McCauley-Bush, "Ergonomics: Foundational Principal Princi	ion Desigr rkplace - F pmics", Un iples, Appl	i - Analysis of lealth Manag ited Kingdon ications, and	of W	ent RC F	ress logie	Design Scope Total:45
Information I Unit - V Work system Work Envelope Safety: Occup of Ergonomics India - Case St TEXT BOOK: 1. Bridge REFERENCES 1. Pame Edition 2. Dul, Ji Edition COURSE OUT On completion	Work System Evaluation and Safety Evaluation: Contribution of Ergonomics to Workstates - Workplace Evaluation Tools - Case Studies. ational / Ergonomic Safety and Stress at Various Workstates. Tr., Robert. "Introduction to Human Factors and Ergonomic Safety and Stress at Various Workstates." Tr., Robert. "Introduction to Human Factors and Ergonomic Safety and Stress at Various Workstates." Tr., Robert. "Introduction to Human Factors and Ergonomic Safety and Stress at Various Workstates." Tr., Robert. "Introduction to Human Factors and Ergonomic Safety and McCauley-Bush, "Ergonomics: Foundational Principal Principa	ion Desigr rkplace - F pmics", Un iples, Appl	i - Analysis of lealth Manag ited Kingdon ications, and	of W	ent F RC F chno	ules Press logie ide",	Design Scope Total:45 -, 2017. s", 1st 3rd
Information I Unit - V Work system Work Envelope Safety: Occup of Ergonomics India - Case Si TEXT BOOK: 1. Bridge REFERENCES 1. Pame Edition 2. Dul, Ja Edition COURSE OUT On completion CO1 define	Work System Evaluation and Safety Evaluation: Contribution of Ergonomics to Workstates - Workplace Evaluation Tools - Case Studies. ational / Ergonomic Safety and Stress at Various Woin tudies. Tr., Robert. "Introduction to Human Factors and Ergonomic Safety and Stress at Various Woin tudies. Tr., Robert. "Introduction to Human Factors and Ergonomics." Banding Agenta Stress, New York, 2011. Tr., Taylor & Francis, CRC Press, New York, 2011. Tr., and Weerdmeester, Bernard. "Ergonomics for Ben. United Kingdom, Taylor & Francis, 2017. TCOMES: To the Course, the students will be able to	ion Desigr rkplace - F pmics", Un iples, Appl	i - Analysis of lealth Manag ited Kingdon ications, and	of W	ent RC F chno ce Gu BT (High	ress logie ide", Map est I	Design Scope Total:45 -, 2017. s", 1st 3rd ped _evel)
Information I Unit - V Work system Work Envelope Safety: Occup of Ergonomics India - Case Si TEXT BOOK: 1. Bridge REFERENCES 1. Pame Edition 2. Dul, Ja Edition COURSE OUT On completion CO1 define CO2 make to	Work System Evaluation and Safety Evaluation: Contribution of Ergonomics to Workstates - Workplace Evaluation Tools - Case Studies. ational / Ergonomic Safety and Stress at Various Woin tudies. Tr., Robert. "Introduction to Human Factors and Ergonomic Safety and Stress at Various Woin tudies. Tr., Robert. "Introduction to Human Factors and Ergonomics." Banda McCauley-Bush, "Ergonomics: Foundational Princes, Taylor & Francis, CRC Press, New York, 2011. Tr., Taylor & Francis, CRC Press, New York, 2011. The components of the course, the students will be able to ergonomics and its components.	ion Desigr rkplace - F omics", Un iples, Appl	i - Analysis of lealth Manag ited Kingdon ications, and Quick Refer	of W	ent R RC F chno ce Gu BT (High nders	ules Press logie ide", Map est I ttand	Design Scope Total:45 -, 2017. s", 1st 3rd ped _evel) ing (K2)
Information I Unit - V Work system Work Envelope Safety: Occup of Ergonomics India - Case Si TEXT BOOK: 1. Bridge REFERENCES 1. Pame Edition 2. Dul, Ji Edition COURSE OUT On completion CO1 define CO2 make u CO3 examin	Work System Evaluation and Safety Evaluation: Contribution of Ergonomics to Workstates - Workplace Evaluation Tools - Case Studies. ational / Ergonomic Safety and Stress at Various Workstates. Tr., Robert. "Introduction to Human Factors and Ergonomic Safety and Stress at Various Workstates. Tr., Robert. "Introduction to Human Factors and Ergonomic Science of Management of Science	ion Desigr rkplace - F omics", Un iples, Appl	i - Analysis of lealth Manag ited Kingdon ications, and Quick Refer	of W	ent RC F chno ce Gu BT (High nders App	ules 'ress logie ide", Map est I tand	Design Scope Total:45 , 2017. s", 1st 3rd ped _evel) ing (K2) (K3)

					Mappin	g of CC	s with	POs ar	nd PSO	s				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2				2						1		
CO2	2		2		3	3						1		
CO3	2			1	2	3	2					1		
CO4	2					3	1					1		
CO5	2				2	3						1		

ASSESSMENT	PATTERN -	- THEORY
AUGLOGIVILIVI		

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	45	35				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	10	45	45				100

^{* ±3%} may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

Branch	All BE/BTech branches except Mechanical Engineering	Sem.	Category	L	Т	Р	Credit
Prerequisites	NIL C C	7	OE ,	3	0	0	3
			<u> </u>	-			
Preamble	The course provides the principles, theory and practice of mar covers the skills to meet the challenges of management, human						
Unit – I	Principles of Management						9
	ignificance of Management - Evolution of Modern Management - Approaches to the study of Management - Basic Function			ment	t - D	evelo	pment of
Unit – II	Planning and Organizing						9
	ives and Strategies - Policies and Planning Premises - Decisi acture- Premises - Departmentalization - Decentralization - Organ			g: Na	ature	and F	Process -
Unit – III	Staffing, Leading and Controlling						9
Managing Huma	n and training - Placement - Performance Appraisal - Career n Factor - Leadership - Communication. Controlling: Process of Management - Preventive Control - Industrial Safety.						
Unit – IV	Industrial Psychology- Job Analysis and Organization Dev	elopment					9
	Employ Satisfaction, Motivation and Group Behavior tion: Measuring Job Satisfaction – Consequences of Dissa Group Behavior, Teams, and Conflict - Stress Management- Pred						
TEXT BOOKS:							
1 Harold K							Total:4
	oontz & Heinz Weihrich., "Essentials of Management: An Internative".11th Edition. McGraw Hill Education Pvt. Ltd New Delhi. 20			_eade	ership)	Total:4
2. Michael	oontz & Heinz Weihrich., "Essentials of Management: An Internative",11th Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 20 3 Aamodt., "Industrial Psychology", 7th Edition, Cengage Learnir	20 for Unit	s I,II,III.)	Total:4
2. Michael	ive",11th Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 20	20 for Unit	s I,II,III.)	Total:4
REFERENCE:	ive",11th Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 20	20 for Uniting, India, 20	s I,II,III. 013 for Units	IV,V.			Total:4
1. Spector,	ive",11th Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 20 G Aamodt., "Industrial Psychology", 7th Edition, Cengage Learning P.E., "Industrial and organizational psychology: Research and pr	20 for Uniting, India, 20	s I,II,III. 013 for Units	IV,V.	2021. B	т Мај	
1. Spector, COURSE OUTCON completion of	ive",11th Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 20 G Aamodt., "Industrial Psychology", 7th Edition, Cengage Learning P.E., "Industrial and organizational psychology: Research and promes:	20 for Uniting, India, 20	s I,II,III. 013 for Units	IV,V.	2021. B (Hi	T Ma _l	oped
1. Spector, COURSE OUTCON completion of CO1 interpret	ive",11th Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 20 G Aamodt., "Industrial Psychology", 7th Edition, Cengage Learning P.E., "Industrial and organizational psychology: Research and property." DMES: the course, the students will be able to	20 for Uniting, India, 20	s I,II,III. 013 for Units	ons, 2	2021. B (Hig	T Ma _l ghest	oped Level)
1. Spector, COURSE OUTCON completion of CO1 interpret CO2 Infer the	ive",11th Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 20 Aamodt., "Industrial Psychology", 7th Edition, Cengage Learning P.E., "Industrial and organizational psychology: Research and promess: the course, the students will be able to the theory and the practice of management.	20 for Uniting, India, 20 actice". Jol	s I,II,III. 013 for Units	ons, 2	B (Hig Unde	T Map ghest erstand	oped Level) ding (K2)
1. Spector, COURSE OUTCO On completion of CO1 interpret CO2 Infer the CO3 present t	ive",11th Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 20 Aamodt., "Industrial Psychology", 7th Edition, Cengage Learning P.E., "Industrial and organizational psychology: Research and promess: the course, the students will be able to the theory and the practice of management. knowledge of planning and organizing activities in an industry	ng, India, 20 actice". Jol	s I,II,III. 013 for Units nn Wiley & So	IV,V.	B (Hig Unde	T Map ghest erstanderstand	oped Level) ding (K2)
1. Spector, COURSE OUTCO On completion of CO1 interpret CO2 Infer the CO3 present t CO4 develop	ive",11th Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 20 Aamodt., "Industrial Psychology", 7th Edition, Cengage Learning P.E., "Industrial and organizational psychology: Research and promessing the course, the students will be able to the theory and the practice of management. knowledge of planning and organizing activities in an industry the functions of staffing, leading and controlling of an organization.	actice". Jol	s I,II,III. 013 for Units nn Wiley & So	DDNS, 2	B (High	T Maj ghest erstand erstand erstand	oped Level) ding (K2) ding (K2)

					Mappin	g of CO	s with	POs an	d PSOs	3				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2					2				2	1			
CO2	2					2				2	1			
CO3	2					2				2	1			
CO4	2					2				2	1			
CO5	2					2				2	1			

¹⁻ Slight, 2- Moderate, 3- Substantial, BT- Bloom's Taxonomy

		ASSESSMENT	PATTERN -	THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	35	65					100
CAT2	35	65					100
CAT3	35	65					100
ESE	40	60					100

^{*} $\pm 3\%$ may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

	22MEO03 WASTE HEAT RECOVERY SYSTEM AND STORAGE	E				
Programme & Branch	All BE/BTech branches except Mechanical Engineering Sem. Cat	egory	L	Т	Р	Credit
Prerequisites	Nil 7	OE	3	0	0	3
Preamble	The course explores the fundamentals of waste heat recovery and thermal energy for diverse industrial processes to enhance energy efficiency and sustainability.	y storage	tec	nnolo	gies	applicable
Unit – I	Introduction					9
	cs Laws -Types of Waste Heat Sources - Principles of Energy Conversion - Ran and Power Plant - Combined Plants- Potential for Energy Conservation -Total Ene				bined	Cycles -
Unit – II	Waste Heat Recovery Systems					9
Recuperators -	Fundamentals- Conduction, Convection, and Radiation- Selection Criteria for Was Regenerators -Economizers - Plate Heat Exchangers - Thermic Fluid Heaters - W rs - Heat Pipe Exchangers - Heat Pumps – Sorption Systems.					
Unit – III	Cogeneration					9
 Gas Turbine Systems – Adva Cogeneration To 	•	Combine	d C	ycles	Co-g	generation election of
Unit – IV	Thermal Energy Storage			01		9
Thermochemica	y Storage, Sensible and Latent Heat - Sensible Heat Storage Materials- Ice Storage - Molten Salt, Metal Hydrides, Sorption Materials - Hybrid Thermal Eneage – Mass and Energy Balance Analysis of Thermal Energy Storage.	rage- Ph ergy Stor	ase age	Cha Syst	nge I ems -	//aterials – – Potential
Unit – V	Economic and Environmental Considerations					9
TEXT BOOKS:						Total:45
1. Hussan	n Jouhara "Waste Heat Recovery in Process Industries "John Wiley & Sons, 2022.	for Units	I,II.			
Horlock	x, J. H "Cogenerationcombined heat and power (CHP): thermodynamics and ecorny; Reprint edition, 1996 for Unit III.			ger P	ublish	ning
	Dincer and Mark A. Rosen, Thermal Energy Storage Systems and Applications, Jo	ohn Wile	y & \$	Sons	2010	. for Unit
4. David F Unit V	lin, "Cogeneration - A User's Guide" Institution of Engineering and Technology, Lor	ndon, Un	ited	King	dom,	2009. for
REFERENCES:	:					
1. Charles	H.Butler, Cogeneration, McGraw Hill Book Co., 1984.					
2. Institut	e of Fuel, London, Waste Heat Recovery, Chapman & Hall Publishers, London, 196	63.				
3. Sengu	pta Subrata, Lee SS EDS, Waste Heat Utilization and Management, Hemisphere, V	Washingt	on,	1983		
4. De Nev	vers, Noel., Air Polllution Control Engineering, McGrawHill, New York,1995					
COURSE OUTO	COMES: of the course, the students will be able to					pped Level)
	and the basic thermodynamic principles and concepts of waste heat recovery and esystems.	energy	ı	Jnde	rstan	ding (K2)
CO2 acquire	knowledge pertaining to various waste heat recovery systems and their application are principles of energy conversion and distribution to design of cogeneration system					g(K3) g(K3)
	and analyze the sensible, latent, and thermochemical storage systems and their			•		g(K3) ding (K2)
	te the economic viability and environmental impact of heat recovery and storage sys	stem				g(K3)
			1	- 1	1 7	O(-/

					Mappin	g of CO	s with	POs an	d PSO	3				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2												
CO2	3	2	1											
CO3	3	2		2										
CO4	3		1											
CO5	3	1	1				2							

		ASSESSMENT	PATTERN -	THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	45	30				100
CAT2	15	40	45				100
CAT3	25	40	35				100
ESE	25	40	35				100

 $^{^*}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

	22MEO04 SAFETY MEASURES FOR ENGI	NEERS	5				
Programme & Branch	All BE/BTech branches except Mechanical Engineering	Sem.	Category	L	Т	Р	Credi
Prerequisites	Nil	8	OE	3	0	0	3
Preamble	The course explores the knowledge on safety aspects, procedulindustries, while performing various types of activities in electrical personnel protection equipment's and risk assessment procedures.	l, chem					
Unit – I	Safety Management and Accident Prevention	•					9
Sampling Techr Accident Preven	ment: Need for Safety - Safety and Productivity - Safety Managemenique - Incident Recall Technique - Plant Safety Inspection. ention: Nature and Causes of Accidents - Accident Proneness - Costing and Investigation - Safety Education and Training. Electrical and Fire Safety		•		-	-	
Usefulness and Safety Measure Atmosphere - S Statutoryand otl Maintenance an	Hazards of Electricity - Statutory Provisions - Indian Standards - Effects for Electric work - Overload and Other Protections - Portable Electricity - Energy Conservation and Safety Fire Phenomenther standards - Design for Fire Safety - Fire Prevention and Protection d Training for Fire Protection.	ctrical <i>i</i> na - Cl	Apparatus - assification	Elect of Fir	ric Wo	ork in H I Exting	n Body - lazardou guishers spection,
Material(Propert Pollution Hazar	Safety in Chemical Industry mical Industry - Statutory Provisions - Indian Standards y)Hazards and Controls - Storage Hazards & Controls - Process Ha ds & Controls - Instrumentation for Safe Plant Operations - Safe	azards	& Controls -	Utility	y Haza	ards &	Controls
Maintenance - V Unit – IV	Vork Permits of Hazardous Work- case studies Personnel Protection Equipment (PPE)						9
							7
	stion Statutory Dravisiona Indian 9 Other standards Salastian and	Classi	fination No.	. Doo	niroto	n, Faui	nmont
	ation - Statutory Provisions - Indian & Other standards - Selection and						
Respiratory Equ	ation - Statutory Provisions - Indian & Other standards - Selection and sipment - Training, Maintenance, Precaution and Care of PPE - Detect						
Respiratory Equ Standards Unit – V Basic Concepts	Risk Assessment of Risk - Safety Appraisal, Analysis and Control Techniques - Act Assessment Techniques - Reliability Engineering - Major Acciden	tion Eq	uipment - PF	PE Te	sting F	Procedu and R	g eporting nd Off-si
Respiratory Equ Standards Unit – V Basic Concepts Hazardand Risk Emergency Plar	Risk Assessment of Risk - Safety Appraisal, Analysis and Control Techniques - Act Assessment Techniques - Reliability Engineering - Major Acciden	tion Eq	uipment - PF	PE Te	sting F	Procedu and R	y 9 Reporting and Off-si
Respiratory Equ Standards Unit – V Basic Concepts Hazardand Risk Emergency Plar TEXT BOOK:	Risk Assessment of Risk - Safety Appraisal, Analysis and Control Techniques - Act Assessment Techniques - Reliability Engineering - Major Acciden	tion Eq	Investigation	PE Te	sting F alysis - On	and R	g eporting nd Off-si
Respiratory Equity Standards Unit – V Basic Concepts Hazardand Risk Emergency Plar TEXT BOOK: 1. Mistry K	Risk Assessment of Risk - Safety Appraisal, Analysis and Control Techniques - Act Assessment Techniques - Reliability Engineering - Major Accidents. C.U., "Fundamentals of Industrial Safety and Health", 2 nd Edition, Siddle	tion Eq	Investigation	PE Te	sting F alysis - On	and R	g eporting nd Off-si
Respiratory Equity Standards Unit – V Basic Concepts Hazardand Risk Emergency Plar TEXT BOOK: 1. Mistry K REFERENCES:	Risk Assessment of Risk - Safety Appraisal, Analysis and Control Techniques - Act Assessment Techniques - Reliability Engineering - Major Accidents. C.U., "Fundamentals of Industrial Safety and Health", 2 nd Edition, Siddle	tion Eq ccident nt Haza	uipment - PF Investigation Ind (MAH) Co	n, An ontrol	alysis On	and R-site ar	geporting of Off-si
Respiratory Equity Standards Unit – V Basic Concepts Hazardand Risk Emergency Plar TEXT BOOK: 1. Mistry K REFERENCES: 1. John Ca 2012. 2. Davies	Risk Assessment of Risk - Safety Appraisal, Analysis and Control Techniques - Act Assessment Techniques - Reliability Engineering - Major Accidents. C.U., "Fundamentals of Industrial Safety and Health", 2 nd Edition, Siddhadick, Mary CapelliSchellpfeffer& Dennis Neitzell, "Electrical Safety Hadv.J. &Thomasin K., "Construction Safety Hand Book", 2 nd Edition, Thomasin K., "Construction Safety Hand Book", 2 nd Edition, Thomasin K., "Construction Safety Hand Book", 2 nd Edition, Thomasin K., "Construction Safety Hand Book", 2 nd Edition, Thomasin K., "Construction Safety Hand Book", 2 nd Edition, Thomasin K., "Construction Safety Hand Book", 2 nd Edition, Thomasin K., "Construction Safety Hand Book", 2 nd Edition, Thomasin K.	ccident hat Haza	uipment - PF Investigation rd (MAH) Co Prakashan, A k", 4th Edition	n, Anontrol	sting F alysis - On dabad, Graw- n, 199	and R-site ar 2008.	geporting of Off-si
Respiratory Equity Standards Unit – V Basic Concepts Hazardand Risk Emergency Plar TEXT BOOK: 1. Mistry K REFERENCES: 1. John Ca 2012. 2. Davies Rao S, 4	Risk Assessment of Risk - Safety Appraisal, Analysis and Control Techniques - Act Assessment Techniques - Reliability Engineering - Major Accidents. A.U., "Fundamentals of Industrial Safety and Health", 2 nd Edition, Siddradick, Mary CapelliSchellpfeffer& Dennis Neitzell, "Electrical Safety Haddick, Mary Capelli Schellpfeffer& Dennis Neitzell, "Electrical Safety Haddick, Mary Capelli Schellpfeffer& Dennis Neitzell," "Electrical Safety Haddick, Mary Capelli Schellpfeffer& Dennis Neitzell, "Electrical Safety Haddick, Mary Capelli Schellpfeffer& Dennis Neitzell, "Electrical Safety Haddick, "Electrical Safety Haddick, "Electrical Safety Haddick, "Electrical Safety Haddic	ccident hat Haza	uipment - PF Investigation rd (MAH) Co Prakashan, A k", 4th Edition	n, Anontrol	sting F alysis - On dabad, Graw- n, 199	and R-site ar 2008.	geporting of Off-si
Respiratory Equity Standards Unit – V Basic Concepts Hazardand Risk Emergency Plar TEXT BOOK: 1. Mistry K REFERENCES: 1. John Ca 2012. 2. Davies 3. Rao S, Publishe	Risk Assessment of Risk - Safety Appraisal, Analysis and Control Techniques - Act Assessment Techniques - Reliability Engineering - Major Accidents. C.U., "Fundamentals of Industrial Safety and Health", 2 nd Edition, Siddradick, Mary CapelliSchellpfeffer& Dennis Neitzell, "Electrical Safety Had V.J. &Thomasin K., "Construction Safety Hand Book", 2 nd Edition, The Jain R.K. & Saluja H.L., "Electrical Safety, Fire Safety Engineering and ers, 2012.	ccident hat Haza	uipment - PF Investigation rd (MAH) Co Prakashan, A k", 4th Edition	n, Anontrol	sting F alysis - On dabad, Graw- n, 199	and R-site ar 2008. Hill Edu 6	geporting nd Off-si Total:4 ucation,
Respiratory Equity Standards Unit - V Basic Concepts Hazardand Risk Emergency Plan TEXT BOOK: 1. Mistry K REFERENCES: 1. John Ca 2012. 2. Davies 3. Rao S, Publisho	Risk Assessment of Risk - Safety Appraisal, Analysis and Control Techniques - Act Assessment Techniques - Reliability Engineering - Major Accidents. C.U., "Fundamentals of Industrial Safety and Health", 2 nd Edition, Siddradick, Mary CapelliSchellpfeffer& Dennis Neitzell, "Electrical Safety Had V.J. &Thomasin K., "Construction Safety Hand Book", 2 nd Edition, The Jain R.K. & Saluja H.L., "Electrical Safety, Fire Safety Engineering and ers, 2012.	ccident hat Haza	uipment - PF Investigation rd (MAH) Co Prakashan, A k", 4th Edition	n, Anontrol	sting F allysis - On dabad, Graw- n, 199 2nd Edi	and R-site ar 2008.	geporting nd Off-si Total:4
Respiratory Equity Standards Unit – V Basic Concepts Hazardand Risk Emergency Plar TEXT BOOK: 1. Mistry K REFERENCES: 1. John Ca 2012. 2. Davies 3. Rao S, Published COURSE OUTCON completion of	Risk Assessment of Risk - Safety Appraisal, Analysis and Control Techniques - Act Assessment Techniques - Reliability Engineering - Major Accidents. C.U., "Fundamentals of Industrial Safety and Health", 2 nd Edition, Siddradick, Mary CapelliSchellpfeffer& Dennis Neitzell, "Electrical Safety Had V.J. &Thomasin K., "Construction Safety Hand Book", 2 nd Edition, The Jain R.K. & Saluja H.L., "Electrical Safety, Fire Safety Engineering and ers, 2012.	ccident th Haza marth F andboo mas T d Safet	uipment - PF Investigation rd (MAH) Co Prakashan, A k", 4th Edition	n, Annontrol	sting F alysis - On dabad, Graw- n, 199 2nd Edi B (Hig	and R-site ar 2008. Hill Edu 6 tion, Kh	geporting nd Off-si Total:4
Respiratory Equity Standards Unit - V Basic Concepts Hazardand Risk Emergency Plan TEXT BOOK: 1. Mistry K REFERENCES: 1. John Ca 2012. 2. Davies 3. Rao S, Published COURSE OUT CONCOMPLETION CONCEPTION	Risk Assessment of Risk - Safety Appraisal, Analysis and Control Techniques - Act Assessment Techniques - Reliability Engineering - Major Accidents. C.U., "Fundamentals of Industrial Safety and Health", 2 nd Edition, Siddradick, Mary CapelliSchellpfeffer& Dennis Neitzell, "Electrical Safety Had V.J. &Thomasin K., "Construction Safety Hand Book", 2 nd Edition, The Jain R.K. & Saluja H.L., "Electrical Safety, Fire Safety Engineering and ers, 2012. COMES: of the course, the students will be able to	ccident th Haza marth F andboo	uipment - PF Investigation rd (MAH) Co Prakashan, A k", 4th Edition elford Ltd., L y Manageme	n, Annontrol	sting F alysis alysis alabad, Graw- n, 199 2nd Edi B (Hig	and R-site ar 2008. Hill Edu 6 tion, Kh	geporting of Off-sind
Respiratory Equity Standards Unit - V Basic Concepts Hazardand Risk Emergency Plar TEXT BOOK: 1. Mistry K REFERENCES: 1. John Ca 2012. 2. Davies: 3. Rao S, Publish COURSE OUT CON completion of CO1 perceive safe early safe early consideration.	Risk Assessment of Risk - Safety Appraisal, Analysis and Control Techniques - Act Assessment Techniques - Reliability Engineering - Major Accidents. A.U., "Fundamentals of Industrial Safety and Health", 2 nd Edition, Siddhadick, Mary CapelliSchellpfeffer& Dennis Neitzell, "Electrical Safety Had V.J. &Thomasin K., "Construction Safety Hand Book", 2 nd Edition, The Jain R.K. & Saluja H.L., "Electrical Safety, Fire Safety Engineering and ers, 2012. COMES: of the course, the students will be able to the safety management concepts and accident prevention methods.	ccident at Haza	uipment - PF Investigation Ind (MAH) Co Prakashan, A Prakashan, A Prakashan, A Prakashan, A Prakashan, A Prakashan, A	n, Annontrol	sting F alysis - On dabad, Graw- n, 199 2nd Edi Hig Under	and R -site ar 2008. Hill Edu 6 tion, Kh	geporting and Off-si Total:4 Total:4 ucation, nanna ped evel) ng (K2) (K3)
Respiratory Equity Standards Unit - V Basic Concepts Hazardand Risk Emergency Plan TEXT BOOK: 1. Mistry K REFERENCES: 1. John Ca 2012. 2. Davies 3. Rao S, Publish COURSE OUTCON completion of CO1 perceive Safe ear identify safe plan CO3 identify safe plan	Risk Assessment of Risk - Safety Appraisal, Analysis and Control Techniques - Act Assessment Techniques - Reliability Engineering - Major Accidents. A.U., "Fundamentals of Industrial Safety and Health", 2 nd Edition, Siddhadick, Mary CapelliSchellpfeffer& Dennis Neitzell, "Electrical Safety Had V.J. &Thomasin K., "Construction Safety Hand Book", 2 nd Edition, The Jain R.K. & Saluja H.L., "Electrical Safety, Fire Safety Engineering and ers, 2012. COMES: of the course, the students will be able to the safety management concepts and accident prevention methods. Expropriate measuring and /or insulating equipment, use of fire extinguishing practices. the hazards in chemical industries during transporting, storing and process.	ccident at Haza	uipment - PF Investigation Ind (MAH) Co Prakashan, A Prakashan, A Prakashan, A Prakashan, A Prakashan, A Prakashan, A	n, Annontrol	sting F lalysis lalysis labad, Graw- n, 199 2nd Edi Hig Under	and R-site ar 2008. Hill Edu tion, Kh T Mapp ghest L rstandir	geporting and Off-si Total:4 Total:4 ucation, nanna ped .evel) ng (K2) (K3)

					Mappi	ng of C	Os with	POs a	nd PSC)s				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1					3	2	1						
CO2	1					3	2	1						
CO3	1					3	2	1						
CO4	1					3	2	1						
CO5	1					3	2	1						

		ASSESSMEN	T PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	45	40				100
CAT2	20	40	40				100
CAT3	30	30	40				100
ESE	30	35	35				100

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

		22MEO05 ENERGY CONSERVATION IN THERMA	L EQUIP	MENTS				
Progra	amme &					_		
Brancl		All BE/BTech branches except Mechanical Engineering	Sem.	Category	L	Т	Р	Credit
Prereq	uisites	Nil	8	OE	3	0	0	3
Pream	ble	This course provides the knowledge on the methods to conserve evaluation of the performance parameters.	e energy	in thermal e	quipr	ment	after	a detailed
Unit -	I	Basics of Energy						9
Measu	rement of I Performa	of Energy – Power – Units – Estimation of Energy Requirement – Electrical Quantities - Energy Efficiency and Conservation – Plant nce – Energy Audit and Survey Instruments - Energy related CO:	Energy P	erformance -	- Pro	ducti	on Fa	ctor Plant
Unit –		Energy Conservation in Steam System						9
	rmance As	gram - Steam Distribution - Steam Pipe Design and Sizing – Stean seessment Methods Energy Saving Opportunities. Energy Conservation in Boilers and Furnaces	n Traps -	- Selection – (Oper	ation	– Ma	aintenance 9
		eatment – Water to Steam Conversion – Hot Water Systems – F	leat trans	sfer Coefficie	nts -	- Boil	er Pe	_
Assess	sment using	g Direct and Indirect Method – Energy Conservation Opportunities. nance Evaluation – General Fuel Economy Measures- Estimation of			1113	DOII	Ci i c	mormance
Unit -	IV	Energy Conservation in Air conditioners						9
Energy	/ Conserva	tics and Calculation - Factors Affecting Cooling Rate - Air condition Opportunities – Energy Monitoring and Control System.	oner – W	orking – Typ	es –	Effic	iency	- Sizing -
Unit -	V	Cogeneration						
			nnical Pa	rameters Infl	luend	cina 1	the S	9 selection of
Need - Cogen Assess	 Classific eration Sys sment. 	ation – Commercial Cogeneration Systems – Factors and Techstems – Energy Savings through Cogeneration Systems - Relative						election of
Need - Cogen	 Classific eration Sys sment. BOOK:	ation – Commercial Cogeneration Systems – Factors and Tech stems – Energy Savings through Cogeneration Systems - Relative	Merits of	Cogeneration	n Sy:	stems	s – Pe	relection of erformance
Need - Cogen Assess	 Classific eration Sys sment. BOOK:	ation – Commercial Cogeneration Systems – Factors and Techstems – Energy Savings through Cogeneration Systems - Relative	Merits of	Cogeneration	n Sy:	stems	s – Pe	relection of erformance
Need - Cogen Assess TEXT I	- Classific eration Systement. BOOK: Guide Bo	ation – Commercial Cogeneration Systems – Factors and Techstems – Energy Savings through Cogeneration Systems - Relative	Merits of	Cogeneration	n Sy:	stems	s – Pe	relection of erformance
Need - Cogen Assess TEXT I	- Classific eration Sys sment. BOOK: Guide Bo Efficiency RENCES:	ation – Commercial Cogeneration Systems – Factors and Techstems – Energy Savings through Cogeneration Systems - Relative	Merits of	Cogeneration	n Sy:	stems	s – Pe	relection of erformance
Need - Cogene Assess TEXT I 1. REFER	- Classific eration Sys sment. BOOK: Guide Bo Efficiency RENCES: Sonal Do	ation – Commercial Cogeneration Systems – Factors and Techstems – Energy Savings through Cogeneration Systems - Relative boks for National Certification Examination for Energy Managers are, 2015. esai, "Handbook of Energy Audit", 1st Edition, McGraw Hill Education A Roosa, Steve Doty, Wayne C Turner, "Energy Management Har	Merits of	rs, 4 th Edition	n Sy	eau (s – Pe	Total:45
TEXT I 1. REFEF 1. 2.	BOOK: Guide Book: Stephan York, 200	ation – Commercial Cogeneration Systems – Factors and Techstems – Energy Savings through Cogeneration Systems - Relative books for National Certification Examination for Energy Managers are, 2015. Desai, "Handbook of Energy Audit", 1st Edition, McGraw Hill Education A Roosa, Steve Doty, Wayne C Turner, "Energy Management Hare 18. DMES:	Merits of	rs, 4 th Edition	n Sy	eau c	of Ene	Total:45 ergy New
TEXT I 1. REFEF 1. 2.	BOOK: Guide Books Efficiency RENCES: Sonal Do Stephan York, 20° SE OUTCO mpletion of	ation – Commercial Cogeneration Systems – Factors and Techstems – Energy Savings through Cogeneration Systems - Relative books for National Certification Examination for Energy Managers are, 2015. esai, "Handbook of Energy Audit", 1st Edition, McGraw Hill Education A Roosa, Steve Doty, Wayne C Turner, "Energy Management Hares."	Merits of	rs, 4 th Edition	n Sy	eau d	of Ene	Total:45 ergy New
TEXT I 1. REFER 1. 2. COUR: On con	BOOK: Guide Bo Efficiency RENCES: Sonal Do Stephan York, 200	ation – Commercial Cogeneration Systems – Factors and Techstems – Energy Savings through Cogeneration Systems - Relative books for National Certification Examination for Energy Managers are y, 2015. Desai, "Handbook of Energy Audit", 1st Edition, McGraw Hill Education A Roosa, Steve Doty, Wayne C Turner, "Energy Management Hare 18. DMES: the course, the students will be able to	Merits of	rs, 4 th Edition	n Sy	eau d	of End	Total:45 Pergy New Ipped t Level)
TEXT I 1. REFEF 1. 2. COUR: On con	BOOK: Guide Bo Efficiency RENCES: Sonal Do Stephan York, 20° SE OUTCO mpletion of infer the explain t	ation – Commercial Cogeneration Systems – Factors and Techstems – Energy Savings through Cogeneration Systems - Relative books for National Certification Examination for Energy Managers are, 2015. Desai, "Handbook of Energy Audit", 1st Edition, McGraw Hill Education A Roosa, Steve Doty, Wayne C Turner, "Energy Management Harms. DMES: the course, the students will be able to basics of energy with reference to energy conservation.	Merits of	rs, 4 th Edition	n Sy	eau c Publis (Hi Und	of Ene	Total:45 ergy New pped t Level) nding (K2)
TEXT I 1. REFEF 1. 2. COUR: On con CO1 CO2	BOOK: Guide Bookers Guide Bookers Guide Bookers Guide Bookers Sences Sonal Door Stephan York, 200 SEOUTCO SEOU	ation – Commercial Cogeneration Systems – Factors and Techstems – Energy Savings through Cogeneration Systems - Relative books for National Certification Examination for Energy Managers are, 2015. Desai, "Handbook of Energy Audit", 1st Edition, McGraw Hill Education A Roosa, Steve Doty, Wayne C Turner, "Energy Management Hare 18. DMES: the course, the students will be able to basics of energy with reference to energy conservation. The energy conservation opportunities in steam system.	Merits of	rs, 4 th Edition	n Sy	eau c Publis (Hi Und	of Energy Englishments of Energy Englishments, ersta	Total:45 ergy New Ipped t Level) nding (K2)

					Mappin	g of CO	s with	POs an	d PSOs	3				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2				1	1	3					1		
CO2	2					1	3					1		
CO3	2		2			1	3					1		
CO4	2		2			1	3					1		
CO5	3		2			1	2					1		

^{1 -} Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

		ASSESSMENT	PATTERN -	THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	50	20				100
CAT2	15	50	35				100
CAT3	15	50	35				100
ESE	15	50	35				100

^{*} $\pm 3\%$ may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

Programme & Branch	All BE/BTech branches except Mechanical Engineering	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	8	OE	3	0	0	3
Preamble	This course provides an overview on global and national clir energy technologies for sustainable development are also cover			s. In	addi	ition,	the future
Unit – I	Climate Change						9
– Green House	cepts of Climate Change - International Climate Policy - Causes o Gases in Atmosphere - Global Warming - Effects of Global Warmi on Agriculture – Forest - Water Resources - Monsoon System of	ng - Climat	Change - Enha e Change Sc	ance enari	d Gre o of I	enho ndia -	use Effec Impact o
Unit – II	Energy Transition						9
Energy Transition	y Needs - Personal Carbon Dioxide Balance - Carbon Dioxide Secon in Heat Sector - Transport Sector - Electricity Sector - Direct and bon-free Technology.						
Unit – III	Renewable Energy System						9
Designing Grid-	systems - Domestic Solar Water Heating - Space Heating - Solar connected Systems - Renewable Power Plants - Solar Photovol Grid-connected Wind Turbines - Geothermal Heat and Power Plan	Itaic Power	· Plants - Cor	rcent	rating	g Sola	
Unit – IV	Battery Technologies						9
	eries – Types - Discharge Curves - Terminal Voltages - Plateau	ı Voltage -	Lead Acid B	atter	ıes –	Cons	truction -
Unit – V Demand for Pov Efficiency of End	httery Performance Evaluation - Factors Affecting Battery Performate Energy Storage Technology Ver Systems - Overview of Energy Storage Technologies - Energy Energy Storage systems -Thermal Energy Storage (TES) using Pha	ance - Adva y Storage Mase Change	anced Batterie Methods – Ele	es fo	r Elec	tric V orage	ehicles. 9 Systems
Unit – V Demand for Pov Efficiency of End	httery Performance Evaluation - Factors Affecting Battery Performa Energy Storage Technology ver Systems - Overview of Energy Storage Technologies - Energy	ance - Adva y Storage Mase Change	anced Batterie Methods – Ele	es fo	r Elec	tric V orage	ehicles. 9 Systems
Unit - V Demand for Pov Efficiency of End TES - Planning	httery Performance Evaluation - Factors Affecting Battery Performate Energy Storage Technology Ver Systems - Overview of Energy Storage Technologies - Energy Energy Storage systems -Thermal Energy Storage (TES) using Pha	ance - Adva y Storage Mase Change	anced Batterie Methods – Ele	es fo	r Elec	tric V orage	ehicles. 9 Systems /ation wit
Unit – V Demand for Pov Efficiency of End TES - Planning a	httery Performance Evaluation - Factors Affecting Battery Performate Energy Storage Technology Ver Systems - Overview of Energy Storage Technologies - Energy Energy Storage systems -Thermal Energy Storage (TES) using Pha	ance - Ādva y Storage N ase Change ns.	anced Batterion	es for ectric Energ	al Sto	orage onserv	ehicles. 9 Systems /ation wit
Unit – V Demand for Pov Efficiency of End TES - Planning : TEXT BOOKS: 1. Volker \	Attery Performance Evaluation - Factors Affecting Battery Performate Penergy Storage Technology Ver Systems - Overview of Energy Storage Technologies - Energy Pergy Storage Storage (TES) using Phase and Implementation of TES - Environmental impact of TES system	y Storage Nase Changens.	Anced Batterion Methods – Ele Materials - I	ectric Energ	al Stogy Co	orage onserv	ehicles. 9 Systems vation wit Total:4
Unit – V Demand for Pov Efficiency of End TES - Planning a TEXT BOOKS: 1. Volker \	Attery Performance Evaluation - Factors Affecting Battery Performate Energy Storage Technology Wer Systems - Overview of Energy Storage Technologies - Energy Storage systems - Thermal Energy Storage (TES) using Phase and Implementation of TES - Environmental impact of TES systems. W. Quaschning, "Renewable Energy and Climate Change", 2nd Edition	y Storage Nase Changens.	Anced Batterion Methods – Ele Materials - I	ectric Energ	al Stogy Co	orage onserv	ehicles. 9 Systems vation wit Total:4
Unit – V Demand for Pov Efficiency of End TES - Planning a TEXT BOOKS: 1. Volker \ 2. Beard K REFERENCES:	Interly Performance Evaluation - Factors Affecting Battery Performate Energy Storage Technology I Systems - Overview of Energy Storage Technologies - Energy Pergy Storage systems - Thermal Energy Storage (TES) using Phase and Implementation of TES - Environmental impact of TES systems. I Quaschning, "Renewable Energy and Climate Change", 2nd Edition of Test and Book of Batteries", 5th Edition, McGraw Hill Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Dince	y Storage Nase Changens.	Anced Batterion Methods – Ele Materials - I Publications, I	es for ectric Energy	al Stogy Co	orage onserved	ehicles. 9 Systems vation wit Total:4 Units I,II,II
Demand for Pov Efficiency of Eng TES - Planning a TEXT BOOKS: 1. Volker \ 2. Beard k REFERENCES: 1. Ibrahim USA, 2 Mehme	Interly Performance Evaluation - Factors Affecting Battery Performate Energy Storage Technology I Systems - Overview of Energy Storage Technologies - Energy Pergy Storage systems - Thermal Energy Storage (TES) using Phase and Implementation of TES - Environmental impact of TES systems. I Quaschning, "Renewable Energy and Climate Change", 2nd Edition of Test and Book of Batteries", 5th Edition, McGraw Hill Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Dince	y Storage Mase Changens. ion, Wiley I Book Cor	Methods – Ele Materials - I Publications, I mpany, New N	JSA,	al Stogy Co	orage onserved for U	ehicles. 9 Systems vation with Total:4 Units I,II,II
Demand for Pove Efficiency of Engraphic TES - Planning and TES - Plann	Attery Performance Evaluation - Factors Affecting Battery Performate Energy Storage Technology Aver Systems - Overview of Energy Storage Technologies - Energy Bergy Storage systems - Thermal Energy Storage (TES) using Phase and Implementation of TES - Environmental impact of TES system Average Company and Climate Change, 2nd Edition, and Energy W., "Linden's Hand Book of Batteries, 5th Edition, McGraw Hill, and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and 21 It Kanoglu, Yunus A. Cengel, John M. Cimbala, "Fundamentals and W. Hill Book Company, New York, 2020.	y Storage Mase Changens. ion, Wiley I Book Cor	Methods – Ele Materials - I Publications, I mpany, New N	JSA,	al Stores 2019 2019 Wiley Ener	orage onserv of for U y Pub rgy", 1	ehicles. 9 Systems vation wit Total:4 Units I,II,II Inits IV,V
Demand for Pove Efficiency of Englisher Files - Planning and February Street Files -	Interly Performance Evaluation - Factors Affecting Battery Performate Energy Storage Technology Inver Systems - Overview of Energy Storage Technologies - Energy Pergy Storage systems - Thermal Energy Storage (TES) using Phase and Implementation of TES - Environmental impact of TES systems. In Quaschning, "Renewable Energy and Climate Change", 2 nd Edition of Tes and Book of Batteries", 5 th Edition, McGraw Hill of Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and Dincer and Marc A. Rosen, "Thermal Energy Storage and Dincer and Marc A. Rosen, "Thermal Energy Storage and Dincer and Marc A. Rosen, "Thermal Energy Storage and Dincer an	y Storage Mase Changens. ion, Wiley I Book Cor	Methods – Ele Materials - I Publications, I mpany, New N	JSA,	2019 Wile Ene	orage onserv of for U y Pub rgy", 1	ehicles. 9 Systems vation with Total:4 Inits I,II,II nits IV,V lications, st Edition pped Level)
Demand for Pove Efficiency of Englisher Files - Planning and February Street Files -	Interly Performance Evaluation - Factors Affecting Battery Performate Energy Storage Technology I were Systems - Overview of Energy Storage Technologies - Energy Pergy Storage systems - Thermal Energy Storage (TES) using Phase and Implementation of TES - Environmental impact of TES systems and Implementation of TES - Environmental impact of TES systems and Implementation of TES - Environmental impact of TES systems and Implementation of TES - Environmental impact of TES systems and Implementation of TES - Environmental impact of TES systems and Implementation of TES - Environmental impact of TES systems and Implementation of TES - Environmental impact of TES systems and Implementation of TES - Environmental impact of TES systems and Implementation of TES - Environmental impact of TES systems and Implementation of TES - Environmental impact of TES systems and Implementation of TES - Environmental impact of TES systems and Implementation of TES - Environmental impact of TES systems and Implementation of TES - Environmental impact of TES systems and Implementation of TES - Environmental impact of TES systems and Implementation of TES - Environmental impact of TES systems and Implementation of TES - Environmental impact of TES systems and Implementation of TES - Environmental impact of TES systems and Implementation of TES - Environmental impact of TES systems and Implementation of TES - Environmental impact of TES of Edition of TES - Environmental impact of TES of Edition of TES - Environmental impact of TES of Edition	y Storage Nase Changens. ion, Wiley I II Book Cor	Methods – Ele Materials - I Publications, I mpany, New N	JSA,	2019 Wile: Enel	orage onserv of for U y Pub rgy", 1	ehicles. 9 Systems vation with Total:4 Units I,II,II Inits IV,V Ilications, st Edition pped Level)
Demand for Pove officiency of Engliciency of English of E	Energy Storage Technology Ver Systems - Overview of Energy Storage Technologies - Energy Energy Storage systems - Thermal Energy Storage (TES) using Pharand Implementation of TES - Environmental impact of TES system V. Quaschning, "Renewable Energy and Climate Change", 2 nd Edition Tirby W, "Linden's Hand Book of Batteries", 5 th Edition, McGraw Hill Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and 21 It Kanoglu, Yunus A. Cengel, John M. Cimbala, "Fundamentals and W Hill Book Company, New York, 2020. EOMES: If the course, the students will be able to the global and Indian climate change scenario	y Storage Nase Changens. ion, Wiley I II Book Cor	Methods – Ele Materials - I Publications, I mpany, New N	JSA,	2019 Wile Ener	orage onserved of for U	ehicles. 9 Systems //ation wit Total:4 Inits I,II,II Inits IV,V Ilications, st Edition pped Level) I (K3) I (K3)
Demand for Pove Efficiency of Englished Final Pooks: 1. Volker V	Interly Performance Evaluation - Factors Affecting Battery Performate Energy Storage Technology I Energy Storage Technology I Ver Systems - Overview of Energy Storage Technologies - Energy I Storage systems - Thermal Energy Storage (TES) using Phate and Implementation of TES - Environmental impact of TES system I Storage Systems - Thermal Energy and Climate Change", 2nd Edition of TES - Environmental impact of TES system I Storage Systems and Climate Change", 2nd Edition of TES - Environmental impact of TES systems and Energy W, "Linden's Hand Book of Batteries", 5th Edition, McGraw Hill Dincer and Marc A. Rosen, "Thermal Energy Storage: Systems and 21 of Kanoglu, Yunus A. Cengel, John M. Cimbala, "Fundamentals and W Hill Book Company, New York, 2020. EOMES: If the course, the students will be able to the global and Indian climate change scenario of the energy transition mechanism in transport and electricity sectors.	y Storage Mase Change Ins. ion, Wiley I II Book Corand Application Application I Applications.	Publications, Impany, New Nations", 3rd Edi	JSA,	2019 2019 Wiley Ener	orage onserved of for U y Pub rgy", 1 T Maighest plying plying	ehicles. 9 Systems /ation wit Total:4 Units I,II,II Inits IV,V lications, st Edition pped Level) (K3) (K3) (K3)

	Mapping of COs with POs and PSOs													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			1			2	3	1						
CO2			3			1	3							
CO3			3			1	3							
CO4	3		2				1							
CO5	3					1	3							

¹⁻ Slight, 2- Moderate, 3- Substantial, BT- Bloom's Taxonomy

		ASSESSMENT	PATTERN -	THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	30	50				100
CAT2	20	30	50				100
CAT3	20	30	50				100
ESE	20	30	50				100

^{*} $\pm 3\%$ may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

	(Offered by Department of Mechatroni	cs Engineerin	a)				
Programme & Branch	All B.E./B.Tech. Branches Except Mechatronics Engineering	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	5	OE	3	1	0	4
Preamble	This course provides knowledge on system design, do between basic mechanical structure and its control.	evices and pr	oducts in ach	ievir	ıg an	optim	nal balance
Unit - I	Fundamentals of Mechatronics Systems:						9+3
	y elements – Mechatronics design process –Types of Des Advanced approaches in Mechatronics - Industrial des tems.						
Unit - II	System Modelling:						9+3
Simulation - Des	del categories - Fields of application - Model development - ign of mixed system: Electro mechanical system design – M h and Block Diagram - Simulator coupling. Response study: System Interfacing:	lodel transforn	nation – Doma	ain ir	depe	endent	description
Introduction – Ele TIA/EIA serial inte	ements of data acquisition and control system – Overview of a						software -
11 14 157							
Unit - IV	Case Study on Mechatronics Systems:						9+3
Semi-active Whe Transducer calib	el Suspension - Internal Combustion Engine with Drive Train ration system - Strain gauge weighing system - Controllin	g temperature					Disk Drive -
Semi-active Whe Transducer calib Control system. F Unit - V	el Suspension - Internal Combustion Engine with Drive Train ration system - Strain gauge weighing system - Controlling Response study: Simulation of closed loop control of systems: Case Study on Advanced Systems:	g temperature s.	of a hot/colo	d res	ervoi	r usin	Disk Drive - g PID – ph
Semi-active Whe Transducer calib Control system. F Unit - V Machine tool con	el Suspension - Internal Combustion Engine with Drive Train ration system - Strain gauge weighing system - Controlling Response study: Simulation of closed loop control of systems	g temperatures. and place indu	of a hot/colo	d res	ervoi – Au	r usin	Disk Drive - g PID – ph 9+3 nous mobile
Semi-active Whe Transducer calib Control system. F Unit - V Machine tool con	el Suspension - Internal Combustion Engine with Drive Train ration system - Strain gauge weighing system - Controlling Response study: Simulation of closed loop control of systems	g temperatures. and place indu	of a hot/colo	d res	ervoi – Au	r usin	Disk Drive - g PID – ph 9+3 nous mobile
Semi-active Whe Transducer calib Control system. F Unit - V Machine tool con robot - Artificial Ir	el Suspension - Internal Combustion Engine with Drive Train ration system - Strain gauge weighing system - Controlling Response study: Simulation of closed loop control of systems	g temperatures. and place indunine.	e of a hot/coloustrial manipu	lator	– Au Tuto	r usin tonom	Disk Drive - g PID – ph 9+3 ous mobile 5, Total: 60
Semi-active Whe Transducer calib Control system. F Unit - V Machine tool controbot - Artificial In TEXT BOOK: 1. Devdas \$\frac{3}{2}\$	el Suspension - Internal Combustion Engine with Drive Train ration system - Strain gauge weighing system - Controlling Response study: Simulation of closed loop control of systems Case Study on Advanced Systems: crol system - Electronics engine management system - Pick at telligence in Mechatronics - Fuzzy controlled washing mach	g temperatures. and place indunine.	e of a hot/coloustrial manipu	lator	– Au Tuto	r usin tonom	Disk Drive - g PID – ph 9+3 ous mobile 5, Total: 66
Semi-active Whe Transducer calib Control system. F Unit - V Machine tool controbot - Artificial In TEXT BOOK: 1. Devdas S REFERENCES: 1. Bolton W Educatio	el Suspension - Internal Combustion Engine with Drive Train ration system - Strain gauge weighing system - Controlling Response study: Simulation of closed loop control of system: Case Study on Advanced Systems: Case Study on Advanced Systems: Crol system - Electronics engine management system - Pick at telligence in Mechatronics - Fuzzy controlled washing mach Shetty & Richard A. Kolk, "Mechatronics System Design", 2 nd Shetty & Richard A. Kolk, "Mechatronics System Design", 2 nd Shetty & Richard A. Kolk, "Mechatronics Systems in Mechanical In Limited, New York, 2015.	g temperatures. and place induine. d Edition, CT (e of a hot/coloustrial manipu Lecture: Cengage Lear	lator 45, rning	- Au ^r Tuto	tonom rial: 1 mford,	Disk Drive - g PID - ph 9+3 ious mobile 5, Total: 60 2011.
Semi-active Whe Transducer calib Control system. F Unit - V Machine tool controbot - Artificial In TEXT BOOK: 1. Devdas S REFERENCES: 1. Bolton W Educatio	el Suspension - Internal Combustion Engine with Drive Train ration system - Strain gauge weighing system - Controlling Response study: Simulation of closed loop control of system: Case Study on Advanced Systems: Case Study on Advanced Systems: Crol system - Electronics engine management system - Pick at telligence in Mechatronics - Fuzzy controlled washing mach Shetty & Richard A. Kolk, "Mechatronics System Design", 2 nd Shetty & Richard A. Kolk, "Mechatronics System Design", 2 nd M., "Mechatronics: Electronic Control Systems in Mechanical Systems in Mech	g temperatures. and place induine. d Edition, CT (e of a hot/coloustrial manipu Lecture: Cengage Lear	lator 45, rning	- Au ^r Tuto	tonom rial: 1 mford,	Disk Drive - g PID – ph 9+3 ous mobile 5, Total: 66 2011.
Semi-active Whe Transducer calib Control system. F Unit - V Machine tool controbot - Artificial In TEXT BOOK: 1. Devdas S REFERENCES: 1. Bolton W Educatio 2. Robert H COURSE OUTCO	el Suspension - Internal Combustion Engine with Drive Train ration system - Strain gauge weighing system - Controlling Response study: Simulation of closed loop control of systems Case Study on Advanced Systems: Case Study on Advanced Syste	g temperatures. and place induine. d Edition, CT (e of a hot/coloustrial manipu Lecture: Cengage Lear	lator 45, rning	- Au Tutor , Star	tonom rial: 1 mford, Edition	Disk Drive - g PID – ph 9+3 ious mobile 5, Total: 60 2011.
Semi-active Whe Transducer calib Control system. F Unit - V Machine tool controbot - Artificial In TEXT BOOK: 1. Devdas S REFERENCES: 1. Bolton W Educatio 2. Robert H COURSE OUTCO On completion of	el Suspension - Internal Combustion Engine with Drive Train ration system - Strain gauge weighing system - Controlling Response study: Simulation of closed loop control of systems Case Study on Advanced Systems: Case Study on Advanced Syste	g temperatures. and place induine. d Edition, CT (e of a hot/coloustrial manipu Lecture: Cengage Lear	lator 45, rning	- Au Tuto	r usin tonom rial: 1 mford, Editior ondon	Disk Drive - g PID - ph 9+3 ious mobile 5, Total: 60 2011. n, Pearson 1, 2008.
Semi-active Whe Transducer calib Control system. F Unit - V Machine tool controbot - Artificial Ir TEXT BOOK: 1. Devdas S REFERENCES: 1. Bolton W Educatio 2. Robert H COURSE OUTCO On completion of CO1 identify the	el Suspension - Internal Combustion Engine with Drive Train ration system - Strain gauge weighing system - Controlling Response study: Simulation of closed loop control of systems: Case Study on Advanced Systems: Case Study on Advanced Sys	g temperatures. and place induine. d Edition, CT (e of a hot/coloustrial manipu Lecture: Cengage Lear	lator 45, rning	- Au Tuto , Star , 6th I Sss, Lo	r usin tonom rial: 1 mford, Edition ondon BT Ma ighes erstan	Disk Drive - g PID - pl 9+3 rous mobile 5, Total: 60 2011. n, Pearson , 2008.
Semi-active Whe Transducer calib Control system. F Unit - V Machine tool controbot - Artificial In TEXT BOOK: 1. Devdas S REFERENCES: 1. Bolton W Education 2. Robert H COURSE OUTCO On completion of CO1 identify th CO2 model th	el Suspension - Internal Combustion Engine with Drive Train ration system - Strain gauge weighing system - Controlling Response study: Simulation of closed loop control of systems Case Study on Advanced Systems: Case Study on Advanced Syste	g temperatures. and place induine. d Edition, CT (e of a hot/coloustrial manipu Lecture: Cengage Lear	lator 45, rning	- Au Tutor , Star , 6th I sss, Le (Hi Und	r usin tonom rial: 1 mford, Edition ondon BT Ma ighes erstar erstar	Disk Drive - g PID - ph 9+3 hous mobile 5, Total: 60 2011. n, Pearson , 2008. httpped t Level) hding (K2)
Semi-active Whe Transducer calib Control system. F Unit - V Machine tool controbot - Artificial In TEXT BOOK: 1. Devdas S REFERENCES: 1. Bolton W Educatio 2. Robert H COURSE OUTCO On completion of CO1 identify th CO2 model the CO3 select the	el Suspension - Internal Combustion Engine with Drive Train ration system - Strain gauge weighing system - Controlling Response study: Simulation of closed loop control of systems: Case Study on Advanced Systems:	g temperatures. and place induine. d Edition, CT (e of a hot/coloustrial manipu Lecture: Cengage Lear	lator 45, rning	- Au Tuton , Star , 6th I ss, Le (Hi Und	r usin tonom rial: 1 mford, Editior ondon 3T Ma ighes erstar erstar	Disk Drive- g PID – pl 9+3 hous mobile 5, Total: 60 2011. 1, Pearson 1, 2008. 1pped 1 Level) 1 ding (K2) 1 ding (K2)

	Mapping of COs with POs and PSOs													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1										3		
CO2	2	1			2							3		
CO3	3	1			2							3		
CO4	3	2	1	1	3							3		
CO5	3	2	1	1	3							3		

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	85					100
CAT2	15	85					100
CAT3	15	55	30				100
ESE	5	60	35				100

 $^{^*}$ ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	(Offered by Department of Mechati	ronics Engineering	g)				
Programme & Branch	All B.E./B.Tech. Branches Except Mechatronics Engineering	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	5	OE	3	0	2	4
Preamble	This course provides the basics, programming technic Instrumentation (VI) and its applications.	ques, data acquisi	tion and inter	facin	g tecl	nnique	
Unit - I	Virtual Instrumentation:	0 1: 1					9
	and architecture of a virtual instrument- Data -flow technical programming- Graphical user interfaces - Controls and VI Software Tools:						
	ata flow programming – Editing, Debugging and Running a	Virtual Instrumer	at Graphica	Inro	aramı	mina r	
tools - Functio	n and Libraries - Structures: FOR Loops- WHILE loops-	Shift Registers -	CASE structu	ire -	Ever		
•	dback node - Expression node - Formula nodes - Sequen	ce structures - Tir	ned looped st	ructu	ıres.		
Unit - III	VI Programming Techniques:						9
High level and	sters – Bundle/ Unbundle and Bundle /Unbundle by name Low level file I/O's– Local and global variables - Sub-VI.	e – Plotting data:	graphs and c	harts	– St	ring a	nd File I/O:
Unit - IV	Data Acquisition Hardware:						9
	hardware and software – Concepts of data acquisition ard addressing the hardware – Digital and Analog I/O functio						
Unit - V	VI applications:						9
TCP/IP VI's – I simulation.	PXI – Instrument control – Image acquisition – Motion co	ntrol – Signal pro	cessing/ ana	lysis	– Co	ontrol	design and
LIGT OF EVE	DIMENTO / EVED DIOCO						
	RIMENTS / EXERCISES:	h ahift ragistara f	andhaak nade				
	p Graphical programming using For loops, While loops wit			35			
	p Graphical programming using Arrays functions and Mult	i-dimensional arra	iys				
3. Develo	p Graphical programming using Local variables, Global va	riables, Case stru	ctures and Se	eque	nce s	tructu	res
	p Graphical programming using Local variables, Global va p Graphical programming using Timed structures, Formula	•		eque	nce s	structu	res
4. Develo		a nodes and Even	t structures	eque	nce s	structu	res
4. Develo	p Graphical programming using Timed structures, Formula	a nodes and Even	t structures graph	eque	nce s	tructu	res
 Develo Develo Develo 	p Graphical programming using Timed structures, Formula p Graphical programming using Waveform graph, Wavefo	a nodes and Even rm chart and XY of prmatting and par	t structures graph sing string				res
 Develo Develo Develo Develo Develo 	p Graphical programming using Timed structures, Formula p Graphical programming using Waveform graph, Wavefo p Graphical programming using String functions, editing, for	a nodes and Even rm chart and XY of prmatting and par mbling clusters ar	t structures graph sing string nd disassemb				res
4. Develo	p Graphical programming using Timed structures, Formula p Graphical programming using Waveform graph, Waveform Graphical programming using String functions, editing, for p Graphical programming using Clusters operations: Asse	a nodes and Even rm chart and XY of prmatting and par mbling clusters an action, Read / Writ	t structures graph sing string nd disassemb e a file	ling (cluste	ers	
4. Develor 5. Develor 6. Develor 7. Develor 8. Develor 9. Interface	p Graphical programming using Timed structures, Formula p Graphical programming using Waveform graph, Waveform Graphical programming using String functions, editing, for p Graphical programming using Clusters operations: Asset p Graphical programming using File Input / File Output fur	a nodes and Even rm chart and XY of prmatting and par mbling clusters an action, Read / Writh or real time measu	t structures graph sing string nd disassemb e a file trements usin	ling o	cluste	ers	n
4. Develor 5. Develor 6. Develor 7. Develor 8. Develor 9. Interface	p Graphical programming using Timed structures, Formula p Graphical programming using Waveform graph, Waveform Graphical programming using String functions, editing, for p Graphical programming using Clusters operations: Asset p Graphical programming using File Input / File Output fur the data acquisition hardware with graphical environment for	a nodes and Even rm chart and XY of prmatting and par mbling clusters an action, Read / Writh or real time measu	t structures graph sing string nd disassemb e a file trements usin	ling o	RIO :	ers syster syste	n m
4. Develor 5. Develor 6. Develor 7. Develor 8. Develor 9. Interface	p Graphical programming using Timed structures, Formula p Graphical programming using Waveform graph, Waveform Graphical programming using String functions, editing, for p Graphical programming using Clusters operations: Asset p Graphical programming using File Input / File Output fur the data acquisition hardware with graphical environment for	a nodes and Even rm chart and XY of prmatting and par mbling clusters an action, Read / Writh or real time measu	t structures graph sing string nd disassemb e a file trements usin	ling o	RIO :	ers syster syste	n m
4. Develor 5. Develor 6. Develor 7. Develor 8. Develor 9. Interfact 10. Interfact TEXT BOOK:	p Graphical programming using Timed structures, Formula p Graphical programming using Waveform graph, Waveform Graphical programming using String functions, editing, for p Graphical programming using Clusters operations: Asset p Graphical programming using File Input / File Output fur the data acquisition hardware with graphical environment for	a nodes and Even rm chart and XY of prmatting and par mbling clusters an action, Read / Write or real time measu	t structures graph sing string nd disassemb e a file trements usin trements usin Lecture	g My	RIO :	ers syster syste tical:3	n m 30, Total:7 5
4. Develor 5. Develor 6. Develor 7. Develor 8. Develor 9. Interfact 10. Interfact TEXT BOOK: 1. Jeffery Educat	p Graphical programming using Timed structures, Formula p Graphical programming using Waveform graph, Waveform graphical programming using String functions, editing, for p Graphical programming using Clusters operations: Asset p Graphical programming using File Input / File Output fur the data acquisition hardware with graphical environment for edata acquisition hardware with graphical environment for the data acquisition hardware with graphical environmen	a nodes and Even rm chart and XY of prmatting and par mbling clusters an action, Read / Write or real time measu	t structures graph sing string nd disassemb e a file trements usin trements usin Lecture	g My	RIO :	ers syster syste tical:3	n m 30, Total:7 5
4. Develor 5. Develor 6. Develor 7. Develor 8. Develor 9. Interfact 10. Interfact TEXT BOOK: 1. Jeffery Educat REFERENCES	p Graphical programming using Timed structures, Formula p Graphical programming using Waveform graph, Waveform graphical programming using String functions, editing, for p Graphical programming using Clusters operations: Asset p Graphical programming using File Input / File Output fur the data acquisition hardware with graphical environment for edata acquisition hardware with graphical environment for the data acquisition hardware with graphical environmen	a nodes and Even rm chart and XY g prmatting and par mbling clusters an action, Read / Writ or real time measu or real time measu programming ma	t structures graph sing string nd disassemb e a file trements usin trements usin Lecture de easy and	g Myg Myg Hy;:45,	RIO s	syster syste tical:3	n m 30, Total:7 5

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	demonstrate the basic concepts of Virtual Instrumentation	Understanding (K2)
CO2	interpret the software tools in Virtual Instrumentation using GSD platform	Applying (K3)
CO3	develop programming concepts in graphical programming environment	Applying (K3)
CO4	interface data acquisition hardware with software tools	Applying (K3)
CO5	develop programming concepts with advanced software tools	Applying (K3) Precision (S3)

Mapping of COs with	POs and PSOs
---------------------	--------------

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2							2		
CO2	3	3	3	3	2							2		
CO3	3	3	3	3	2							2		
CO4	3	3	3	3	2							2		
CO5	3	3	3	3	2							2		

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	35	50				100
CAT2	10	35	55				100
CAT3	10	35	55				100
ESE	5	40	55				100

 $^{^{\}star}$ ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

			ORY AUTOMATION	`				
Drogra	amme &	(Offered by Department o All B.E./B.Tech. Branches Except Mecha	f Mechatronics Engineerin	g) 				
Branch		Engineering	Sem.	Category	L	Т	Р	Credit
Prereq	quisites	Nil	5	OE	3	0	2	4
D	h.l.a							
Preaml		This course provides the fundamental kno lines.	wledge about automation	in the field of	pro	ductio	on and	
Unit –		Overview: ew, Requirement of automation systems, A	rehitacture of factory aut	tomation evet	om	Paci	0 000	9
automa		ors for temperature, pressure, force, displace						
Unit –	II	Programmable Automation Controllers:						9
	m, PLC sele	ntrollers, Programmable logic controllers, Anaction, PLC installation, Basic discrete I/o programmunication and Control Systems:						
Man-m	achine inte	face, Computer aided process control hardwaransfer techniques, Computer based data acqu						ication an
Unit –		SCADA:						9
	ion – Eleme g and trendir	nts of SCADA – SCADA control – Remote ter	minal units – Master statio	n – Interfacin	g PL	C wit	h SC	ADA – Dat
Unit –		Robots for Factory Automation:						9
	construction noid robots.	and configuration of robot, Pick and place ro	bot, Welding robot, Robot	ts in Sorting, I	Mobi	le rol	bots, (Cobots an
i iuiiiai	ioid iobots.							
LIST O	F EXPERIM	MENTS / EXERCISES:						
1.	Introduction	on to programming /simulation/communication	software for PLC program	ming				
2.	Logical te	sting of I/O's and its interfacing with PLC for a	given case study					
3.	Level con	trol using PLC						
4.	Interfacing	Pneumatic cylinders with PLC						
5.	Introduction	on to HMI programming using software						
6.	Interfacing	PLC and HMI						
7.	Data logg	ng and trending using PLC & HMI for a given	case study					
8.	Studies or	ABB robot functions and programming						
				Lecture	:45,	Prac	tical:	30, Total:7
TEXT I	воок:							
1.	Bolton W.	"Mechatronics", 6th Edition, Pearson Educati	on, New Delhi, 2019.					
REFER	RENCES/ M	ANUAL / SOFTWARE:						
1.	Petruzella	Frank D., "Programmable Logic Controllers",	5th Edition, McGraw-Hill, N	New York, 201	9.			
2.	Stuart Boy	ver A., "SCADA Supervisory Control and Data	Acquisition", 4th Edition, IS	SA, USA, 201	6.			
	SE OUTCO							apped
Δ.								
On co CO1	_	the course, the students will be able to e different types of sensors, actuators and PLC	Normal transfer of the state of					t Level) nding (K2)

CO2	infer the knowledge about communication and control system in real time interfacing	Understanding (K2)
CO3	adapt the concepts of SCADA for factory automation	Applying (K3)
CO4	interpret the basic configuration and application of robot in factory automation	Applying (K3)
CO5	develop plant level automation for real process plant using PLC/SCADA/ robotics	Applying (K3) Precision (S3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2											
CO2	3	3	3											
CO3	3	3	3		2									
CO4	3	3	3		3									
CO5	3	3	3	3	3				2	2		2		

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	5	95					100
CAT2	5	50	50				100
CAT3	5	55	40				100
ESE	10	50	40				100

 * ±3% may be varied (CAT 1,2,3 - 50 marks & ESE - 100 marks)

						ZZIVITO	002 - RO	אווטפע	<i>,</i> 5						
				(Offer	ed by D	epartme	nt of Me	echatror	nics Eng	gineering)				
Progra Brancl	amme & h		.E./B.Tech neering	n. Branc	hes Ex	cept Me	chatro	nics		Sem.	Category	L	T	Р	Credit
Prereq	quisites	Nil								6	OE	3	1	0	4
Pream						knowled	ge abou	ut indus	trial ma	nipulator	, its control	desig	n ar	nd applic	
Unit –			duction to			f roboto	Class	ممالمم	and an	an laan	control ou	tomo	Vin	amatia	9+3
			and manip						and op	реп юор	control sys	sterns.	KIII	iematics	s system
Unit –			t Kinema												9+3
			slation and g: Equation							ation- Di	H paramete	rs- Jac	cobi	an-Sing	ularity ar
Unit -			ors and V			ioi Lagii	arige io	mulatic	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,						9+3
						orce, Ta	ctile. Int	troduction	on to Ca	ameras-	Camera cal	ibratio	n- G	Seometr	
formati	ion - Visio	n applicat	ons in rob	otics.											
Unit –			t Control												9+3
			functions, Gears, Tir								ntrols. Actua	ators: E	Elec	tric, Hyd	draulic ar
Unit -			rol Hardw				i aiai	notelo l	01 30100	Mon or a	oluaiors.				9+3
•	•						s Actua	ators P	rogrami	ming for	robot applic	ations			3+3
1. REFEF 1.	RENCES		uction to F								lew Delhi, 2	2014.		torial:1	
1. REFEF 1. 2. COUR On coi	Saha S RENCES Niku Sa Ghosal SE OUTO mpletion interpre	eed B., "Ir A., "Robot COMES: of the co t the featu		to Robo amental (students	concept S will be robots v	alysis", ls and Are able to with end	PHI Leannalysis"	arning, N	New De	lhi, 2011	lew Delhi, 2		(F Und	BT Ma _l	Level) ding (K2)
1. REFEF 1. 2.	Saha S RENCES Niku Sa Ghosal SE OUTO mpletion interpre	eed B., "Ir A., "Robot COMES: of the co t the featu kinematic	troduction ics: Funda urse, the s res of an in	to Robo amental (students adustrial mic anal	concept S will be robots v	alysis", ls and Are able to with end	PHI Leannalysis"	arning, N	New De	lhi, 2011	lew Delhi, 2		(F Uno	BT Maj Highest derstand	Level) ding (K2)
1. REFEF 1. 2. COUR: On cool CO1 CO2	Saha S RENCES Niku Sa Ghosal SE OUTO mpletion interpre perform select v	eed B., "Ir A., "Robot COMES: of the co t the featu kinematic arious ser	troduction ics: Funda urse, the s res of an ir and dyna	to Robo amental (students adustrial mic anal	otics: An Concept s will be robots v	alysis", less and Arest able to with end	PHI Leanalysis" effector	arning, N	New De	lhi, 2011	lew Delhi, 2		(F Und	BT Mal Highest derstand Applying derstand	Level) ding (K2) g (K3) ding (K2)
1. REFEF 1. 2. COUR: On coil CO1 CO2 CO3	Saha S RENCES Niku Sa Ghosal SE OUTO mpletion interpre perform select v identify	eed B., "Ir A., "Robot COMES: of the co t the featu kinematic arious ser	troduction ics: Funda urse, the s res of an in and dyna sors for ro	students andustrial botics actuatio	concept s will be robots wayses with the system	alysis", s and Are able to with end the simular	PHI Leanalysis" effectoration	, Oxford	New De	lhi, 2011 Delhi, 20	lew Delhi, 2		(H Una	BT Mal Highest derstand Applying derstand	Level) ding (K2) g (K3) ding (K2) ding (K2)
1. REFEF 1. 2. COUR: On col CO1 CO2 CO3 CO4	Saha S RENCES Niku Sa Ghosal SE OUTO mpletion interpre perform select v identify	eed B., "Ir A., "Robot COMES: of the co t the featu kinematic arious ser	urse, the sees of an inance dynamics.	students andustrial botics actuatio	concept S will be robots with the robots with	alysis", s and Are able to with end the simulations for robe for robe	PHI Leanalysis" effectoration bots ot progr	r r	New Del	Ihi, 2011 Delhi, 20	lew Delhi, 2		(H Una	BT Mal Highest derstand Applying derstand	Level) ding (K2) g (K3) ding (K2) ding (K2)
1. REFEF 1. 2. COUR: On col CO1 CO2 CO3 CO4 CO5	Saha S RENCES Niku Sa Ghosal SE OUTC mpletion interpre perform select v identify Integra	eed B., "Ir A., "Robot COMES: of the co t the featu kinematic arious ser different co	urse, the sees of an inance dynamics.	students andustrial botics actuatio	concept S will be robots with the robots with	alysis", s and Are able to with end the simular	PHI Leanalysis" effectoration bots ot progr	r r	New Del	Ihi, 2011 Delhi, 20	lew Delhi, 2		(H Und	BT Mal Highest derstand Applying derstand	Level) ding (K2) g (K3) ding (K2) ding (K2) g (K3)
1. REFEF 1. 2. COUR: On col CO1 CO2 CO3 CO4 CO5	Saha S RENCES Niku Sa Ghosal SE OUTO mpletion interpret perform select v identify Integra	eed B., "Ir A., "Robo COMES: of the co t the featu kinematic arious ser different c e mechan	troduction ics: Funda urse, the s res of an ir and dyna sors for ro ontrol and cal and ele	students andustrial botics actuatio ectrical h	s will be robots with n system nardware Mappi	alysis", s and An able to with end the simulations for robe of C	PHI Leanalysis" effectoration bots ot progr	r POs a	New Dedd, New [Ihi, 2011 Delhi, 20 Delhi, 20	lew Delhi, 2	PO12	(H Und	BT Mal Highest derstand Applying derstand derstand	Level) ding (K2) g (K3) ding (K2) ding (K2)
1. REFEF 1. 2. COUR On col CO1 CO2 CO3 CO4 CO5	Saha S RENCES Niku Sa Ghosal SE OUTC mpletion interpre perform select v identify Integra	eed B., "Ir A., "Robot COMES: of the co t the featu kinematic arious ser different co e mechan	urse, the sees of an interest and dynatics for roother and call and electrons.	students industrial mic anal botics actuatio ectrical h	s will be robots was with a system ardward Mappi	alysis", s and An able to with end the simulations for robe of C	PHI Leanalysis" effectoration bots ot progr	r POs a	New Dedd, New [Ihi, 2011 Delhi, 20 Delhi, 20	lew Delhi, 2	PO12 2	(H Und	BT Mal Highest derstand Applying derstand derstand	Level) ding (K2) g (K3) ding (K2) ding (K2) g (K3)
1. REFEF 1. 2. COUR: On col CO1 CO2 CO3 CO4 CO5 CO5/P CO2/CO2	Saha S RENCES Niku Sa Ghosal SE OUTO mpletion interpret perform select v identify Integra POS PO 1 3 2 3	eed B., "Ir A., "Robot COMES: of the co t the featu kinematic arious ser different c e mechan	troduction ics: Funda urse, the series of an ir and dyna sors for rocontrol and cal and ele PO3 2 2	students ndustrial botics actuatio ectrical h	s will be robots wyses with ardware Mappi PO5	alysis", s and An able to with end the simulations for robe of C	PHI Leanalysis" effectoration bots ot progr	r POs a	New Dedd, New [Ihi, 2011 Delhi, 20 Delhi, 20	lew Delhi, 2	PO12 2 2	(H Und	BT Mal Highest derstand Applying derstand derstand	Level) ding (K2) g (K3) ding (K2) ding (K2) g (K3)
1. REFEF 1. 2. COUR On col CO1 CO2 CO3 CO4 CO5 CO6/P CO6/CO6/CO6/CO6/CO6/CO6/CO6/CO6/CO6/CO6/	Saha S RENCES Niku Sa Ghosal SE OUTC mpletion interpre perform select v identify Integra POS PC 1 3 2 3 3 3	eed B., "Ir A., "Robot COMES: of the co t the featu kinematic arious ser different co e mechan	res of an in and dyna cal and ele	students industrial mic anal botics actuatio ectrical h	mardware Mappi PO5 1 1 1	alysis", s and An able to with end the simulations for robe of C	PHI Leanalysis" effectoration bots ot progr	r POs a	New Dedd, New [Ihi, 2011 Delhi, 20 Delhi, 20	lew Delhi, 2	PO12 2 2 2 2	(H Und	BT Mal Highest derstand Applying derstand derstand	Level) ding (K2) g (K3) ding (K2) ding (K2) g (K3)
1. REFEF 1. 2. COUR: On col CO1 CO2 CO3 CO4 CO5 CO5/P CO2/CO2	Saha S RENCES Niku Sa Ghosal SE OUTO mpletion interpret select v identify Integra POS PO 1 3 2 3 3 4 4 3	eed B., "Ir A., "Robot COMES: of the co t the featu kinematic arious ser different c e mechan PO2 3 3 3 3 3	troduction ics: Funda urse, the series of an ir and dyna sors for rocontrol and cal and ele PO3 2 2	students ndustrial botics actuatio ectrical h	s will be robots wyses with ardware Mappi PO5	alysis", s and An able to with end the simulations for robe of C	PHI Leanalysis" effectoration bots ot progr	r POs a	New Dedd, New [Ihi, 2011 Delhi, 20 Delhi, 20	lew Delhi, 2	PO12 2 2	(H Und	BT Mal Highest derstand Applying derstand derstand	Level) ding (K2) g (K3) ding (K2) ding (K2) g (K3)

		ASSESSMEN	T PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	65	20				100
CAT2	15	65	20				100
CAT3	10	60	30				100
ESE	10	55	35				100
* ±3% may be varied (CAT 1,2,3 – 50 maı	rks & ESE – 100 ma	arks)				

				22MT	003 - 3D P	PRINTING AN	D DESI	GN					
		ı				nt of Mechatro	nics En	gineering	g)		1		
Programn Branch	me &	All B.E		Branches E	xcept Mec	hatronics		Sem.	Category	L	Т	Р	Credit
Prerequis	sites	Nil						6	OE	3	1	0	4
Preamble				igned to imp		dge and skills product.	related	to 3D pi	inting techno	ologie	s, se	lection	of
Unit – I				D for Addit									9+3
Introduction Electronica translation	s- Health	Care- D	Defense – A	, Additive v Automotive	/s Conven – Construc	ntional Manuf ction - Food	acturing Process	proces ing - M	ses. Applica achine Tool	ation s. CA	Dom D Da	ains: ata for	Aerospace mats- Dat
Unit – II		Additiv	ve Manufad	cturing Tec	nniques:								9+3
Reverse e Unit – III Metals, No	engineerin	g – Step Materi , Ceram	s for 3d prii als: ics; Various	nting techno	logy. aw materia	ology; Proces							9+3
	, Polymer			es; Support I									
Unit – IV				cturing Equ	-			_					9+3
Process E Design	quipment	-Design	and proces	s parameter	s; Governir	ng Bonding M	echanis	m; Com	mon faults a	nd tro	ubles	shootin	g; Proces
Unit – V				& Product									9+3
Post Proce	essing- R	equireme	ent and Tec	chniques. Pr	oduct Qual	lity- Inspection	and te	sting - D	efects and th	neir ca	auses	3.	
1. C	hee Kai C cientific, S			eong, "3D Pı	inting and	Additive Man	ufacturir	ng - Prin			-		
1. So	thee Kai Cocientific, Solution	Singapor	e, 2017. D Printing a	and Design",	Khanna P	Additive Man	se, Nev	/ Delhi, 2	ciples and A	pplica	ations	s", Wor	
1. Si 2. M	chee Kai C cientific, S NCES: abrie Solo iibson I., F lanufactur ndreas Go	oman, "3 Rosen D. ring", Spi ebhardt,	e, 2017. D Printing a W. & Stuck	and Design", ker B., "Addi a, 2010.	Khanna P	ublishing Hou	se, Nev	/ Delhi, 2 s: Rapid	ciples and A 2021. Prototyping	pplica	ations	s", Wor	rld
1. Si REFEREN 1. Si G AI AI AI AI COURSE	chee Kai C cientific, S NCES: abrie Solo sibson I., F lanufactur ndreas G lanser Pul	oman, "3 Rosen D. ring", Spr ebhardt, blisher, C	e, 2017. D Printing a W. & Stuck ringer, USA "Understan Germany, 26	and Design", ker B., "Addi A, 2010. Iding Additiv 012.	Khanna P tive Manufac	ublishing Hou acturing Tech	se, Nev	/ Delhi, 2 s: Rapid	ciples and A 2021. Prototyping	pplica	etions rect E Man	o", Wor Digital ufactu	ring",
1. Si REFEREN 1. Si 2. M 3. Ai 3. H COURSE On compl	chee Kai C cientific, S NCES: abrie Solo libson I., F lanufactur ndreas Gol lanser Pul OUTCOM letion of	oman, "3 Rosen D. ring", Spi ebhardt, blisher, C	D Printing a W. & Stuck ringer, USA "Understan Germany, 26	and Design", ker B., "Addi a, 2010. Iding Additiv 012.	Khanna P tive Manufac Manufac	ublishing Hou acturing Tech	se, Nev nologie: Prototyp	/ Delhi, 2 s: Rapid	ciples and A 2021. Prototyping	pplica	rect E Man	oigital ufactu BT Ma ighest	ring",
1. Si REFEREN 1. Si 2. M 3. Ai 3. H COURSE On compl	chee Kai C cientific, S NCES: abrie Sold dibson I., F lanufactur ndreas G lanser Pul OUTCOM letion of tenderstand	oman, "3 Rosen D. ring", Sprebhardt, blisher, C	D Printing a. W. & Stuckringer, USA "Understan Germany, 20	and Design", ker B., "Addi a, 2010. Iding Additiv 012.	Khanna P tive Manufact e Manufact ne able to ring in real	Publishing Hou facturing Tech	se, Nev nologie: Prototyp	/ Delhi, 2 s: Rapid	ciples and A 2021. Prototyping	pplica to Dir	Man I (H	oigital ufactu BT Ma ighest	ring", pped t Level) ding (K2)
1. Si REFEREN 1. Si 2. M 3. Ai H: COURSE On comple CO1 ur CO2 ch	chee Kai C cientific, S NCES: abrie Sold sibson I., F lanufactur ndreas G lanser Pul OUTCON letion of the nderstand	oman, "3 Rosen D. ring", Sprebhardt, blisher, C	D Printing a. W. & Stuckringer, USA "Understan Germany, 20 rse, the study of additive technique for the study of additive technique for the study of the study of the study of additive technique for the study of th	and Design", ker B., "Addi a, 2010. ding Additiv 012. dents will k	Khanna P tive Manufact e Manufact e able to ring in real cations	Publishing Hou facturing Tech	se, Nev nologie: Prototyp	/ Delhi, 2 s: Rapid	ciples and A 2021. Prototyping	to Din	Pect Γ Man	oigital ufactu BT Ma ighest erstan	ring", pped t Level) ding (K2)
1. Si REFEREN 1. Si 2. M 3. Ai H: COURSE On compl CO1 ur CO2 cr CO2 cr	chee Kai C cientific, S NCES: abrie Sold sibson I., F danufactur ndreas G lanser Pul OUTCOM letion of t nderstand hoose app	oman, "3 Rosen D. ring", Spr ebhardt, blisher, C MES: the cour I the nee propriate	D Printing a W. & Stuck ringer, USA "Understan Germany, 20 rse, the stuck d of additive technique for	and Design", ker B., "Addi a, 2010. ding Additiv 012. dents will ker manufactur for AM appli	Khanna P tive Manufact e Manufact ne able to ring in real cations cation	dublishing Hour facturing Technology Rapid	se, Nev nologie: Prototyp	/ Delhi, 2 s: Rapid	ciples and A 2021. Prototyping	to Dia	Tect E Man Und pplyi	BT Maighest erstan	ring", pped t Level) ding (K2)
1. Si REFEREN 1. Si 2. M 3. Ai 3. H COURSE On compl CO1 ur CO2 cr CO3 se CO4 id	chee Kai Cocientific, SonCES: abrie Sold Sibson I., Fondanufactur Indreas Golanser Pul OUTCOM Inderstand Ind	oman, "3 Rosen D. ring", Spi ebhardt, blisher, C IES: the cour I the nee propriate ecific ma	D Printing a W. & Stuck ringer, USA "Understan Germany, 20 rse, the stuck d of additive technique for	and Design", ker B., "Addi a, 2010. ding Additiv 012. Idents will kee manufactu for AM appli e given appl	Khanna P tive Manufact e Manufact ne able to ring in real cations cation	dublishing Hour facturing Technology Rapid	se, Nev nologie: Prototyp	/ Delhi, 2 s: Rapid	ciples and A 2021. Prototyping	pplica to Dir Rapid A A	Man H Und pplyi pplyi	Digital ufactu BT Ma ighest erstan ng (K3	ring", pped t Level) ding (K2)
1. Si REFEREN 1. Si 2. M 3. Ai H: COURSE On comple CO1 ur CO2 cr CO3 se CO4 id	chee Kai Cocientific, SonCES: abrie Sold Sibson I., Fondanufactur Indreas Golanser Pul OUTCOM Inderstand Ind	oman, "3 Rosen D. ring", Spi ebhardt, blisher, C IES: the cour I the nee propriate ecific ma	e, 2017. D Printing a W. & Stuck ringer, USA "Understan Germany, 20 rse, the stuck d of additive technique for the parameters	and Design", ker B., "Addi a, 2010. ding Additiv 012. Idents will ke manufactu for AM appli e given appl s of different	Khanna P tive Manufact e Manufact e able to ring in real cations cation AM proces	Publishing Houracturing Tech turing: Rapid	retotyp	/ Delhi, 2	ciples and A 2021. Prototyping	pplica to Dir Rapid A A	Man H Und pplyi pplyi	Digital ufactu BT Ma ighest erstan ng (K3 ng (K3	ring", pped t Level) ding (K2)
1. C. S. REFEREN 1. S. G. M. M. S. M.	chee Kai Cocientific, S NCES: abrie Solo sibson I., F lanufactur ndreas G lanser Pul OUTCON letion of t nderstand hoose app elect a spo	oman, "3 Rosen D. ring", Spi ebhardt, blisher, C IES: the cour I the nee propriate ecific ma	D Printing a. W. & Stuckringer, USA "Understan Germany, 20 technique for the parameters of the AM pr	and Design", ker B., "Addi a, 2010. ding Additiv 012. Idents will ke manufactu for AM appli e given appl s of different	Khanna P tive Manufact e Manufact e Manufact ring in real cations cation AM proces	dublishing Hour facturing Technology Rapid	retotyp	/ Delhi, 2	ciples and A 2021. Prototyping	pplica to Dir Rapid A A	manus I (H Und pplyi pplyi ppplyi ppplyi	Digital ufactu BT Ma ighest erstan ng (K3 ng (K3	ring", pped t Level) ding (K2)
1. Si REFEREN 1. Si 2. M 3. Ai 3. Ai COURSE On compl CO1 ur CO2 cr CO3 se CO4 id	chee Kai Cocientific, S NCES: abrie Solo sibson I., F lanufactur ndreas G lanser Pul OUTCON letion of t nderstand hoose app elect a spo	oman, "3 Rosen D. ring", Spr ebhardt, blisher, C MES: the cour I the nee propriate ecific ma process quality o	D Printing a. W. & Stuckringer, USA "Understan Germany, 20 technique for the parameters of the AM pr	and Design", ker B., "Addi a, 2010. Iding Additiv 012. Idents will ke manufactu for AM appli e given appl s of different roduct Map	Khanna P tive Manufact e Manufact e Manufact ring in real cation AM proces	Publishing Houracturing: Rapid Interest world applicate the second secon	rese, New nologies Prototyp tions	Delhi, 2 s: Rapid ping, Rap	ciples and A 2021. Prototyping oid Tooling, I	pplicate to Director A A A A A	manus I (H Und pplyi pplyi ppplyi ppplyi	Digital ufactu BT Ma ighest erstan ng (K3 ng (K3	ring", pped t Level) ding (K2)
1. Si REFEREN 1. Si 2. M 3. Ai 3. H COURSE On compl CO1 ur CO2 cr CO3 se CO4 id CO5 er CO5/POs	chee Kai Cocientific, S NCES: abrie Sold bibson I., F Ianufactur ndreas G lanser Pul OUTCOM letion of t nderstand hoose app lentify the nsure the	oman, "3 Rosen D. ring", Sprebhardt, blisher, C MES: the cour I the nee coropriate ecific ma process quality o	D Printing a. W. & Stuckringer, USA "Understan Germany, 20 technique for the parameters of the AM pr	and Design", ker B., "Addi a, 2010. Iding Additiv 012. Idents will ke manufactu for AM appli e given appl s of different roduct Map	Khanna P tive Manufact e Manufact e Manufact ring in real cation AM proces	Publishing Houracturing: Rapid Interest world applicate the second secon	rese, New nologies Prototyp tions	Delhi, 2 s: Rapid ping, Rap	ciples and A 2021. Prototyping oid Tooling, I	pplicate to Director A A A A A A A A A A A A A A A A A A A	manus I (H Und pplyi pplyi ppplyi ppplyi	Digital ufactu BT Ma ighest erstan ng (K3 ng (K3	ring", pped t Level) ding (K2)

CO4	2	3	1	2	2			2	2	
CO5	2	3	1	2	2			2	2	

		ASSESSMEN	T PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	33	67					100
CAT2	10	42	38				100
CAT3	10	42	38				100
ESE	6	60	34				100

 $^{^*}$ ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	-			(Offere	ed by De	epartment of	f Mechatror	nics Eng	gineering)				
Progr Branc	amme &	All B.E		. Branc	hes Exc	cept Mecha	tronics		Sem.	Category	/ L	Т	Р	Credit
Prere	quisites	Nil							7	OE	3	0	0	3
Pream	nble					nd introduce hrough com								by remote
Unit -						nanned Aer		•	•					9
	riew and ba nment and		history of	UAVs, o	classifica	ations of UA	Vs, lift gen	eration	method.	Contempo	rary ap	plica	itions lik	ke military
Unit -			itle: Unm	anned /	Aerial S	ystem (UAS	S) compon	ents:						9
On-bo		urations - c	characteri Payloads:	stics – a : sensin	pplicatio g/survei	ons. Propulsi Ilance, wea	ion: interna	ıl combu						
Unit –	- 111	Unit T	itle: Basi	c Conce	epts of I	Flight:								9
flight a		controls, a	utopilots.	Emerge		erformance: of the continuation of the continu								
Unit –						/laintenance								9
	enance of one of the contract					ce of ground	l equipmen	t- batter	ies - Sch	eduled ser	vicing -	- Rep	pair of e	equipmen
Unit –						egulations:								9
					o ana n	equiations.								9
Home	land regula	tory: FCC	, FAA. Re	egulatior	ns: FCC	compliance	e, UAS reg	jistration	n, Federa	al Aircraft I	Regulat	tions	(FARs	_
consid	BOOK:	perational	, FAA. Re consider	egulatior ations lik	ns: FCC ke liabilit	compliance ty / legal issu	e, UAS reg ues, ethical	l implica	ations.					s) - Safet
TEXT 1. REFE	BOOK: Paul Fall RENCES:	lstrom, Th	, FAA. Reconsider	egulatior ations lik eason, "li	ns: FCC ke liabilit	compliance	e, UAS regues, ethical	I implica	ations.	Wiley & S	ons, N	۹, 20)22	Total:4
TEXT	BOOK: Paul Fal RENCES: Randal \ Press, \	lstrom, Th V. Beard & ewjersy, 20	omas Gle Timothy	egulation ations lik eason, "II	ns: FCC ke liabilit ntroduct ain, "Sm	compliance ty / legal issu	e, UAS regues, ethical	5th Editi	ion, Johr	Wiley & S	ons, NA	A, 20	022 nceton	Total:4
TEXT 1. REFE 1. 2. COUR On co	BOOK: Paul Fall RENCES: Randal N Press, N Jha, "Th RSE OUTC Infer known	Istrom, The V. Beard & ewjersy, 20 eory, Design Mes: of the countered whedge on	Timothy 012. gn, and Apthe see, the sethed development of the develop	egulation ations like eason, "li W. McLa oplication students lopment	ns: FCC ke liabilit ntroduct ain, "Sm ns of Un will be and pot	compliance ty / legal issue tion to UAV section mall Unmann manned Ae the able to the able to the control of UA	e, UAS regues, ethical Systems", sed Aircraft: erial Vehicle	5th Editi Theory s", 1st I	ion, Johr and Pra	Wiley & S	ons, NA	A, 20 , Prii a, 20 (H (Und	nceton 20. BT Mapighest erstance	Total:4 University Deped Level) ling (K2)
TEXT 1. REFE 1. COUR On co	BOOK: Paul Fall RENCES: Randal \ Press, \ Jha, "The RSE OUTCompletion of infer known interpretion of the control of the contr	Istrom, The V. Beard & ewjersy, 20 eory, Design the count whedge on the feature	omas Gle Timothy D12. gn, and Ap rse, the s the devel	egulation ations like eason, "like eason, "l	ns: FCC se liabilit ntroduct ain, "Sm ns of Un s will be and pote	compliance ty / legal issue tion to UAV standard Unmann manned Ae able to ential of UA in unmanned	e, UAS regues, ethical Systems", sed Aircraft: erial Vehicle	5th Editi Theory s", 1st I	ion, Johr and Pra	Wiley & S	ons, NA	, Priii , Priii a, 20 (H Und	D22 nceton 20. BT Mapighest erstand	Total:4 Universit
TEXT 1. REFE 1. COUR On co CO1 CO2 CO3	BOOK: Paul Falt RENCES: Randal N Press, N Jha, "Th RSE OUTC Infer know interpreted infer on the control of th	Istrom, Th /. Beard & ewjersy, 20 eory, Desig DMES: of the coul wledge on the feature ight opera	omas Gle Timothy D12. gn, and Ap the devel es and chatton and c	egulation ations like eason, "li www. McLa extudents lopment eracteris control us	ns: FCC xe liabilit ntroduct ain, "Sm ns of Un s will be and potentics of a sing dro	compliance ty / legal issue tion to UAV state all Unmann manned Ae able to ential of UA an unmanned one	e, UAS regues, ethical Systems", sed Aircraft: erial Vehicle	5th Editi Theory s", 1st I	ion, Johr and Pra	Wiley & S	ons, NA	, Prin , Prin , Prin (H Und A	20. BT Mapighest erstand applying appl	Total:4 Universit Deed Level) ling (K2) g (K3)
TEXT 1. REFE 1. COUR On co CO1 CO2 CO3 CO4	BOOK: Paul Fall RENCES: Randal N Press, N Jha, "Th RSE OUTC Infer known interpret Infer on realize the	Istrom, The V. Beard & ewjersy, 20 eory, Design Wledge on the feature ight opera	Timothy 012. gn, and Ap rse, the s the devel es and cha	egulation ations like eason, "luw. McLa estudents lopment eracteris control umainten.	ns: FCC xe liabilit ntroduct ain, "Sm ns of Un s will be and pote stics of a sing dro ance an	compliance ty / legal issue tion to UAV section to UAV section mail Unmann manned Ae the able to the ential of UA the unmanned the index one	e, UAS regues, ethical Systems", sed Aircraft: erial Vehicle V in professed aerial sys	5th Editi : Theory es", 1st I	ion, Johr and Pra	Wiley & S	ons, NA	, Priii , Priii a, 20 (H Und A Und	nceton 20. BT Mapighest erstance applying applying erstance and applying erstance a	Total:4 Universit Deped Level) ling (K2) g (K3) g (K3)
TEXT 1. REFE 1. 2. COUR On co CO1 CO2 CO3	BOOK: Paul Fall RENCES: Randal N Press, N Jha, "Th RSE OUTC Infer known interpret Infer on realize the	Istrom, The V. Beard & ewjersy, 20 eory, Design Wledge on the feature ight opera	Timothy 012. gn, and Ap rse, the s the devel es and cha	egulation ations like eason, "luw. McLa estudents lopment eracteris control umainten.	ns: FCC xe liabilit ntroduct ain, "Sm ns of Un s will be and pote stics of a sing dro ance an	compliance ty / legal issue tion to UAV state all Unmann manned Ae able to ential of UA an unmanned one	e, UAS regues, ethical Systems", sed Aircraft: erial Vehicle V in professed aerial sys	5th Editi : Theory es", 1st I	ion, Johr and Pra	Wiley & S	ons, NA	, Priii a, 20 I (H Und A Und	nceton 20. BT Mapighest erstance applying applying erstance and applying erstance a	Total:4 Universit Deed Level) ling (K2) g (K3)
TEXT 1. REFE 1. COUR COCO1 COCO2 COCO3 COCO4	BOOK: Paul Fall RENCES: Randal N Press, N Jha, "Th RSE OUTC Infer known interpret Infer on realize the	Istrom, The V. Beard & ewjersy, 20 eory, Design Wledge on the feature ight opera	Timothy 012. gn, and Ap rse, the s the devel es and cha	egulation ations like eason, "luw. McLa estudents lopment eracteris control umainten.	ns: FCC xe liabilit ntroduct ain, "Sm ns of Un s will be and potentics of a sing dro ance an d regula	compliance ty / legal issue tion to UAV section to UAV section mail Unmann manned Ae the able to the ential of UA the unmanned the index one	e, UAS regues, ethical Systems", seed Aircraft: erial Vehicle V in professed aerial sys	5th Editi : Theory es", 1st I	ion, John and Pra Edition, C	Wiley & S	ons, NA	, Priii a, 20 I (H Und A Und	nceton 20. BT Mapighest erstance applying applying erstance and applying erstance a	Total:4 Universit Deped Level) ling (K2) g (K3) g (K3)
TEXT 1. REFE 1. COUR On co CO1 CO2 CO3 CO4 CO5	BOOK: Paul Fall RENCES: Randal N Press, N Jha, "Th RSE OUTC Infer know interpret infer on realize the interpret	Istrom, The V. Beard & ewjersy, 20 eory, Design Medge on the feature ight opera e drone ecthe regular	Timothy 012. gn, and Ap rse, the s the devel es and cha	egulation ations like eason, "luw. McLa estudents lopment eracteris control umainten.	ns: FCC xe liabilit ntroduct ain, "Sm ns of Un s will be and potentics of a sing dro ance an d regula	compliance ty / legal issue tion to UAV state all Unmann manned Ae able to ential of UA' un unmanned tone ad repair	e, UAS regues, ethical Systems", sed Aircraft: erial Vehicle V in professed aerial systems	5th Editi : Theory es", 1st I	ion, John and Pra Edition, C	Wiley & S	ons, NA	, Prii , Prii (H Und A Und	nceton 20. BT Mapighest erstance applying applying erstance and applying erstance a	Total:4 Universit Deped Level) ling (K2) g (K3) g (K3)
TEXT 1. REFE 1. COUR On co CO1 CO2 CO3 CO4 CO5	BOOK: Paul Fal RENCES: Randal \ Press, \ Jha, "Th RSE OUTCOMPletion of interpret infer on realize the interpret interpret. POS PO	Istrom, The V. Beard & ewjersy, 20 eory, Design Medge on the feature ight opera e drone ecthe regular	Timothy D12. gn, and Apthe develops and chartion and capuipment tory meas	egulation ations like eason, "luw McLa estudents estudents es and estate estate es and estate	ns: FCC xe liabilit ntroduct ain, "Sm ns of Un s will be and pote stics of a sing dro ance an d regula Mappi	compliance ty / legal issue tion to UAV section to UAV section all Unmann amanned Ae able to cential of UA an unmanned and repair ations in UAV and of COs very	e, UAS regues, ethical Systems", sed Aircraft: erial Vehicle V in professed aerial systems	5th Editi Theory s", 1st I	ion, John and Pra Edition, (ctivities	Wiley & S	ons, N/	, Prii , Prii (H Und A Und	D22 nceton 20. BT Mapighest erstance applying erstance erstance erstance	Universit Deped Level) ling (K2) g (K3) g (K3) ling (K2)
TEXT 1. REFE 1. COUR CO1 CO2 CO3 CO4 CO5	BOOK: Paul Fall RENCES: Randal \(\text{Press}, \text{N} \) Jha, "Th RSE OUTCOMPletion infer known interprete infer on realize the interprete	Istrom, The Arrival Section of the Country of the Country of the Country of the Feature of the regular of the regular of the PO2	omas Gle Timothy D12. gn, and Ap rse, the s the devel es and cha tion and c quipment tory meas	egulation ations like eason, "In W. McLa oplication etudents lopment aracteris control un mainten sures and PO4	ns: FCC xe liabilit ntroduct ain, "Sm ns of Un s will be and pote stics of a sing dro ance an d regula Mappi PO5	compliance ty / legal issue tion to UAV section to UAV section all Unmann amanned Ae able to cential of UA an unmanned and repair ations in UAV and of COs very	e, UAS regues, ethical Systems", sed Aircraft: erial Vehicle V in professed aerial systems	5th Editi Theory s", 1st I	ion, John and Pra Edition, (ctivities	Wiley & S	ons, NA Edition Florida	, Prii , Prii (H Und A Und	D22 nceton 20. BT Mapighest erstance applying erstance erstance erstance	Universit Deped Level) ling (K2) g (K3) g (K3) ling (K2)
TEXT 1. REFE 1. COUR On co CO1 CO2 CO3 CO4 CO5	BOOK: Paul Fal RENCES: Randal \ Press, \ Jha, "Th RSE OUTCompletion of interpret infer on realize the interpret i	Istrom, The V. Beard & ewjersy, 20 eory, Design Medge on the feature ight opera e drone ed the regular PO2 3	Timothy D12. gn, and Apthe develops and charton and conjuipment tory measures 2	egulation ations like eason, "lu www. McLa extendents lopment earacteris control umaintents ures and extendents earacteris extendents extendent	ns: FCC xe liabilit ntroduct ain, "Sm ns of Un will be and pote stics of a sing dro ance an d regula Mappi PO5 1	compliance ty / legal issue tion to UAV section to UAV section all Unmann amanned Ae able to cential of UA an unmanned and repair ations in UAV and of COs very	e, UAS regues, ethical Systems", sed Aircraft: erial Vehicle V in professed aerial systems	5th Editi Theory s", 1st I	ion, John and Pra Edition, (ctivities	Wiley & S	ons, N/ Edition Florida PO12 2	, Prii , Prii (H Und A Und	D22 nceton 20. BT Mapighest erstance applying erstance erstance erstance	Total:4 Universit Deped Level) ling (K2) g (K3) g (K3) ling (K2)
TEXT 1. REFE 1. 2. COUR On co CO1 CO2 CO3 CO4 CO5	BOOK: Paul Fall RENCES: Randal \(\text{Press, N} \) Jha, "Th RSE OUTCOMPLETION infer known interpret interpret interpret interpret interpret interpret 2	Jernational Jernat	omas Gle Timothy D12. gn, and Ap rse, the s the devel es and cha tion and c quipment tory meas	egulation ations like eason, "In W. McLa estudents lopment earacteris control us mainten sures and PO4 3 3 3	ns: FCC se liability of the liability of	compliance ty / legal issue tion to UAV section to UAV section all Unmann amanned Ae able to cential of UA an unmanned and repair ations in UAV and of COs very	e, UAS regues, ethical Systems", sed Aircraft: erial Vehicle V in professed aerial systems	5th Editi Theory s", 1st I	ion, John and Pra Edition, (ctivities	Wiley & S	ons, N/ Edition Florida PO12 2 2	, Prii , Prii (H Und A Und	D22 nceton 20. BT Mapighest erstance applying erstance erstance erstance	Universit Deped Level) ling (K2) g (K3) g (K3) ling (K2)

		ASSESSMEN	T PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	65	20				100
CAT2	15	65	20				100
CAT3	30	70	-				100
ESE	5	65	30				100

		22		(Offered h	by Department	t of Machatran	ice Engli	neering)					
Prograi	mma &	All R F		-	s Except Mec		ics Engil	neering)					
Branch		Engine		Dianche	s Except wec	ilati Ollics		Sem.	Category	L	Т	Р	Credit
Prerequ	uisites				echatronics E Mechatronics)	8	OE	3	0	0	3
Preamb	ماد	This co	urse provi	des introd	duction to the b	hasic concepts	of MEN	//S and N	IEMS It fan	niliariz	es th	e conc	ent of
i icaiiib	,,,,	fabricat	tion, ṁanu	facturing	and packaging								
Unit – I			applicatio		sons and Astr								•
					sors and Actu crosystems - M		Micro ac	tuation t	achniques -	Micro	numi	a – Mici	9 romotors
	valves – Mic			ipie oi iviic	orosystems - IV	11010 3013013	wiicio ac	luation	scriniques -	IVIICIO	puiii	J — IVIICI	OHIOLOI
Unit – I			System Fa										9
					on - MEMS ma		olithogra	phy - lor	implantation	on - D	iffusi	on - Ox	dation
Unit – I					y epitaxy – Etc								9
					ring and Desining – LIGA – S		svstem r	nackagin	n – Material	ls - Di	e levi	al - Dev	-
- Syste	m level - P				ace bonding								
Applicat													
Unit – ľ					w: Nanoscale								9
					Electronic Co						ce -	Carbor	1
Unit - \					of Carbon Nan- mechanical S		sincation	or Carbo	n Nanotub	25			9
					n of NEMS - N		chanics -	Function	nal Nano-El	ectro-	mech	nanical	
- Piezoa	actuators: St	eady-stat	te models	and Chara	acteristics.								-
1.	Tai-Ran Hs Delhi, 2002 Lyshevski,	 S.E, "Nar	no- and Mi		s: Design And								New
1.	Tai-Ran Hs Delhi, 2002	 S.E, "Nar	no- and Mi										
1. 2. REFER	Tai-Ran Hs Delhi, 2002 Lyshevski, Edition, CR	2. S.E, "Nar C Press,	no- and Mi 2005.	cro-Electr		Systems: Fun	damenta	ls of Nar	o- and Mici				New
1. 2. REFER 1.	Tai-Ran Hs Delhi, 2002 Lyshevski, Edition, CR ENCES:	S.E, "Nar C Press, ou, "Funda	no- and Mi 2005. amentals o	cro-Electr	romechanical \$	Systems: Fundation	damenta Press, N	ls of Nar	o- and Micro	roengi	neer	ing", 2r	New
1. 2. REFER 1. 2. 3.	Tai-Ran Hs Delhi, 2002 Lyshevski, Edition, CR ENCES: Marc Mado Zhang, Dar 2017.	s.E, "Nar S.E, "Nar C Press, u, "Funda n, Wei, Bi	no- and Mi 2005. amentals o	cro-Electr of Microfab ced Mech	romechanical s	Systems: Fundamental Systems: Fundamental Systems: Fundamental Systems Bystems: Fundamental Systems: Fundamenta	Press, N	ls of Nar lew York Edition,	no- and Micro	roengi	neer	ng", 2r	New id
1. 2. REFER 1. 2. 3. COURS	Tai-Ran Hs Delhi, 2002 Lyshevski, Edition, CR ENCES: Marc Mado Zhang, Dar 2017. Takahata, F	S.E, "Nar S.E, "Nar C Press, ou, "Funda n, Wei, Bi K, "Advand	no- and Mi 2005. amentals on, "Advand	cro-Electr of Microfate ced Mechano o/Nano El	romechanical solution, 2nd atronics and Marketine	Systems: Fundamental Systems: Fundamental Systems: Fundamental Systems Bystems: Fundamental Systems: Fundamenta	Press, N	ls of Nar lew York Edition,	no- and Micro	roengi	onal	Publish	New ind ing, NA
1. 2. REFER 1. 2. 3. COURS On com	Tai-Ran Hs Delhi, 2002 Lyshevski, Edition, CR ENCES: Marc Mado Zhang, Dar 2017. Takahata, F	S.E, "Nar S.E, "Nar C Press, u, "Funda n, Wei, Bi C, "Advand MES: the cours	amentals on, "Advances in Micr	cro-Electr of Microfate ced Mechanology o/Nano Electrony	romechanical solution, 2nd atronics and Marchania	Systems: Fundation, CRC MEMS Devices cal Systems a	Press, N	ls of Nar lew York Edition,	no- and Micro	roengi ernati "1st E	onal dition	Publish n, InTec	New ind, NA ch, 2013
1. 2. REFER 1. 2. 3. COURS On com	Tai-Ran Hs Delhi, 2002 Lyshevski, Edition, CR ENCES: Marc Mado Zhang, Dar 2017. Takahata, k	S.E, "Nar S.E, "Nar C Press, u, "Funda n, Wei, Bi K, "Advand MES: the cours e basics of	amentals on, "Advances in Microse, the stu	of Microfab ced Mechano/Nano El	brication", 2nd atronics and Materials at the lectromechanics and micro actuated	Systems: Fundamental Systems and Systems a	Press, N	ls of Nar lew York Edition,	no- and Micro	ernati	onal dition	Publish n, InTec T Map ghest I	New Indication of the second
1. 2. REFER 1. 2. 3. COURS On com	Tai-Ran Hs Delhi, 2002 Lyshevski, Edition, CR ENCES: Marc Mado Zhang, Dar 2017. Takahata, h SE OUTCOM pletion of ti interpret the identify the	S.E, "Nar S.E, "Nar C Press, au, "Funda h, Wei, Bi K, "Advand MES: the cours e basics of suitable f	amentals on, "Advances in Microse, the student of microse fabrication"	oro-Electr of Microfat ced Mecha o/Nano El	orication", 2nd atronics and Natronics and N	Systems: Fundamental Systems and Systems a	Press, N	ls of Nar lew York Edition,	no- and Micro	ernati	onal (Hi) Unde	Publish n, InTec T Map ghest I erstanderstanderstand	New ind, NA ch, 2013 ped evel) ing (K2)
1. 2. REFER 1. 2. 3. COURS On com CO1 CO2 CO3	Tai-Ran Hs Delhi, 2002 Lyshevski, Edition, CR ENCES: Marc Mado Zhang, Dar 2017. Takahata, P	S.E., "Nar S.E., "Nar C Press, au, "Funda n, Wei, Bi C, "Advand MES: the cours e basics of suitable f	amentals on, "Advances in Microse, the study of microse fabrication retens for	oro-Electr of Microfate ced Mecha o/Nano El odents wi nsors and process of various ap	orication", 2nd atronics and Materials at the attronics and Materials at the attronics at the attronics at the attronics at the attronics at the attronic actuate of microsystem pplications	Systems: Fundamental Systems and Systems a	Press, N	ls of Nar lew York Edition,	no- and Micro	ernati	onal (Hi) Unde	Publish n, InTec T Map ghest I erstanderstand opplying	New ind ing, NA ch, 2013 ped evel) ing (K2) ing (K3)
1. 2. REFER 1. 2. 3. COURS On com CO1 CO2 CO3 CO4	Tai-Ran Hs Delhi, 2002 Lyshevski, Edition, CR ENCES: Marc Mado Zhang, Dar 2017. Takahata, h SE OUTCOM Interpret the identify the develop the elucidate th	S.E., "Nar S.E., "Nar C Press, ou, "Funda n, Wei, Bi K, "Advand MES: the cours e basics of suitable for syme function	amentals on, "Advances in Microse, the study of micro segation and stems for on of nanos	oro-Electr of Microfat ced Mecha o/Nano El udents wi nsors and process of various ag cale mate	prication", 2nd atronics and Materials	Systems: Fundamental Systems and Systems a	Press, N	ls of Nar lew York Edition,	no- and Micro	ernati	onal (Hii Unde	Publish T Map ghest I erstand erstand oplying erstand	New ind ing, NA ch, 2013 ped evel) ing (K2) (K3) ing (K2)
1. 2. REFER 1. 2. 3. COURS On com CO1 CO2 CO3 CO4	Tai-Ran Hs Delhi, 2002 Lyshevski, Edition, CR ENCES: Marc Mado Zhang, Dar 2017. Takahata, P	S.E., "Nar S.E., "Nar C Press, ou, "Funda n, Wei, Bi K, "Advand MES: the cours e basics of suitable for syme function	amentals on, "Advances in Microse, the study of micro segation and stems for on of nanos	oro-Electr of Microfat ced Mecha o/Nano El udents wi nsors and process of various ag cale mate	prication", 2nd atronics and Materials	Systems: Fundamental Systems and Systems a	Press, N	ls of Nar lew York Edition,	no- and Micro	ernati	onal (Hii Unde	Publish n, InTec T Map ghest I erstanderstand oplying	New ind ing, NA ch, 2013 ped evel) ing (K2) (K3) ing (K2)
1. 2. REFER 1. 2. 3. COURS On com CO1 CO2 CO3 CO4 CO5	Tai-Ran Hs Delhi, 2002 Lyshevski, Edition, CR ENCES: Marc Mado Zhang, Dar 2017. Takahata, h SE OUTCOM Inpletion of ti interpret the identify the develop the elucidate th	S.E., "Nar S.E., "Nar C Press, u, "Funda n, Wei, Bi K, "Advand MES: the cours e basics of suitable for micro sy the function	amentals on, "Advances in Microse, the study of micro segablication asterns for n of nanos	oro-Electr of Microfat ced Mecha o/Nano El idents wi insors and process of various ap cale mate tronic dev	prication", 2nd atronics and Materials at micro actuate of microsystem pplications arials apping of CO	Edition, CRC MEMS Devices cal Systems a	Press, No II", 1st	ls of Nar	, 2002. Springer Intechnologies	ernati " 1st E	onal (Hii Unde	Publish T Map ghest I erstand erstand oplying erstand opplying	ning, NA ch, 2013 ped _evel) ing (K2) ing (K2) (K3) ing (K2)
1. 2. REFER 1. 2. 3. COURS On com CO1 CO2 CO3 CO4	Tai-Ran Hs Delhi, 2002 Lyshevski, Edition, CR ENCES: Marc Mado Zhang, Dar 2017. Takahata, h SE OUTCOM Inpletion of ti interpret the identify the develop the elucidate th	S.E., "Nar S.E., "Nar C Press, ou, "Funda n, Wei, Bi K, "Advand MES: the cours e basics of suitable for syme function	amentals on, "Advances in Microse, the study of micro segation and stems for on of nanos	oro-Electr of Microfat ced Mecha o/Nano El odents wi nsors and process of various ap cale mate tronic dev	prication", 2nd atronics and Materials at the state of micro actuate of microsystem pplications arials	Edition, CRC MEMS Devices cal Systems a	Press, N s II", 1st	ls of Nar	no- and Micro	ernati	onal (Hii Unde	Publish T Map ghest I erstand erstand oplying erstand	New ind ing, NA ch, 2013 ped evel) ing (K2) (K3) ing (K2)
1. 2. REFER 1. 2. 3. COURS On com CO1 CO2 CO3 CO4 CO5	Tai-Ran Hs Delhi, 2002 Lyshevski, Edition, CR ENCES: Marc Mado Zhang, Dar 2017. Takahata, h SE OUTCOM Interpret the identify the develop the elucidate th Infer the co	S.E., "Nar S.E., "Nar C Press, u, "Funda n, Wei, Bi K, "Advand MES: the cours e basics of suitable for micro sy the function	amentals on, "Advances in Microse, the study of micro segablication asterns for n of nanos	oro-Electr of Microfat ced Mecha o/Nano El idents wi insors and process of various ap cale mate tronic dev	prication", 2nd atronics and Marconics and Marconics and Marconics and Marconics and Marconics are actuated of microsystem polications arials applied applied to Company of COmp	Edition, CRC MEMS Devices cal Systems a	Press, No II", 1st	ls of Nar	, 2002. Springer Intechnologies	ernati " 1st E	onal (Hii Unde	Publish T Map ghest I erstand erstand oplying erstand opplying	ning, NA ch, 2013 ped _evel) ing (K2) ing (K2) (K3) ing (K2)
1. 2. REFER 1. 2. 3. COURS On com CO1 CO2 CO3 CO4 CO5	Tai-Ran Hs Delhi, 2002 Lyshevski, Edition, CR ENCES: Marc Mado Zhang, Dar 2017. Takahata, h SE OUTCOM Interpret the identify the develop the elucidate th Infer the co OS PO1 3	S.E., "Nar S.E., "Nar C Press, au, "Funda n, Wei, Bi K, "Advand MES: the cours the cours the basics of suitable for the function incept of I	amentals on, "Advances in Microse, the study of microse fabrication retems for n of nanos Nano-elect	oro-Electr of Microfat ced Mecha o/Nano El odents wi nsors and process of various ap cale mate tronic dev Ma PO4	prication", 2nd atronics and Marconics and Marconics and Marconics and Marconics and Marconics are actuated of microsystem polications arials applied applied to Company of COmp	Edition, CRC MEMS Devices cal Systems a	Press, No II", 1st	ls of Nar	, 2002. Springer Intechnologies	ernati " 1st E	onal (Hii Unde	Publish T Map ghest I erstand erstand oplying erstand opplying	ning, NA ch, 2013 ped _evel) ing (K2) ing (K2) (K3) ing (K2)
1. 2. REFER 1. 2. 3. COURS On com CO1 CO2 CO3 CO4 CO5 CO5/Pc CO1/Pc CO1/	Tai-Ran Hs Delhi, 2002 Lyshevski, Edition, CR ENCES: Marc Mado Zhang, Dar 2017. Takahata, h SE OUTCOM Interpret the identify the develop the elucidate th Infer the co OS PO1 3 3 3 3	S.E., "Nar S.E., "Nar C Press, u, "Funda n, Wei, Bi K, "Advand MES: the cours e basics of suitable for e micro sy ne function incept of I	amentals on, "Advances in Microse, the study of micro seriabrication restems for an of nanos Nano-election 2	oro-Electr of Microfat ced Mecha o/Nano El odents wi case and process of various ap cale mate tronic dev Ma PO4 I 2	prication", 2nd atronics and Marconics and Marconics and Marconics and Marconics and Marconics are actuated of microsystem polications arials applied applied to Company of COmp	Edition, CRC MEMS Devices cal Systems a	Press, No II", 1st	ls of Nar	, 2002. Springer Intechnologies	ernati " 1st E	onal (Hii Unde	Publish T Map ghest I erstand erstand oplying erstand opplying	ning, NA ch, 2013 ped _evel) ing (K2) ing (K2) (K3) ing (K2)
1. 2. REFER 1. 2. 3. COURS On com CO1 CO2 CO3 CO4 CO5 CO5/PC CO1 CO2	Tai-Ran Hs Delhi, 2002 Lyshevski, Edition, CR ENCES: Marc Mado Zhang, Dar 2017. Takahata, h SE OUTCOM Interpret the identify the develop the elucidate th Infer the co OS PO1 3 3 3 3 3 3	S.E., "Nar S.E., "Nar C Press, au, "Funda n, Wei, Bi K, "Advand IES: the cours the cours the cours the pasics of suitable for e micro sy the function incept of I	amentals on, "Advances in Microse, the study of microse fabrication retems for n of nanos Nano-election 2	oro-Electronic developments with the control of the	prication", 2nd atronics and Marconics and Marconics and Marconics and Marconics and Marconics are actuated of microsystem polications arials applied applied to Company of COmp	Edition, CRC MEMS Devices cal Systems a	Press, No II", 1st	ls of Nar	, 2002. Springer Intechnologies	roengi ernati " 1st E	onal (Hii Unde	Publish T Map ghest I erstand erstand oplying erstand opplying	ning, NA ch, 2013 ped _evel) ing (K2) ing (K2) (K3) ing (K2)

		ASSESSMENT	PATTERN -	THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	50	35				100
CAT2	15	50	35				100
CAT3	15	50	35				100
ESE	5	60	35				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	(Offered by Department of Mechatronics I	Engineering	a)				
Programme & Branch	All B.E./B.Tech. Branches Except Mechatronics Engineering	Sem.	Category	L	т	Р	Credit
Prerequisites	Nil	8	OE	3	0	0	3
Preamble	This course familiarizes the basic concepts of virtual real behaviors of VR Environment through geometric modelling.		o analyze the	e kin	emat	ics ar	nd dynamic
Unit – I	Introduction to Augmented Reality:						9
System structure	of augmented reality; Key technology in AR; General solution f	or calculati	ng geometric	& illu	umina	ation o	consistency
	environment, Augmented Reality Methods.						
Unit – II	Virtual Reality and Virtual Environments:						9
	relopment of VR: Classic components of a VR system, Virtua dware technologies for 3D user interfaces: Visual displays, A er interfaces.						
Unit - III	Geometric Modelling:	dary rapro	contation Go	omo	trical	Trans	9 formations
Geometric modelli Introduction – Fran A Generic VR sys	Geometric Modelling: Ing: Introduction – From 2D to 3D – 3D space curves – 3D bound mes of reference – Modelling transformations – Instances –Picture : Introduction –Virtual environment –Computer environment	king – Flyir	ng – Scaling tl	ne VI	E – C	ollisio	sformations n detection
Geometric modelli Introduction – Fran	ng: Introduction – From 2D to 3D – 3D space curves – 3D boun mes of reference – Modelling transformations – Instances –Pic	king – Flyir	ng – Scaling tl	ne VI	E – C	ollisio	sformations n detection
Geometric modelli Introduction – Fran A Generic VR sys systems. Unit – IV Human factors: In – Acoustic hardwa	ng: Introduction – From 2D to 3D – 3D space curves – 3D bounders of reference – Modelling transformations – Instances – Pictostem: Introduction – Virtual environment – Computer environment – Navigation Systems: Introduction – Eye - Ear- Somatic senses – VR Hardware: Introduction – Model re – Integrated VR systems - VR Software: Introduction – Model	king – Flyir ent – VR T uction – Se	ng – Scaling tl echnology – nsor hardwar	ne VI Mod e – F	E - C el of lead-	intera	sformations n detection action – VR
Geometric modelli Introduction – Fran A Generic VR sys systems. Unit – IV Human factors: In	ng: Introduction – From 2D to 3D – 3D space curves – 3D bounders of reference – Modelling transformations – Instances – Pictostem: Introduction – Virtual environment – Computer environment – Navigation Systems: Introduction – Eye - Ear- Somatic senses – VR Hardware: Introduction – Model re – Integrated VR systems - VR Software: Introduction – Model	king – Flyir ent – VR T uction – Se	ng – Scaling tl echnology – nsor hardwar	ne VI Mod e – F	E - C el of lead-	intera	sformations n detection action – VR
Geometric modelli Introduction – France A Generic VR systems. Unit – IV Human factors: In – Acoustic hardwa – Introduction to V Unit – V Introduction to Production to	ng: Introduction – From 2D to 3D – 3D space curves – 3D bounders of reference – Modelling transformations – Instances –Pic stem: Introduction –Virtual environment –Computer environment Navigation Systems: troduction –Eye - Ear- Somatic senses – VR Hardware: Introduction – Model /RML.	king – Flyir ent – VR T uction – Se lling virtual	ng – Scaling the chnology – nsor hardwar world – Physi	ne VI Mod e – H cal s	E – C el of lead- imula	intera coupl	sformations n detection – VR 9 ed displays VR toolkits
Geometric modelli Introduction – France A Generic VR systems. Unit – IV Human factors: In – Acoustic hardwa – Introduction to V Unit – V Introduction to Production to	ng: Introduction – From 2D to 3D – 3D space curves – 3D bounders of reference – Modelling transformations – Instances –Pic stem: Introduction –Virtual environment –Computer environment Navigation Systems: troduction –Eye - Ear- Somatic senses – VR Hardware: Introduction – Model RML. VR Applications in Manufacturing: oductivity Enhancement Platforms: Virtual prototyping spaces	king – Flyir ent – VR T uction – Se lling virtual	ng – Scaling the chnology – nsor hardwar world – Physi	ne VI Mod e – H cal s	E – C el of lead- imula	intera coupl	sformations n detection action – VR 9 ed displays VR toolkits
Geometric modelli Introduction – France A Generic VR systems. Unit – IV Human factors: In – Acoustic hardwa – Introduction to V Unit – V Introduction to Prand virtual assista	ng: Introduction – From 2D to 3D – 3D space curves – 3D bounders of reference – Modelling transformations – Instances –Pic stem: Introduction –Virtual environment –Computer environment Navigation Systems: troduction –Eye - Ear- Somatic senses – VR Hardware: Introduction – Model RML. VR Applications in Manufacturing: oductivity Enhancement Platforms: Virtual prototyping spaces	king – Flyir ent – VR T uction – Se lling virtual	ng – Scaling the chnology – nsor hardwar world – Physi	ne VI Mod e – H cal s	E – C el of lead- imula	intera coupl	sformations n detection nction – VR 9 ed displays VR toolkits 9 Augmented
Geometric modelli Introduction – France A Generic VR systems. Unit – IV Human factors: In – Acoustic hardwa – Introduction to V Unit – V Introduction to Production to Virtual assista TEXT BOOK: Alan B Cr	ng: Introduction – From 2D to 3D – 3D space curves – 3D bounders of reference – Modelling transformations – Instances –Pic stem: Introduction –Virtual environment –Computer environment Navigation Systems: troduction –Eye - Ear- Somatic senses – VR Hardware: Introduction – Model RML. VR Applications in Manufacturing: oductivity Enhancement Platforms: Virtual prototyping spaces	king – Flyir ent – VR T uction – Se lling virtual , Virtual co eoperation.	ng – Scaling the common of the	ne VI Mod e – H cal s	E – C el of Head- imula g spa	couplation –	sformations n detection n detection p ed displays VR toolkits p Augmented Total:45
Geometric modelli Introduction – Franta Generic VR systems. Unit – IV Human factors: In – Acoustic hardwa – Introduction to V Unit – V Introduction to Production to Virtual assista	ng: Introduction – From 2D to 3D – 3D space curves – 3D bount mes of reference – Modelling transformations – Instances –Pic stem: Introduction –Virtual environment –Computer environment – Navigation Systems: troduction –Eye - Ear- Somatic senses – VR Hardware: Introduction – Eye - Integrated VR systems - VR Software: Introduction – Model / RML. VR Applications in Manufacturing: Diductivity Enhancement Platforms: Virtual prototyping spaces nce, Telepresence - Applications of VR in Robotics: Robot telepage, William R Sherman and Jeffrey D Will, "Developing Virtual aig, William R Sherman and Jeffrey D Will, "Developing Virtual aig, William R Sherman and Jeffrey D Will, "Developing Virtual aig, William R Sherman and Jeffrey D Will, "Developing Virtual aig, William R Sherman and Jeffrey D Will, "Developing Virtual aig, William R Sherman and Jeffrey D Will, "Developing Virtual aig, William R Sherman and Jeffrey D Will, "Developing Virtual aig, William R Sherman and Jeffrey D Will, "Developing Virtual aig, William R Sherman and Jeffrey D Will, "Developing Virtual aig, William R Sherman and Jeffrey D Will, "Developing Virtual aig, William R Sherman and Jeffrey D Will, "Developing Virtual aig, William R Sherman and Jeffrey D Will, "Developing Virtual aig, William R Sherman and Jeffrey D Will, "Developing Virtual aig, William R Sherman and Jeffrey D Will, "Developing Virtual aig, William R Sherman and Jeffrey D Will, "Developing Virtual aig, William R Sherman and Jeffrey D Will, "Developing Virtual aig, William R Sherman and Jeffrey D Will, "Developing Virtual aig, William R Sherman and Jeffrey D Will, "Developing Virtual aig, William R Sherman and Jeffrey D Will, "Developing Virtual aig, William R Sherman aig, William R Sher	king – Flyir ent – VR T uction – Se lling virtual , Virtual co eoperation.	ng – Scaling the common of the	ne VI Mod e – H cal s	E – C el of Head- imula g spa	couplation –	sformations n detection action – VR 9 ed displays VR toolkits 9 Augmented Total:45

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	explain the basic concept and framework of Augmented & virtual reality	Understanding (K2)
CO2	establish an insight to virtual environment	Understanding (K2)
CO3	realize the multimodal user interaction and perception in VR using geometric modelling and control mechanisms	Applying (K3)
CO4	apply computing tools for the development of VR environment	Applying (K3)
CO5	develop virtual reality for manufacturing applications	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	1							3		
CO2	2	2	1	1	1							3		
CO3	3	2	3	3	3							3		
CO4	3	2	3	3	3							3		
CO5	3	2	3	3	3							3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	85					100
CAT2	15	55	30				100
CAT3	15	55	30				100
ESE	5	60	35				100

 * ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

		22AUX01 - AUTOMOTIVE ENGINEE						
Programn	ma &	(Offered by Department of Automobile Eng	ineering)					
Branch	ille &	All BE/BTech Branches except Automobile Engineering	Sem.	Category	L	Т	Р	Credit
Prerequis	sites	Nil	5	OE	3	0	2	4
Preamble		This course provides the knowledge on working principle of au fuel resources recommended for automotive engines.	utomotive	e components	s and	l vari	ous al	ternative
Unit – I		Engines and Exhaust systems:						9
pins - Crai	nk shaft - I	: Cylinder block - Cylinder head - Sump - Manifolds - Gaskets - (Bearings - Valves - Mufflers. Simple Carburetor - Port and Valve I CRDI - Exhaust systems - SCR - EGR - Catalytic converter - I	Timing	diagram - Eng	jine d	coolir	ng and	Lubrication
Unit – II		Transmission Systems:						9
Automatic	- Simple	Construction - Clutch operation - Electromagnetic - Mechanica Floor Mounted Shift Mechanism - CVT - Dual Clutch transmissi Propeller shaft - Slip Joint - Universal Joints - Differential and R	ion - Ove	er Drives - Tra				
Unit – III		Steering, Brakes and Suspension:						9
steering m	nechanism	Wheel Alignment Parameters. Steering: Steering Geometry - Ty ı - Power Steering - Electronic Steering - Types of Front Axle. St Braking Systems: Types and Construction - Hydraulic brakes -	uspensio	n systems: Ty	/pes	of su	spens	sion springs
Unit – IV		Chassis Frame, Battery and Lighting System:						9
		n - Truck chassis - Four-wheel drive chassis - Body on frame - teries - Construction, Operation and Maintenance. Electrical sys					- Loa	ds acting o
Unit – V		Automotive accessories and Alternate Energy Sources:						9
		ENTS / EXERCISES:						
1. D	ismantling	g and Assembling of Two stroke Petrol Engine						
2. D	Dismantling	g and Assembling of Four Stroke Petrol Engine						
3. D	Dismantling	and Assembling of Four Stroke Diesel Engine						
4. D	ismantling	and Assembling of Constant Mesh Gear Box						
5. D	ismantling	, · · · · · · · · · · · · · · · · · · ·						
	ismantling	and Assembling of Synchromesh Gear Box						
6. D								
	Dismantling	g and Assembling of Synchromesh Gear Box	3					
7. D		g and Assembling of Synchromesh Gear Box g and Assembling of Differential and Live Axles		ems				
7. D	Dismantling	g and Assembling of Synchromesh Gear Box g and Assembling of Differential and Live Axles g and Assembling of Hydraulic and Pneumatic Braking Systems		ems				
7. D	ismantling ault diagn	g and Assembling of Synchromesh Gear Box g and Assembling of Differential and Live Axles g and Assembling of Hydraulic and Pneumatic Braking Systems g and Assembling of Recirculating Ball and Rack & Pinion Steer		ems				
7. D	ismantling ault diagn	g and Assembling of Synchromesh Gear Box g and Assembling of Differential and Live Axles g and Assembling of Hydraulic and Pneumatic Braking Systems g and Assembling of Recirculating Ball and Rack & Pinion Steer osis in Automotive Electrical Wiring Circuit			:45,	Prac	tical:	30, Total:7
7. D	Dismantlinç ault diagn	g and Assembling of Synchromesh Gear Box g and Assembling of Differential and Live Axles g and Assembling of Hydraulic and Pneumatic Braking Systems g and Assembling of Recirculating Ball and Rack & Pinion Steer osis in Automotive Electrical Wiring Circuit			:45,	Prac	tical:	30, Total:7
7. D 8. D 9. F 10. D	Dismantling ault diagn Dismantling	g and Assembling of Synchromesh Gear Box g and Assembling of Differential and Live Axles g and Assembling of Hydraulic and Pneumatic Braking Systems g and Assembling of Recirculating Ball and Rack & Pinion Steer osis in Automotive Electrical Wiring Circuit	ring Syste	Lecture				
7. D 8. D 9. F 10. D TEXT BO 1. &	Dismantling Cault diagn Dismantling OK: OK: OK: OK: DISMENSION	g and Assembling of Synchromesh Gear Box g and Assembling of Differential and Live Axles g and Assembling of Hydraulic and Pneumatic Braking Systems g and Assembling of Recirculating Ball and Rack & Pinion Steer osis in Automotive Electrical Wiring Circuit g and Assembling of Horn, Wiper and Starter Motor	ring Syste	Lecture				

2.	Ganesan V., "Internal Combustion Engines", 4th Edition, Tata McGraw-Hill, New Delhi, 2017.	
	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	demonstrate the IC engine components and exhaust system by dismantling and assembling	Applying (K3)
CO2	execute the various types of transmission and steering systems	Applying (K3)
CO3	develop the suspension, brake and steering systems of automobile	Applying (K3)
CO4	design the circuit for automotive electrical systems and illustrate the types of chassis	Applying (K3)
CO5	execute the various automotive accessories and alternate fuel sources in automobiles	Applying (K3)
		1

					Mappi	ng of C	Os with	n POs a	nd PSC	Os				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2			1	1		3	2		1		
CO2	3	3	2			1	1		3	2		1		
CO3	3	2	2			1	1		3	2		1		
CO4	3	2	2			1	1		3	2		1		
CO5	3	3	2			1	1		3	2		1		

		ASSESSMEN'	T PATTERN	– THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	20	80					100
CAT3	20	80					100
ESE	15	85					100

		22AU001 - AUTOMOTIVE ELECTRO (Offered by Department of Automobile Eng	inosti\					
Progra	amme &	(Offered by Department of Automobile Eng						
Branc		All BE/BTech Branches except Automobile Engineering	Sem.	Category	L	Т	Р	Credit
Prerec	quisites	NIL	5	OE	3	1	0	4
D	hla							
Pream		To acquire knowledge on basic automotive electrical and elec like charging, starting, ignition, fuel control and engine manag		ystems for m	ain f	uncti	ons in	vehicles
Unit -		Charging and Starting systems:						9+3
systen	n technology	uirements of the charging system - Charging system principles – A r - Alternator developments - Requirements of the starting syste starting system technology - Electronic starter motor control and	m - Start	er motors an				
Unit -	II	Ignition systems:						9+3
- Indud	tive pulse g	ndamentals - Electronic ignition - Constant dwell systems- Const enerator - Dwell angle control (open loop) - Capacitor discharge on plug (COP) ignition - spark plugs						
Unit -	III	Fuel control:						9+3
fuel inj	ection - Ele	ine fueling and exhaust emissions - Emissions and driving cycle ctronic control of diesel injection - Rotary pump system - Comn sor - air–fuel ratio						
Unit -	IV	Engine management:						9+3
		and fuel injection system - Exhaust emission control - Engine de anagement systems - Other aspects of engine management sys		atalytic conve	erters	s - Clo	osed l	oop lambo
Anti-lo Advan Cruise	ck brakes - ced chassis control - Airl	Vehicle Safety and Comfort: Traction and stability control - Active suspension - Automatic to systems technology - Comfort and safety - Seats, mirrors and so bags and belt tensioners - Advanced comfort and safety systems in calculations	sun-roofs	- Central loc gy - Cruise co	king ontrol	and of	electri syster	c windows n respons
Anti-lo Advan Cruise - Radio	ck brakes - ced chassis control - Airl o suppressic	Traction and stability control - Active suspension - Automatic to systems technology - Comfort and safety - Seats, mirrors and spags and belt tensioners - Advanced comfort and safety systems	sun-roofs	- Central loc gy - Cruise co	king ontrol	and of	electri syster	al systems c windows
Anti-lo Advan Cruise - Radio	ck brakes - ced chassis control - Airl suppressio	Traction and stability control - Active suspension - Automatic to systems technology - Comfort and safety - Seats, mirrors and so bags and belt tensioners - Advanced comfort and safety systems for calculations	sun-roofs technolo	- Central loc gy - Cruise co Lectur	king entrol	and and	electri syster orial:1	al systems c windows m respons
Anti-lo Advan Cruise - Radio	ck brakes - ced chassis control - Airl o suppression BOOK:	Traction and stability control - Active suspension - Automatic transfers technology - Comfort and safety - Seats, mirrors and stags and belt tensioners - Advanced comfort and safety systems on calculations on., "Automobile Electrical and Electronic Systems", 5th Edition,	sun-roofs technolo	- Central loc gy - Cruise co Lectur	king entrol	and and	electri syster orial:1	al systems c windows m respons
Anti-lo Advan Cruise - Radio TEXT 1.	ck brakes - ced chassis control - Airl suppressio BOOK: Tom Dent	Traction and stability control - Active suspension - Automatic to systems technology - Comfort and safety - Seats, mirrors and stags and belt tensioners - Advanced comfort and safety systems for calculations on., "Automobile Electrical and Electronic Systems", 5th Edition, ANUAL / SOFTWARE: bbens., "Understanding Automotive Electronics an Engineering	sun-roofs technolog	- Central loc gy - Cruise co Lectur ge, United Kir	king ontrol e:45	and and land	electri syster orial:1	al systems c windows m respons
Anti-lo Advan Cruise - Radio TEXT 1.	ck brakes - ced chassis control - Airl o suppressio BOOK: Tom Dent RENCES/ M William Ri Science,2	Traction and stability control - Active suspension - Automatic to systems technology - Comfort and safety - Seats, mirrors and stags and belt tensioners - Advanced comfort and safety systems for calculations on., "Automobile Electrical and Electronic Systems", 5th Edition, ANUAL / SOFTWARE: bbens., "Understanding Automotive Electronics an Engineering	Routledo Perspect	- Central loc gy - Cruise co Lectur ge, United Kir	king ontrol e:45	and and land	electri syster orial:1	al systems c windows m respons
TEXT 1. REFEI 1. 2.	ck brakes - ced chassis control - Airl o suppressio BOOK: Tom Dent RENCES/ M William Ri Science,2 Robert Bo SE OUTCO	Traction and stability control - Active suspension - Automatic to systems technology - Comfort and safety - Seats, mirrors and stags and belt tensioners - Advanced comfort and safety systems for calculations on., "Automobile Electrical and Electronic Systems", 5th Edition, ANUAL / SOFTWARE: bbens., "Understanding Automotive Electronics an Engineering 017. sch GmbH., "Bosch Automotive Handbook", 10th Edition , Wiley,	Routledo Perspect	- Central loc gy - Cruise co Lectur ge, United Kir	king ontrol e:45	and and Tand	orial:1	al systems c windows m respons
Anti-lo Advan Cruise - Radio TEXT 1. REFEI 1. 2. COUR On co	BOOK: Tom Dent William Ri Science,2 Robert Bo SE OUTCO mpletion of	Traction and stability control - Active suspension - Automatic transport to systems technology - Comfort and safety - Seats, mirrors and stags and belt tensioners - Advanced comfort and safety systems on calculations on., "Automobile Electrical and Electronic Systems", 5th Edition, ANUAL / SOFTWARE: bbens., "Understanding Automotive Electronics an Engineering 017. sch GmbH., "Bosch Automotive Handbook", 10th Edition , Wiley, MES:	Routledo Perspect	- Central loc gy - Cruise co Lectur ge, United Kir	king ontrol e:45	and of another another and of another anot	electri syster orial:1 017. ier	al systems c windows m respons
TEXT 1. REFEI 1. 2. COUR On co	BOOK: Tom Dent RENCES/ M William Ri Science,2 Robert Bo SE OUTCO mpletion of design and	Traction and stability control - Active suspension - Automatic to systems technology - Comfort and safety - Seats, mirrors and stags and belt tensioners - Advanced comfort and safety systems for calculations on., "Automobile Electrical and Electronic Systems", 5th Edition, ANUAL / SOFTWARE: bbens., " Understanding Automotive Electronics an Engineering 017. sch GmbH., "Bosch Automotive Handbook", 10th Edition , Wiley, MES: the course, the students will be able to	Routledo Perspect	- Central loc gy - Cruise co Lectur ge, United Kir	king ontrol e:45	and of another	orial:1 017. ier BT Maighes	al systems c windows m respons 15, Total:6
Anti-lo Advan Cruise - Radio TEXT 1. REFEI 1. 2. COUR On co CO1	ck brakes - ced chassis control - Airl o suppression BOOK: Tom Dent RENCES/ M William Ri Science,2 Robert Bo SE OUTCO mpletion of design and describe to	Traction and stability control - Active suspension - Automatic transport to systems technology - Comfort and safety - Seats, mirrors and stags and belt tensioners - Advanced comfort and safety systems for calculations on., "Automobile Electrical and Electronic Systems", 5th Edition, ANUAL / SOFTWARE: bbens., "Understanding Automotive Electronics an Engineering 017. sch GmbH., "Bosch Automotive Handbook", 10th Edition , Wiley, MES: the course, the students will be able to d implement the electrical circuits for charging and starting systems.	Routledo Perspect	- Central loc gy - Cruise co Lectur ge, United Kir	king ontrol e:45	and of another anoth	orial:1 017. ier BT Maighes applyinerstan	al systems c windows m respons 15, Total:6 apped t Level) ag (K3)
TEXT 1. REFEI 1. 2. COUR On co CO1 CO2	ck brakes - ced chassis control - Airl o suppression BOOK: Tom Dent RENCES/ M William Ri Science,2 Robert Bo SE OUTCO mpletion of design and describe the	Traction and stability control - Active suspension - Automatic transport to systems technology - Comfort and safety - Seats, mirrors and stags and belt tensioners - Advanced comfort and safety systems and calculations on., "Automobile Electrical and Electronic Systems", 5th Edition, ANUAL / SOFTWARE: bbens., "Understanding Automotive Electronics an Engineering 017. sch GmbH., "Bosch Automotive Handbook", 10th Edition , Wiley, MES: the course, the students will be able to d implement the electrical circuits for charging and starting systems and the layout and types of ignition system used in gasoline engine	Routledo Perspect	- Central loc gy - Cruise co Lectur ge, United Kir	king ontrol e:45	and of another anothe	orial:1 017. ier BT Maighes applyinerstan	al systems c windows m respons 15, Total:6 apped t Level) ng (K3)
TEXT 1. REFEI 1. 2. COUR On co CO1 CO2 CO3 CO4	BOOK: Tom Denter Science,2 Robert Books SE OUTCO mpletion of design and describe the explain above the control of the control	Traction and stability control - Active suspension - Automatic transport to the systems technology - Comfort and safety - Seats, mirrors and subags and belt tensioners - Advanced comfort and safety systems and calculations on., "Automobile Electrical and Electronic Systems", 5th Edition, ANUAL / SOFTWARE: bbens., "Understanding Automotive Electronics an Engineering 017. sch GmbH., "Bosch Automotive Handbook", 10th Edition , Wiley, MES: the course, the students will be able to d implement the electrical circuits for charging and starting systems in elayout and types of ignition system used in gasoline engine are different elements of fuel injection systems in engines.	Routledo Perspect	- Central loc gy - Cruise co Lectur ge, United Kir	king ontrol e:45	and of another an	orial:1 017. ier BT Maighes applyin erstan	al systems c windows m respons 15, Total:6 apped t Level) ag (K3) adding (K2)
TEXT 1. REFEI 1. 2.	BOOK: Tom Denter Science,2 Robert Books SE OUTCO mpletion of design and describe the explain above the control of the control	Traction and stability control - Active suspension - Automatic transfer systems technology - Comfort and safety - Seats, mirrors and spags and belt tensioners - Advanced comfort and safety systems and calculations on., "Automobile Electrical and Electronic Systems", 5th Edition, ANUAL / SOFTWARE: bbens., " Understanding Automotive Electronics an Engineering 017. sch GmbH., "Bosch Automotive Handbook", 10th Edition , Wiley, MES: the course, the students will be able to d implement the electrical circuits for charging and starting system he layout and types of ignition system used in gasoline engine he different elements of fuel injection systems in engines.	Routledo Perspect , 2018.	- Central loc gy - Cruise co Lectur ge, United Kir	king ontrol e:45	and of another an	orial:1 017. ier BT Maighes applyin erstan	apped t Level) ag (K3) adding (K2) adding (K2)

CO1	3	3	1	1				1	
CO2	3	3	1	1				1	
CO3	3	3	1	1				1	
CO4	3	3	1	1				1	
CO5	3	3	1	1				1	

 $1-Slight,\, 2-Moderate,\, 3-Substantial,\, BT-\,Bloom's\, Taxonomy$

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	15	50	35				100

 $^{^{\}star}$ ±3% may be varied (CAT 1,2,3 – 50 marks $\,$ & ESE – 100 marks)

			<u> </u>	22AUO02 - V	EHICLE MAINTE	NANCE					
			(Offere	ed by Departi	ment of Automobile	e Engineerin	g)				
Programme 8 Branch	A	I BE/BTech	Branches	except Auto	omobile Engineer	ring Sem.	Category	L	Т	Р	Credit
Prerequisites	N	L				6	OE	3	1	0	4
Preamble	TI	is course pro	ovides knov	wledge on m	aintenance and se	ervicing of var	ious systems	in au	tomo	biles.	
Unit - I	M	aintenance p	orocedure	and tools:							9+3
	hicle ins	ırance -Towiı	ng and red		nce – Service inte fety – Personnel,						
Unit - II		ngine Mainte									9+3
Condition che	cking of seel injection	eals, gaskets, n and engine	and sealar managem	nts in engine- ent service. F	ts- Engine repair - - Cooling system so Fault diagnosis usii	ervice, lubrica	ation system s	ervic	e, Fu	el syste	em service
Unit - III		iveline Main									9+3
Removing and Removing axl	d replacin e shafts,	g propeller sl pearings. Ser	naft. Servic	ing of yokes	sion and transaxle s, cross of universa sembly.						
Unit - IV		nassis Maint									9+3
	k and pin	on steering,	Recirculati	ng ball type s	coil spring, leaf spaces tire rotation. The	be steering a	nd Power stee	ring.	Mair	ntenanc	e of Brak
				VIICCI- I II C W	cai, iiic iolalion, i						
Electrical: Ma	intenanc	ectrical and e of battery, s	HVAC Ma	intenance: arging and lig	ghting systems. HN		k detection- A	C Ch	nargir	ng.	9+6 stem parts 5, Total:6
Electrical: Ma	iintenanc ondense	ectrical and e of battery, s	HVAC Ma	intenance: arging and lig	ghting systems. H \		k detection- A	C Ch	nargir	ng.	item parts
Electrical: Maccompressor, o	intenanc	ectrical and e of battery, s , expansion	HVAC Ma starting, characteristics walve and e	intenance: arging and liq evaporator. F	ghting systems. H \	C hoses- Lea	k detection- A	C Cr re:45	argir	ng.	tem parts
Electrical: Maccompressor, of the compressor of	intenanc ondense m H. Cro	ectrical and e of battery, s , expansion	HVAC Ma starting, characteristics walve and e	intenance: arging and liq evaporator. F	ghting systems. H\ Replacement of A/0	C hoses- Lea	k detection- A	C Cr re:45	argir	ng.	tem parts
Electrical: Maccompressor, of the compressor of	intenanc ondense m H. Cro	ectrical and e of battery, s , expansion v	HVAC Ma starting, chavalve and e	intenance: arging and lig evaporator. F	ghting systems. H\ Replacement of A/0	C hoses- Lea	k detection- A Lecture CGraw Hill Ed	re:45	, Tut	orial:1	tem parts. 5, Total:60 hi, 2017.
TEXT BOOK: 1. Willia REFERENCE 1. Ed M Jigar	m H. Cro	ectrical and e of battery, s , expansion v use and Dona Simpson., "A Dhruv U. Pa	etarting, chavalve and e	intenance: arging and ligevaporator. F	ghting systems. HN Replacement of A/G re Mechanics"., 10	C hoses- Lea	k detection- A Lecture Graw Hill Ede	re:45	, Tut on, N	orial:1:	tem parts 5, Total:6 hi, 2017.
Electrical: Maccompressor, of the compressor of	m H. Cro S: ay & Les A. Doshi, Delhi, 20	ectrical and e of battery, s , expansion v use and Dona Simpson., "A Dhruv U. Pa 4.	etarting, chavalve and e	intenance: arging and ligevaporator. F	ghting systems. HN Replacement of A/G re Mechanics"., 10 Volume I and II", 8	C hoses- Lea	k detection- A Lecture Graw Hill Ede	re:45	nargir , Tut on, N	orial:1:	tem parts 5, Total:6 hi, 2017. hi, 2009. g Pvt. Ltd
Electrical: Maccompressor, of the compressor of	m H. Cro S: ay & Les A. Doshi, Delhi, 20	ectrical and e of battery, so, expansion we are and Dona Simpson., "A Dhruv U. Pa 4. course, the second	starting, chavalve and early ald I. Anglir utomotive nchal &Jag	intenance: arging and ligevaporator. Find the service of the servi	ghting systems. H\ Replacement of A/6 re Mechanics"., 10 Volume I and II", 8 iar, "Vehicle Maint	Oth Edition, Meth Edition, Meth Edition, Methods	k detection- A Lectur Graw Hill Edi Graw Hill Edi Garage Practi	re:45	nargir , Tut on, N	orial:1: ew Del ew Del Learnin	tem parts 5, Total:6 hi, 2017. hi, 2009. g Pvt. Ltd
Electrical: Maccompressor, of the compressor of	m H. Cro S: ay & Les A. Doshi, Delhi, 20	ectrical and e of battery, so, expansion we are and Dona Simpson., "A Dhruv U. Pa 4. course, the second	starting, chavalve and early ald I. Anglir utomotive nchal &Jag	intenance: arging and ligevaporator. Find the service of the servi	ghting systems. HN Replacement of A/G re Mechanics"., 10 Volume I and II", 8 iar, "Vehicle Maint	Oth Edition, Meth Edition, Meth Edition, Methods	k detection- A Lectur Graw Hill Edi Graw Hill Edi Garage Practi	re:45	nargir , Tut on, N	orial:1: ew Del ew Del earnin BT Maj	tem parts 5, Total:6 hi, 2017. hi, 2009. g Pvt. Ltd
Electrical: Maccompressor, of the compressor, of th	m H. Cro S: A. Doshi, Delhi, 20 TCOMES on of the as the impobiles	ectrical and e of battery, so, expansion we are and Dona Simpson., "A Dhruv U. Pa 4. course, the soortance of me	starting, chavalve and estarting the starting of the starting	intenance: arging and ligevaporator. Find the service of the servi	ghting systems. H\ Replacement of A/6 re Mechanics"., 10 Volume I and II", 8 iar, "Vehicle Maint	Oth Edition, Meth Edition, Meth Edition, Methedation, Met	k detection- A Lectur Graw Hill Edi Graw Hill Edi Garage Practi	re:45	, Tut nn, N nn, N PHIL (H	orial:1: ew Del ew Del Learnin BT Maj ighest	tem parts 5, Total:6 hi, 2017. hi, 2009. g Pvt. Lto pped Level)
Electrical: Maccompressor, of the compressor, of th	m H. Cro S: ay & Les A. Doshi, Delhi, 20 TCOMES on of the as the impobiles in the ma	ectrical and e of battery, so, expansion we have an domain to the second point of the	starting, chavalve and estarting and estarti	intenance: arging and ligevaporator. Find the service of the servi	ghting systems. HN Replacement of A/6 re Mechanics"., 10 Volume I and II", 8 iar, "Vehicle Maint to practices, tools an	C hoses- Lea	k detection- A Lectur Graw Hill Edi Graw Hill Edi Garage Practi	re:45	, Tut , Tut on, N on, N PHI I (H Und	ew Del ew Del earnin BT Mal ighest erstand	tem parts 5, Total:6 hi, 2017. hi, 2009. g Pvt. Lto pped Level) ding (K2)
Electrical: Maccompressor, of the compressor, of th	m H. Cro S: ay & Les A. Doshi, Delhi, 20 FCOMES on of the as the impobiles in the ma	ectrical and e of battery, so, expansion we have an domain to the property of the source of meaning and the property of the source of the sour	estarting, chavalve and estarting and estart	arging and ligevaporator. Find the service of the s	ghting systems. HN Replacement of A/G re Mechanics"., 10 Volume I and II", 8 iar, "Vehicle Maint to practices, tools an ts sub-systems	Oth Edition, Moth Edition, Moth Edition, Mother Edition, Mothe	k detection- A Lectur Graw Hill Edi Graw Hill Edi Garage Practi	re:45	, Tut DDN, N DDN, N DDN, N DDN, N DDN, N DDN, N Und Und Und	ew Del ew Del earnin BT Maj ighest erstand erstand	tem parts 5, Total:6 hi, 2017. hi, 2009. g Pvt. Ltc pped Level) ding (K2)
Electrical: Maccompressor, of the compressor, of th	m H. Cro S: ay & Les A. Doshi, Delhi, 20 FCOMES on of the as the impobiles in the ma	ectrical and e of battery, so a particular of battery	starting, chavalve and estarting the valve at the va	arging and liquevaporator. Find the service of the	ghting systems. HV Replacement of A/G re Mechanics"., 10 Volume I and II", 8 iar, "Vehicle Maint to practices, tools an ts sub-systems mission and drive	Oth Edition, Moth Edition, Moth Edition, Moth Edition, Mother and Standard and Safety required the safety	k detection- A Lecture CGraw Hill Educe Graw Hill Educe Garage Practi	re:45	, Tut DDN, N DDN, N PHIL Und Und Und	ew Del ew Del earnin BT Maj ighest erstand erstand	tem parts 5, Total:6 hi, 2017. hi, 2009. g Pvt. Ltc pped Level) ding (K2) ding (K2) ding (K2)
Electrical: Maccompressor, of the compressor, of th	m H. Cro S: ay & Les A. Doshi, Delhi, 20 FCOMES on of the as the impobiles in the ma	ectrical and e of battery, so a particular of battery	estudents value and estanting, chavalve and estanting, chavalve and estantial estantia	intenance: arging and ligevaporator. Find the properties of the pr	ghting systems. HV Replacement of A/G re Mechanics"., 10 Volume I and II", 8 iar, "Vehicle Maint to practices, tools an ts sub-systems mission and drive I suspension and w ets in electrical and	C hoses- Lead the Edition, Market Edition, Editio	k detection- A Lecture CGraw Hill Educe Graw Hill Educe Garage Practi	re:45	, Tut DDN, N DDN, N PHIL Und Und Und	ew Del ew Del earnin BT Maj ighest erstand erstand erstand	tem parts 5, Total:6 hi, 2017. hi, 2009. g Pvt. Ltc pped Level) ding (K2) ding (K2) ding (K2)
Electrical: Maccompressor, of the compressor, of th	m H. Cro S: ay & Les A. Doshi, Delhi, 20 TCOMES on of the as the impobiles in the ma ate the m fy the ser the main	ectrical and e of battery, so a particular of battery	starting, chavalve and estarting and a starting and estarting and estart	intenance: arging and ligevaporator. Find the properties of the pr	ghting systems. HV Replacement of A/6 re Mechanics"., 10 Volume I and II", 8 iar, "Vehicle Maint to practices, tools an ts sub-systems mission and drive suspension and w ets in electrical and	C hoses- Lead the Edition, Market Edition, Editio	Lecture CGraw Hill Edit CGraw Hill Edit CGraw Fracti CGraw Fracti CGraw Fracti CGraw Hill Edit CGraw Fracti CGraw Hill Edit CG	re:45	, Tut on, N on, N PHI I (H Und Und Und	ew Del ew Del earnin BT Maj ighest erstand erstand erstand	tem parts 5, Total:6 hi, 2017. hi, 2009. g Pvt. Ltd pped Level) ding (K2) ding (K2) ding (K2)
Electrical: Maccompressor, of the compressor, of th	m H. Cro S: ay & Les A. Doshi, Delhi, 20 FCOMES on of the as the impobiles in the ma ate the m fy the ser the main	ectrical and e of battery, so a particular of battery, so a particular of the source, source, source, source, source of mantenance provide practices tenance cum	starting, chavalve and estarting and a starting and estarting and estart	intenance: arging and ligevaporator. Find the properties of the pr	ghting systems. HV Replacement of A/6 re Mechanics"., 10 Volume I and II", 8 iar, "Vehicle Maint to practices, tools an ts sub-systems mission and drive suspension and w ets in electrical and	C hoses- Lea Oth Edition, Moth Edition, Moth Edition, Mother E	Lecture CGraw Hill Edit CGraw Hill Edit CGraw Fracti CGraw Fracti CGraw Fracti CGraw Hill Edit CGraw Fracti CGraw Hill Edit CG	ucatio	, Tut on, N on, N PHI I (H Und Und Und	ew Del ew Del earnin BT Maj ighest erstand erstand erstand	tem parts 5, Total:6 hi, 2017. hi, 2009. g Pvt. Ltd pped Level) ding (K2) ding (K2) ding (K2)

CO3	3	2		2			2	
CO4	3	2		2			2	
CO5	3	2		2			2	

		ACCECCINEN					
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	20	80					100
CAT3	15	65	20				100
ESE	15	70	15				100

^{*} $\pm 3\%$ may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

				(Offered by	Department of Auto	omobile En	aineerina'					
Program Branch	mme &	All BE	/BTech Bra		ept Automobile En		Sem.	Category	L	Т	Р	Credit
Prerequ	uisites	Nil					7	OE	3	0	0	3
Preamb	ole		ourse provid		ge on motor vehicle	e act, vehicl	e taxation	, vehicle ins	urance	e and	l transp	oort
Unit - I		Introd	uction:									9
					s – Psychology -S terviewing - Trainin					aniza	tion. D	rivers and
Unit - II			Vehicle Ad									9
& condu	uctors - Re cle - State	sponsibilit and inters	y of driver. tate permit	Accidents -	of motor vehicle & v Causes & analysis. and preventive me	. Rules rega	rding con	struction of i	notor	vehic	cles - F	Registration
Unit - II			on and Ins									9
Insuran	nce: Insurar	nce types	 Significan 	nce and rene	ition - Onetime tax wal- Furnishing par nd loss assessor -	rticulars of	vehicles ir	nvolved in a	n acci	dent	- Duty	of driver in
Unit - I			ort Opera									9
transpo	ort vehicles	- Preparati			Depot layouts and structure - Methods					ransp		
			sport vehic	cles - Mana	gement Information	n System	(MIS) in (oort c	pera		
transpo Unit - V Service	ortation of p / e advisor - F	Mainte Roles and	nsport vehic products -C enance Mar Responsibi	cles - Mana Dperation cos nagement: ilities - Job ca		on System ecords.	tion - Tria	goods trans	rstand	d cus	tion -	Storage & 9 complaints
transpo Unit - V Service - Time a control	ortation of p a advisor - F and cost an in stores -	Mainte Roles and alysis for	sport vehic products - Cenance Mar Responsibite repair work	cles - Mana Operation cos nagement: ilities - Job cas s - Precautio	gement Information at, revenues and recent	on System ecords. ord prepara out repair w	tion - Tria	run to unde	rstandure fo	d cus	tomer chanic	Storage & 9 complaints
transpo Unit - V Service - Time a control	ortation of p de advisor - F and cost an in stores -	etroleum Mainte Roles and nalysis for Customer	asport vehic products -C enance Mar Responsibi repair work longue req	cles - Mana Operation cos nagement: ilities - Job ca ss - Precautio quirements - (gement Information at, revenues and rec ard and service reco as before carrying of Customer feedback	on System ecords. ord prepara out repair w	tion - Tria	run to unde	rstandure fo	d cus	tomer chanic	Storage & 9 complaints - Inventory
transpo Unit - V Service - Time a control TEXT B	e advisor - F and cost an in stores -	etroleum Mainte Roles and nalysis for Customer	asport vehic products -C enance Mar Responsibi repair work longue req	cles - Mana Operation cos nagement: ilities - Job cas s - Precautio	gement Information at, revenues and rec ard and service reco as before carrying of Customer feedback	on System ecords. ord prepara out repair w	tion - Tria	run to unde	rstandure fo	d cus	tomer chanic	Storage & 9 complaints - Inventory
transpo Unit - V Service - Time a control TEXT B	advisor - F and cost an in stores - E BOOK:	etroleum Mainte Roles and ealysis for Customer	nsport vehic products -Cenance Mar Responsible repair work longue req	cles - Mana Dperation cos nagement: illities - Job cas s - Precautio quirements - (gement Information it, revenues and record and service records before carrying of Customer feedback	on System ecords. ord prepara out repair w k systems -	tion - Tria rorks -Trai Workshop	run to unde ning proced Maintenan	rstandure fo	d cus r med ftward	tomer chanic e.	Storage & 9 complaints Inventory Total:45
transpo Unit - V Service - Time a control TEXT B	advisor - F and cost an in stores - E BOOK:	etroleum Mainte Roles and halysis for Customer Customer	nsport vehic products -Cenance Mar Responsible repair work longue req	cles - Mana Dperation cos nagement: illities - Job cas s - Precautio quirements - (gement Information at, revenues and rec ard and service reco as before carrying of Customer feedback	on System ecords. ord prepara out repair w k systems -	tion - Tria rorks -Trai Workshop	run to unde ning proced Maintenan	rstandure fo	d cus r med ftward	tomer chanic e.	Storage & 9 complaints Inventory Total:45
transpo Unit - V Service - Time a control TEXT E 1. REFER 1.	advisor - Fand cost and in stores - Motor Versier Santosh Spelhi, NA	etroleum Mainte Roles and halysis for Customer chicle Act"	repair wehich sproducts - Cenance Market Mar	cles - Mana Dperation cos nagement: ilities - Job ca s - Precautio quirements - (gement Information it, revenues and record and service records before carrying of Customer feedback	on System ecords. ord prepara out repair was systems -	tion - Tria rorks -Trai Workshop	run to unde ning proced Maintenan	rstandure fo	d cus r med ftward	tomer chanic e.	Storage & 9 complaints Inventory Total:45
transpo Unit - V Service - Time a control TEXT E 1. REFER 1. 2.	advisor - Fand cost and in stores - Motor Versier Santosh Stantankar	Mainte Roles and halysis for Customer Chicle Act" Charma., " P G., "Roa	repair vehicles of the products of the products of the productivity of the productivit	cles - Mana Dperation cos nagement: ilities - Job ca s - Precautio quirements - (gement Information of the record of the reco	on System ecords. ord prepara out repair was systems -	tion - Tria rorks -Trai Workshop	run to unde ning proced Maintenan	rstandure fo	d cus r med ftware	tomer chanic e.	Storage & 9 complaints Inventory Total:45
transpo Unit - V Service - Time a control TEXT E 1. REFER 1. 2. COURS On con	advisor - Fand cost and in stores - Motor Version Santosh Sant	etroleum Mainte Roles and halysis for Customer Customer Chicle Act P G., "Roa MES: f the cour	Responsible repair work longue request, Govt. of least passengers, the sturns of the productivity and Passengerse, the sturns of the productivity and passengerse.	cles - Mana Dperation cos nagement: ilities - Job ca s - Precautio quirements - (ndia Publicat y in Road Tra ger Transport udents will b	gement Information of the record of the reco	on System ecords. ord prepara out repair which systems -	tion - Tria rorks -Trai Workshop	run to unde ning proced Maintenan	rstandure fo	d cus r med ftward t Und	tomer chanic e.	Storage & 9 complaints Inventory Total:45 gs, New
transpo Unit - V Service - Time a control TEXT E 1. REFER 1. 2. COURS On con	advisor - Fand cost and in stores - Fand cos	etroleum Mainte Roles and halysis for Customer Customer Chicle Act" Charma., " P G., "Roa MES: f the cour interviewin	repair vehicle of the students	cles - Mana Dperation cos nagement: ilities - Job ca s - Precautio quirements - o ndia Publicat y in Road Tra ger Transport udents will b	gement Information of the revenues and record and service records before carrying of Customer feedback ions. Insport", 2nd Edition in India", CIRT, Pure able to	on System ecords. ord prepara out repair we k systems -	tion - Tria rorks -Trai Workshop	run to unde ning proced Maintenan	rstandure fo	d cus r mec ftware	tomer chanic e.	Storage & 9 complaints Inventory Total:45 gs, New coped Level)
transpo Unit - V Service - Time a control TEXT E 1. REFER 1. COURS On con CO1 CO2	advisor - Fand cost and in stores - Fand cos	etroleum Mainte Roles and halysis for Customer Phicle Act" P G., "Roa Phicle Court Phicle Customer Phicle	repair vehicle results and Passengers the stung and train	cles - Mana Dperation cos nagement: illities - Job ca ss - Precautio quirements - o ndia Publicat y in Road Tra ger Transport udents will b ning procedur	gement Information of the revenues and record and service records before carrying of Customer feedback ions. Insport", 2nd Edition of the India", CIRT, Pure able to the res for drivers and of the res for drivers and	on System ecords. ord prepara out repair was systems -	tion - Tria rorks -Trai Workshop	run to unde ning proced Maintenan	rstandure fo ce sof	d cus r med ftwarn t Und t Und	tomer chanic e. lertakin BT Majighest	Storage & 9 complaints Inventory Total:45 gs, New oped Level) gg (K2)
transpo Unit - V Service - Time a control TEXT E 1. REFER 1. 2. COURS On con CO1 CO2 CO3	advisor - Fand cost and in stores - Fand cos	etroleum Mainte Roles and halysis for Customer Customer Chicle Act" Charma., " P G., "Roa Component of the cour Component of the co	repair wehich products - Cenance Mar Responsible repair work longue request., Govt. of large and Passengerse, the sturn and train rehicle issuetax and instance of the productivity of the sturn and train rehicle issuetax and instance of the productivity of the sturn and train rehicle issuetax and instance of the productivity of the productivity of the sturn and train rehicle issuetax and instance of the productivity of the productivity of the sturn and train rehicle issuetax and instance of the productivity of the product	cles - Mana Deration cos nagement: illities - Job ca ss - Precautio quirements - i ndia Publicat y in Road Tra ger Transport udents will b ning procedur tes with help surance polic	gement Information of the revenues and record and service record and service records before carrying of Customer feedback items. Insport", 2nd Edition of India", CIRT, Pure able to the res for drivers and confirmation of motor vehicle accord in the respective of the results of the results and confirmation of the results and the res	on System ecords. ord preparation out repair with the systems - on, Association, Association. conductors of the conductors of the conductors	tion - Tria rorks -Trai Workshop	run to unde ning proced Maintenan	rstandure foce sof	d cus r med ftward t Und t Und (H	tomer chanic e. lertakin BT Majighest standir	Storage & 9 complaints Inventory Total:45 gs, New oped Level) ng (K2) ng (K2)
transpo Unit - V Service - Time a control TEXT E 1. REFER 1. 2. COURS On con CO1 CO2	advisor - Fand cost and in stores - SOOK: "Motor Veta ENCES: Santosh South, NA Patankar SE OUTCOmpletion of illustrate exemplify identify apdiscuss the south of the south of the second of the south	etroleum Mainte Roles and halysis for Customer Customer P G., "Roa MES: f the cour interviewin public & v propriate ne operation	repair work longue req The products - Cenance Mai Responsible repair work longue req The productivity and Passeng The sturn and and train wehicle issue tax and insert on cost and	cles - Mana Deperation cos nagement: illities - Job ca ss - Precautio quirements - i ndia Publicat y in Road Tra ger Transport udents will b ning procedur tes with help surance polic I revenues of	gement Information of the revenues and record and service records before carrying of Customer feedback items. Insport", 2nd Edition of India", CIRT, Pure able to the res for drivers and of the services for their own velocities for their own velocities and the services for their own velocities and the services for their own velocities for their own velocities and the services for their own velocities for their own velocities and the services for their own velocities and the services and the services for their own velocities and the services and	on System ecords. ord preparation out repair with the systems - on, Association, Association. conductors of the conductors of the conductors	tion - Tria rorks -Trai Workshop	run to unde ning proced Maintenan	rstandure fooce sof	d cus r med ftware t Und (H (H inder	tomer chanic e. lertakin BT Majighest standir standir	Storage & 9 complaints - Inventory Total:45 gs, New oped Level) ng (K2) ng (K2) ng (K2) ng (K2)
TEXT E 1. COURS On con CO1 CO2 CO3 CO4	advisor - Fand cost and in stores - SOOK: "Motor Veta ENCES: Santosh South, NA Patankar SE OUTCOmpletion of illustrate exemplify identify apdiscuss the south of the south of the second of the south	etroleum Mainte Roles and halysis for Customer Customer P G., "Roa MES: f the cour interviewin public & v propriate ne operation	repair work longue req The products - Cenance Mai Responsible repair work longue req The productivity and Passeng The sturn and and train wehicle issue tax and insert on cost and	cles - Mana Deperation cos nagement: illities - Job ca is - Precautio quirements - i ndia Publicat y in Road Tra ger Transport udents will b ning procedur tes with help surance polic I revenues of iples involved	gement Information of the receipt of the rest of the rest of motor vehicle actions for their own velocity of motor operation of in maintenance	on System ecords. ord preparation out repair with the systems - on, Association. conductors of the c	tion - Tria Yorks -Trai Workshop	run to unde ning proced Maintenan	rstandure fooce sof	d cus r med ftware t Und (H (H inder	tomer chanic e. BT Majighest standir standir standir	Storage & 9 complaints - Inventory Total:45 gs, New oped Level) ng (K2) ng (K2) ng (K2) ng (K2)
TEXT E 1. COURS On con CO1 CO2 CO3 CO4	advisor - Fand cost and in stores - Fand cos	etroleum Mainte Roles and halysis for Customer Customer P G., "Roa MES: f the cour interviewin public & v propriate ne operation	repair work longue req Govt. of le Productivity ad Passeng repair work and Passeng repair work and Passeng repair work and passeng repair work and productivity and passeng repair work and passe	cles - Mana Deperation cos nagement: illities - Job ca is - Precautio quirements - i ndia Publicat y in Road Tra ger Transport udents will b ning procedur tes with help surance polic I revenues of iples involved	gement Information of the revenues and record and service record and service records before carrying of Customer feedback ions. Insport", 2nd Edition of India", CIRT, Pure able to res for drivers and cord motor vehicle across for their own velocity transport operation of in maintenance on the service of	on System ecords. ord preparation out repair with the systems - on, Association. conductors of the c	tion - Tria vorks -Trai Workshop	run to unde ning proced Maintenan	rstandure fooce sof	d cus r med ftwarn t Und t Und (H Inder	tomer chanic e. BT Majighest standir standir standir	Storage & 9 complaints - Inventory Total:45 gs, New oped Level) ng (K2) ng (K2) ng (K2) ng (K2)

CO2	3	2		3	3	2		3	
CO3	3	2		3	3	2		3	
CO4	3	2		3	3	2		3	
CO5	3	2		3	3	2		3	

	ASSESSMENT PATTERN – THEORY													
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %							
CAT1	20	80					100							
CAT2	20	80					100							
CAT3	20	80					100							
ESE	15	85					100							

^{*} $\pm 3\%$ may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22A0004 - A010NON	IOUS VEHICLES					
	(Offered by Department of Au	ıtomobile Engineering)					
Programme & Branch	B.E Automobile Engineering	Sem.	Category	L	Т	Р	Credit
Prerequisites	NIL	8	OE	3	0	0	3
Preamble	To acquire knowledge on the concept of automa intelligence with case studies of an autonomous		and the cont	tribut	ion o	f artific	cial
Unit – I	Automated Driving:						9
Introduction to AD	DV - Safety - Vehicle and its occupants – External pe	eople and property - Se	ervice and rep	oair -	IMI T	echS	afe.
Unit – II	Advanced driver assistance systems:						9
Introduction to Al Stereo Video Car	DAS - Example Systems - Adaptive Cruise control mera - Rear Radar - Functional Safety and Risk.	- Obstacle Avoidance	Radar - Bas	sic re	versi	ng aid	I – Radar
Unit – III	Automated driving technologies:						9
technologies – Co	ad to Autonomy – Perception - Lidar Operation - Sensonnectivity - Artificial Intelligence - Top-down and Bo Social and human issues:	ottom-up AI - Deep lear	ning - End to	End	Mac	hine L	earning.
technologies – Co Unit – IV Introduction - Pub	ad to Autonomy – Perception - Lidar Operation - Sensonnectivity - Artificial Intelligence - Top-down and Bo	ottom-up AI - Deep lear	ning - End to	End	Mac	hine L	earning.
technologies – Co Unit – IV Introduction - Pub china.	ad to Autonomy – Perception - Lidar Operation - Sensonnectivity - Artificial Intelligence - Top-down and Bo Social and human issues:	ottom-up AI - Deep lear	ning - End to	End	Mac	hine L	earning.
Unit – IV Introduction - Pubchina. Unit – V	ad to Autonomy – Perception - Lidar Operation - Sensonnectivity - Artificial Intelligence - Top-down and Bo Social and human issues: Dic reaction to CAVs – Insurance - Mobility as a Serv	ottom-up AI - Deep lear	ning - End to	End ean u	Mac	hine L	earning. 9 - japan an
Unit – IV Introduction - Pubchina. Unit – V	ad to Autonomy – Perception - Lidar Operation - Sensonnectivity - Artificial Intelligence - Top-down and Bo Social and human issues: Dic reaction to CAVs – Insurance - Mobility as a Serv	ottom-up AI - Deep lear	ning - End to	End ean u	Mac	hine L	9 - japan an 9 AG.
Unit – IV Introduction - Pubchina. Unit – V Nvidia – Bosch -	ad to Autonomy – Perception - Lidar Operation - Sensonnectivity - Artificial Intelligence - Top-down and Bo Social and human issues: Dic reaction to CAVs – Insurance - Mobility as a Serv	ottom-up AI - Deep lear	ning - End to	End ean u	Mac	hine L	earning. 9 - japan an
Unit – IV Introduction - Pubchina. Unit – V Nvidia – Bosch -	ad to Autonomy – Perception - Lidar Operation - Sensonnectivity - Artificial Intelligence - Top-down and Bo Social and human issues: Case studies: Case studies: Google (Waymo) - Tesla Autopilot – Audi - Jaguar La	vice - Global Overview and Rover - Toyota Gu	ning - End to	ean u	Mac	– US	9 - japan ar 9 - AG.
Unit – IV Introduction - Pubchina. Unit – V Nvidia – Bosch - I TEXT BOOK: 1. Tom Der Kingdom	ad to Autonomy – Perception - Lidar Operation - Sensonnectivity - Artificial Intelligence - Top-down and Bo Social and human issues: Case studies: Case studies: Google (Waymo) - Tesla Autopilot – Audi - Jaguar La	vice - Global Overview and Rover - Toyota Gu	ning - End to	ean u	Mac	– US	9 - japan an 9 AG. Total:
Unit – IV Introduction - Pubchina. Unit – V Nvidia – Bosch - TEXT BOOK: 1. Tom Der Kingdom REFERENCES: Maurer, I	ad to Autonomy – Perception - Lidar Operation - Sensonnectivity - Artificial Intelligence - Top-down and Bo Social and human issues: Case studies: Case studies: Google (Waymo) - Tesla Autopilot – Audi - Jaguar La	ottom-up AI - Deep lear	rning - End to	End ean u	mion irst so	– US ensor	9 - japan ar 9 AG. Total:
Unit – IV Introduction - Pubchina. Unit – V Nvidia – Bosch - II TEXT BOOK: 1. Tom Der Kingdom REFERENCES: Maurer, I social as	ad to Autonomy – Perception - Lidar Operation - Sensonnectivity - Artificial Intelligence - Top-down and Bo Social and human issues: Case studies: Case studies: Google (Waymo) - Tesla Autopilot – Audi - Jaguar Lanton., "Automated Driving and Driver Assistance Systems, 2020.	rice - Global Overview and Rover - Toyota Gu tems", 1st Edition, Rou	- UK - Europe uardian – FLII	End ean u R - F	mnion irst se	- US ensor	9 - japan an 9 AG. Total:
Unit – IV Introduction - Publichina. Unit – V Nvidia – Bosch - III TEXT BOOK: 1. Tom Der Kingdom REFERENCES: Maurer, I social as	ad to Autonomy – Perception - Lidar Operation - Sensonnectivity - Artificial Intelligence - Top-down and Bo Social and human issues: Discretion to CAVs – Insurance - Mobility as a Service Case studies: Google (Waymo) - Tesla Autopilot – Audi - Jaguar Lanton., "Automated Driving and Driver Assistance Systems, 2020. Markus, J. Christian Gerdes, Barbara Lenz, and Herepects" Springer Nature, 2016.	rice - Global Overview and Rover - Toyota Gu tems", 1st Edition, Rou	- UK - Europe uardian – FLII	End ean u R - F	mnion irst se	- US ensor	9 - japan an 9 AG. Total:

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	explain the safety aspects of autonomous vehicles.	Understanding (K2)
CO2	describe advanced driver assistance systems for autonomous vehicles.	Understanding (K2)
CO3	illustrate automated driving technologies with sensor positioning.	Applying (K3)
CO4	apply the artificial intelligence techniques to autonomous vehicles.	Applying (K3)
CO5	analyse the specifications of autonomous vehicles from various manufacturers.	Analyzing (K4)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	2	2					1		
CO2	3	3	2	1	1	2	2					1		
CO3	3	3	2	1	1	2	2					1		
CO4	3	3	2	1	1	2	2					1		
CO5	3	3	2	1	1	2	2					1		

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

				_			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	20	45	35				100
CAT3	10	35	20	35			100
ESE	10	40	35	15			100
	/a.=						

* $\pm 3\%$ may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	(04)	22ECX01 - BASICS OF ELECTRONICS IN AUTO			S			
	(On	ered by Department of Electronics and Communic	ation Er	igineering)				
Progran	mme & Branch	All BE/BTech Branches except Electronics and Communication Engineering	Sem.	Category	L	т	Р	Credit
Prerequ	uisites	Nil	5	OE	3	0	2	4
Preamb	le	To understand the working principles of electronics i sensors in electronic Device.	n appliar	ces and identi	ty the	appl	icati	ons of
Unit – I		Introduction to Electronic Components:						9
Switche	s – Mechanical swi	tches – Poles and throws – Push-button switches – R - Soldering – Safety – Applications.	esistors -	- Capacitors –	Diode	es –	Tran	sistors –
Unit – II		Electronics and Sensors in Practice:						9
remote -	 Microwave oven - 	nsors – Accelerometers – Digital compasses or Magno - Television (TV) – Washing machine – Air Conditione				ensc	ors –	
Unit - II		Electronics in Automotive System Gadgets:						9
system-	Electronic suspens	control: Concept of an electronic engine control systemion control system - Blind spot detection- Automatic control systemion control syst	em- Cruis collision a	e control elect voidance syste	ronics em	s- Ant	tilock	_
compati	s industrial and soc	IoT Enabled Automation System Architecture: ietal automation and digitization - Arrowhead framew facility - Component-based engineering methodolo study: Complex system management and automation	gy- Safe					
Unit – V	/	Electronic Product Safety Standards:						9
Types of Protection	of product safety stoon- Constructive as	What Is a Standard, Structure of the product safety star andards- Objectives for products safety standards- p pects related to EMC- Serviceability.	oroduct s	onformity to pr afety standard	oduct I deve	sate elope	ty sta rs- N	andards- /leans of
EXPER	IMENTS:							
1.	Measurement of	temperature using Thermistor						
2.		temperature using Thermocouple						
3.	Measurement of	torque/ Strain using Strain Gauge						
4.	Speed measurer	ment using Encoder and Opto-coupler						
5.		displacement using Potentiometer						
6.	Measurement of	displacement using LVDT / Capacitive transducer		Lecture: 45	Prac	tical	. 30 ·	Total:75
TEXT B	800K:			2001010. 40		···oui	. 00	
1.	Westcott, S., & V for Units I, II.	Vestcott, J. R, "Basic Electronics: Theory and Practice	e", 3 rd Ed	tion Stylus Pu	blishir	ng, Ll	LC,2	.020,
2.		ns, "Understanding Automotive Electronics an Engine Init III.	ering Pe	rspective", 8 th	Editio	n, El	sevie	∍r
REFER	ENCES:							
1.		nstantin Bolintineanu, Jan Swart,"Electrical Product rs, 1 st Edition, 2017, for Unit IV	Compliar	nce and Safet	y Eng	jinee	ring"	, Artech
2.	BY Jerker Delsir	ng, "IoT Automation - Arrowhead Framework", CRC Pr	ress, US/	A, 1 st Edition 2	017, f	or Ur	nit V	
COURS	SE OUTCOMES:					RT	Man	ped
		rse, the students will be able to			(1			Level)
CO1	_	of electronic components						ling(K2)
CO2	demonstrate rea	l life electronic appliances			Ur	ders	tand	ling(K2)
	1				1			

CO3	conceptualize the connected device architecture	Applying(K3) / Precision(S3)
CO4	relate electronics in modern automotive	Understanding(K2) / Precision(S3)
CO5	relate the requirements of safety standard for different products	Understanding(K2) / Precision(S3)

	Mapping of COs with POs and PSOs													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2								2	2		
CO2	2	2	2			2	2				2	2		
CO3	2	2	2	2		2	2	3			2	2		
CO4	2	2	2	2		2	2	3			2	2		
CO5	2	2	2	2		2	2	3			2	3		

ASSESSMENT	PATTERN	J - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understandi ng (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total
CAT1	20	80	-	-	-	-	100
CAT2	10	60	30	-	-	-	100
CAT3	20	80	-	-	-	-	100
ESE	20	65	15	-	-	-	100

 * ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Digital Image Fundamentals:

Unit - I

ch Branches except Electronics and					I I	
ation Engineering	Sem.	Category	L	Т	Р	Credit
	5	OE	3	0	2	4
-	ation Engineering	ation Engineering 5	ation Engineering	ation Engineering	ation Engineering	ation Engineering

Brightness- Contrast- Hue- Saturation- Mach band effect, Image sampling- Quantization, Basic relationship between pixels-Color image fundamentals - RGB- HSI models - Need for transforms - DFT-DCT- Haar Transform

9

Unit - I	I Image Enhancement and Restoration:	!								
	Enhancement: Basic intensity transformations – Piecewise linear transformation functions, Histogram ncy domain filtering: Smoothing and sharpening filters.	equalization - Spatial and								
Unit - I	II Image Restoration									
	Degradation model - Noise distributions- Median - Geometric mean - Harmonic mean - Contra harm cs filters - Inverse and wiener filtering - Constrained least square filtering.	nonic mean filters – Order								
Unit - I	V Image Segmentation, Representation and Description:	!								
	ine and edge detection – Basics of intensity thresholding – Region based segmentation : Region grov g, Morphology – dilation and erosion – opening and closing	ving – Region splitting and								
Unit - \	/ Image Compression:	!								
	nentals: Fidelity Criteria – Types of redundancy – Huffmann – Run length coding – Arithmetic coding - ss and Lossy Predictive coding	-Block Transform Coding								
LIST O	F EXPERIMENTS / EXERCISES:									
	Simulation of the following Image Processing techniques:									
1.	Finding DCT of an input image									
2.	Image enhancement using basic intensity transformation techniques.									
3.	Contrast enhancement using Histogram Equalisation									
4.	Edge Detection in images using image sharpening masks									
5.	Restoration of an original image by the addition of noise (Gaussian & Impulse)									
6.	Morphological operation on an input image									
	Lecture	:45, Practical:30, Total:7								
TEXT I	воок:									
1.	Rafael C Gonzalez & Richard E Woods, "Digital Image Processing", 4 th Edition, Pearson Education, N	lew Delhi, 2020								
REFER	RENCES/ MANUAL / SOFTWARE:									
1.	Jayaraman S, Esakkirajan S & Veerakumar T, "Digital Image Processing", 1st Edition, 22nd Reprint, Ta 2018.	ta McGraw Hill, New Delhi								
2.	Alan C. Bovik, "The Essential Guide to Image Processing", 1st Edition, Academic Press, 2009									
3.	Anil K Jain, "Fundamentals of Digital Image Processing", 4th Edition, PHI Learning, New Delhi, 1995.									
	SE OUTCOMES: npletion of the course, the students will be able to	BT Mapped (Highest Level)								
CO1	demonstrate the fundamental concepts and image transforms	Applying (K3) /								
002	apply Image enhancement in both spatial and frequency domain to improve the quality of images	Precision (S3) Applying (K3) /								
CO3	Use image restoration techniques to restore the original images from noisy images	Precision (S3) Applying (K3) /								
	identify the features and region of interest of an image using segmentation, representation and	Precision (S3) Applying (K3) /								
CO4	description techniques for image classification employ image compression algorithms on digital images	Precision (S3) Applying (K3)								
CO5	employ image compression algorithms on digital images	Αρριγιιί ς (Νο)								
	Mapping of COs with POs and PSOs									
COs/P		PO12 PSO1 PSO2								

CO1	3	2	2	2	3		2	2	2	
CO2	3	2	2	2	3		2	2	2	
CO3	3	2	2	2	3		2	2	2	
CO4	3	2	2	2	3		2	2	2	
CO5	3	2	2	2			2	2	2	

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %			Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %					
CAT1	10	60	30	-	-	-	100					
CAT2	10	60	30	-	-	-	100					
CAT3	10	60	30	-	-	-	100					
ESE	10	60	30	-	-	-	100					

* $\pm 3\%$ may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	(Offered by Department of Electronics and Comi	nunication E	ngineering)						
Programme & Branch	All BE/BTech Branches except Electronics and Communication Engineering	Sem.	Category	L	Т	Р	Credit		
Prerequisites	Nil	6	OE	3	0	2	4		
Preamble	To fabricate PCB boards								
Unit – I	Introduction to PCB Designing Concepts:						9		
Types of compor basics	nents used in PCB - Types of PCBs: Single layer - Double layer a	nd Multi-layer	PCB - Flexible	PCE	3 - PC	B mai	nufacturing		
Unit – II PCB Design Considerations:									
	•						9		
General, Mecha Interference/ Con	nical and Electrical considerations - Design rules for Analog, mpatibility (EMI/ EMC).	Digital and H	ligh frequency	circu	uits -	Electi	_		
General, Mecha Interference/ Cor Unit – III	nical and Electrical considerations - Design rules for Analog, mpatibility (EMI/ EMC). Design and Simulation of PCB:						romagnetic		
General, Mecha Interference/ Con Unit – III Electronic Desig	nical and Electrical considerations - Design rules for Analog, mpatibility (EMI/ EMC).						romagnetic		
General, Mecha Interference/ Con Unit – III Electronic Desig	nical and Electrical considerations - Design rules for Analog, mpatibility (EMI/ EMC). Design and Simulation of PCB: n Automation (EDA) Tools - Single layer PCB, Two layer PC						romagnetic		
General, Mecha Interference/ Cor Unit – III Electronic Desig Placement and r Unit – IV	nical and Electrical considerations - Design rules for Analog, mpatibility (EMI/ EMC). Design and Simulation of PCB: In Automation (EDA) Tools — Single layer PCB, Two layer PC outing, Generating Gerber file for single layer PCB.	3 - Circuit de	esign and simi	ulatio	n - C	reatin	9 g footprint		
General, Mecha Interference/ Col Unit – III Electronic Desig Placement and r Unit – IV Image transfer to	nical and Electrical considerations - Design rules for Analog, mpatibility (EMI/ EMC). Design and Simulation of PCB: Automation (EDA) Tools - Single layer PCB, Two layer PC outing, Generating Gerber file for single layer PCB. PCB Fabrication Techniques:	3 - Circuit de	esign and simi	ulatio	n - C	reatin	9 g footprint		
General, Mecha Interference/ Cor Unit - III Electronic Desig Placement and r Unit - IV Image transfer to operations Unit - V	nical and Electrical considerations - Design rules for Analog, mpatibility (EMI/ EMC). Design and Simulation of PCB: n Automation (EDA) Tools - Single layer PCB, Two layer PC outing, Generating Gerber file for single layer PCB. PCB Fabrication Techniques: echniques - Plating techniques: Immersion, Electro less, Electro	3 - Circuit de	esign and sime er Mask, Etchi	ulation	n - C	reatin	9 g footprint 9 Mechanica		
General, Mecha Interference/ Cor Unit – III Electronic Desig Placement and r Unit – IV Image transfer to operations Unit – V Soldering technic	nical and Electrical considerations - Design rules for Analog, mpatibility (EMI/ EMC). Design and Simulation of PCB: An Automation (EDA) Tools - Single layer PCB, Two layer PC outing, Generating Gerber file for single layer PCB. PCB Fabrication Techniques: echniques - Plating techniques: Immersion, Electro less, Electro Circuit Tracing and Testing:	3 - Circuit de	esign and sime er Mask, Etchi	ulation	n - C	reatin	9 g footprint 9 Mechanica		

Soldering and de-soldering the components on the PCB including SMD devices

2.

3.	Design and Simulation of 230V AC to 5V/9V/12V DC Power Supply in CAD Tool
4.	Design, simulating, assembling and soldering of IR Sensor Module
5.	Preparation of layout from the circuit design
6.	Troubleshooting of single layer and multi-layer PCB
7.	Miniproject

Lecture:45, Practical:30, Total:75

TEXT BOOK:

- 1. Khandpur R.S., "Printed Circuit Board: Design, Fabrication, Assembly and Testing", 1st Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 2017 for Units I,II, IV,V.
- 2. Laboratory Manual for Unit III.

REFERENCES/ MANUAL / SOFTWARE:

- 1. Mehta S.D, "Electronic Product Design", 1st Edition, S Chand Publications, New Delhi, 2011.
- 2. Clyde Coombs, "Printed Circuits Handbook", 6th Edition, McGraw Hill Professional, New Delhi, 2007.

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	classify the different types of PCBs	Understanding (K2)
CO2	outline the PCB design rules and considerations	Understanding (K2)
CO3	apply the PCB design rules to develop and simulate single layer PCB	Applying (K3)/ Precision (S3)
CO4	experiment with a single layer PCB for a given circuit	Applying (K3)/ Precision (S3)
CO5	identify and rectify the faults in a PCB	Applying (K3)/ Precision (S3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2												
CO2	3	2												
CO3	3	2	2		3				2	2		2		
CO4	3	2	2	2	3			2	2	2		2		
CO5	3	3	2	2	3	2	2	2	2	2		2		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %					
CAT1	30	70	-	-	-	-	100					
CAT2	30	50	20	-	-	-	100					
CAT3	20	50	30	-	-	-	100					
ESE	20	50	30	-	-	-	100					

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22ECO01- WEARABLE DEVICES													
	(Common to All Engineering and Technology	Branches	s)										
Programme & Branch	All BE/BTech Branches except Electronics and Communication Engineering	Sem.	Category	L	Т	Р	Credit						
Prerequisites	Nil	7	OE	3	0	0	3						
			1										
Preamble	To understand the concept of wearable Sensors and its applications in various sectors												
Unit – I Data Acquisition and Sensor Characteristics : 9													
Sensors, Signals, and Systems-Sensor Classification-Units of Measurements-Sensor Characteristics: Transfer Function-Span (Full-Scale Input)- Full-Scale Output-Accuracy-Calibration-Calibration Error-Hysteresis-Nonlinearity-Saturation-Repeatability-Dead Band-Resolution-Special Properties-Output Impedance-Excitation-Dynamic Characteristics-Environmental Factors-Reliability-Application Characteristics-Uncertainty													
Unit – II	,												
Radar Sensors-Thi	sors-Gravitational Sensors-Capacitive Sensors-Inductive and Mag	netic Sen	sors-Optical S	enso	rs-Ult	rason							
Unit – III	Sensors for Wearable Devices :						9						
Pressure Sensors-Flow Sensors- Acoustic Sensors-Humidity and Moisture Sensors-Light Detectors-Radiation Detectors-Temperature Sensors													
Unit – IV	Chemical Sensors :						9						
	haracteristics-Specific Difficulties-Classification of Chemical-Sens	ing Mecha	anisms-Direct	Sens	ors-C	omple	ex Sensors-						
Chemical Sensors '	Scope of Wearable Devices:						9						
Role of Wearables, Adoption of Innova	Attributes of Wearables, The Meta Wearables – Textiles and clotion, On-Body Interaction; Case Study: Smart watches, Smart glare and Research Roadmap.						Aesthetics,						
							Total:45						
ТЕХТ ВООК:													
1. Jacob Frad	len, "Hand Book of Modern Sensors: physics, Designs and Applica	ations", 5 ^{tl}	edition., Sprir	nger,	2016	for U	Inits I, II, III,						
	azonov, Michael R Neuman, "Wearable Sensors: Fundamentals 20 for Unit V.	s, Implem	entation and	Appli	catio	ns" E	lsevier, 2 nd						
REFERENCES:													
1. Subhas Ch	andra Mukhopadhyay, "Wearable Electronics Sensors - For Safe a	and Healt	hy Living",I st Ed	dition	Spri	nger 2	2015						
2. A.K. Sawhi	ney, "Electrical and Electronic Measurements and Instrumentation"	', Dhanpa	t Rai. ",I st Editio	on 20)15								
0.	ajput, "Electronic Measurements and Instrumentation", S. Chand &		•										
1 1	rdonova and Y. Choi, "Review of Wea s to the Mining Industry," Energies, vol. 11, p. 547, 2018, for Unit \	rable / (Case S		echn	ology	'	and Its						

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	understand the concepts of Data Acquisition and Sensor Characteristics	Understanding(K2)
CO2	discuss the concepts of various wearable Position, Displacement and Level Sensors	Understanding(K2)
CO3	acquire knowledge on Sensors for Wearable devices	Understanding(K2)
CO4	describe the different chemical sensors in wearable	Understanding(K2)
CO5	apply the usage of wearable devices as assistive devices, diagnostic devices and other modern applications	Applying(K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3	2	2						2			2		
CO3	3	2	2						2			2		
CO4	3	2			2	2						2		
CO5	3	2	2	2	2	2	2		2	2	2	2		

^{1 –} Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

	AODEOGMENT ATTEMS THEORY													
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %							
CAT1	30	70	-	-	-	-	100							
CAT2	30	70	-	-	-	-	100							
CAT3	20	40	40	-	-	-	100							
ESE	20	40	40	-	-	-	100							

 $^{^{\}star}$ ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Progra	amme &	(Offered by Department of Electronics and Com All BE/BTech Branches except Electronics and			Ι.		_	
Branc		Communication Engineering	Sem.	Category	L	T	Р	Credit
Prerec	quisites	Nil	7	OE	2	0	2	3
		T						
Pream Unit –		To test and troubleshoot electronic hardwares Introduction to Electronic Hardware Troubleshooting a	nd Failura An	alvaia				6
		nalysis-Circuit faults-Troubleshooting methods-Safety consider		-	nante	-Sam	icono	_
		Electron tubes-Ultra capacitors-Inductors.	rauons-resun	y basic compo	Herita	-0611	iicoric	iuciois-
Unit –	II	Troubleshooting Industrial Controls Device:						6
		struments: Digital multimeter-Oscilloscope, Troubleshooting procedures-Preventive maintenance.	industrial contr	ols: Fundame	entals	-Туре	s of	controllers
Unit –		Troubleshooting Consumer Electronic Systems:						6
		it repair-Lighting and control system repair-TV distribution syst itor troubleshooting.	em repair- Fibe	er optic commu	ınicati	on re	pair-(Case study
Unit –		Troubleshooting Digital Circuits:						6
		circuits: Binary Code-Logic gates-Digital technologies-Voltage						
		t- Open inputs - Open outputs- Short circuit, Installation and r	eplacement of	an IC chip, Tro	ouble	shoot	ing e	quipment
	ital circuits.							_
Unit –		PCB Manufacturing, Maintenance and Safety Aspects						6
		omedical equipment: Electrical safety and safety equipment-Tr	ouble shooting:	: ECG systems	s-EEG	syst	ems-	Ultra soun
macmi	nes-X-ray ma	achines.						
LIST C	F EXPERIM	MENTS / EXERCISES:						
1.	Dismantlin	g and Assembling of electronic hardware.						
2.	Troublesh	ooting of digital circuits						
3.	Troublesh	ooting of Shift registers						
4.	Troublesh	ooting of speakers and amplifiers						
5.	Troublesh	ooting of home appliances – Radio / TV						
6.	Troublesh	ooting of PCB of Mobile phone/Modem						
				Lecture	e:30, l	Pract	ical:3	80, Total:6
TEXT	воок:							
1.	Daniel R.	Fomal& Aram S. Agajanian, "Electronic Troubleshooting", 4 th I	Edition, McGrav	w-Hill Education	n, Ne	w De	lhi, 2	014,
REFE	RENCES/ M.	ANUAL / SOFTWARE:						
1.		R.S, "Troubleshooting Electronic Equipment: Includes Repair	r And Maintena	nce", 2 nd Editi	on, M	cGra	w-Hill	Education
2.		ushan Sinha, "Handbook of Repair and Maintenance Of Dom	estic Electronic	s Appliances	handb	ook"	, 1 st E	dition, BP
3.	Publication Michael Ja	ns, 2017. Tygeier, "How to Diagnose and Fix Everything Electronic", 2 nd	Edition McGra	w-Hill Education	on N	ew D	elhi 2	2015
	511401 00	, , , , , , , , , , , , , , , , , , ,		Ladouti	J. 1, 1 4	J., D.	, 2	· · · · · ·
	SE OUTCO	MES: the course, the students will be able to						pped t Level)
CO1	explain tro	ubleshooting principles for testing and point out the failures of	electronic equi	pment.		Unde	erstan	ding (K2)
CO2	interpret th	e use of testing tools and instruments for troubleshooting elec	tronic hardwar	e.				ding (K2)
CO3	identify the	e faults and troubleshoot the home appliances using multimete	er.			Pr	ecisio	g (K3)/ on (S3)
								g (K3)/

CO5	apply troubleshooting principle of Biomedical equipment.													Applying (K3)/ Precision (S3)					
						Марр	ing of C	Os with	n POs a	and PSC)s								
COs/P	Os	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2				
CO	1	3	1	2	2								2						
CO2	2	3	2	2	2	3		2					2						
CO	3	2	1	3	2	2		2		3	2		3						
CO	1	3	2	2	2	2			2	3	2		2						
COS	5	2	3	3	2	3	2			3	2								
1 – Slig	ght, 2	– Mode	rate, 3 –	Substan	tial, BT-	Bloom's	Taxonor	ny											
						ASSI	ESSMEN	IT PAT	ΓERN -	THEOR	Y								
	t / Blo atego	oom's ory*	Re	memberi (K1) %	ing l	Jndersta (K2)	_	Apply (K3)		Analyz (K4)		Evaluating (K5) %		reating K6) %	Total %				
	CAT	1		40		60		-				-	-		100				
	CAT	2		30		50		20)	-		-	-		-		-		100
	CAT	3		20		40		40)	-		-		-	100				
	ESE 20				50	30		-		-	-		100						

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

(Common to All Engineering and Technology Branches)												
Т	L	Category	Sem.	Programme & All BE/BTech Branches except Electronics and Communication Engineering								
0	3	OE	8	Nil	Prerequisites							
0	3	OE	8	Nil	Prerequisites							
	T 0	L T	Category L T	Sem. Category L T	All BE/BTech Branches except Electronics and Communication Engineering Sem. Category L T							

Unit – I Introduction To Optical Fibers :

9

Introduction-general optical fiber communication system- basic optical laws and definitions-optical modes and configurations -mode analysis for optical propagation through fibers- transverse electric and transverse magnetic modes- fiber materials-fiber fabrication techniques-fiber optic cables-classification of optical fiber

Unit – II Transmission Characteristic Of Optical Fiber :

9

Attenuation-absorption --scattering losses-bending losses-core and cladding losses-signal dispersion --inter symbol interference and bandwidth-intra model dispersion-material dispersion- waveguide dispersion-polarization mode dispersion-intermodal dispersion-characteristics of single mode fiber-R-I Profile-cutoff wave length-dispersion calculation-mode field diameter.

Unit – III Optical Sources And Detectors :

9

Sources: Intrinsic and extrinsic material-direct and indirect band gaps-LED-LED structures-LASER diodes-modes and threshold conditions-Rate equations-external quantum efficiency-resonant frequencies-structures and radiation patterns, **Detectors:** PIN photo detector-Avalanche photo diodes-Photo detector noise-noise sources-SNR-detector response time-Avalanche multiplication noise-temperature effects-comparisons of photo detectors.

Unit – IV Optical Receiver and Measurements :

q

Fundamental receiver operation-preamplifiers-digital signal transmission-error sources-Front end amplifiers-digital receiver performance-probability of error.

Optical power measurement-attenuation measurement-dispersion measurement- Fiber Numerical Aperture Measurements- Fiber cut- off Wave length Measurements

Unit – V Optical Communication Systems And Networks :

9

System design consideration Point – to –Point link design –Link power budget –rise time budget, WDM –Passive DWDM Components-Elements of optical networks-SONET/SDH Optical Interfaces-SONET/SDH Rings and Networks-High speed light wave Links-OADM configuration-Optical ETHERNET-Soliton.

Total:45

TEXT BOOK:

- 1. P Chakrabarti, "Optical Fiber Communication II, McGraw Hill Education (India) Private Limited, 2016 for Units I, II, III.
- 2. GredKeiser, "Optical Fiber CommunicationII, McGraw Hill Education (India) Private Limited. Fifth Edition, Reprint 2013 for UnitsIV, V.

REFERENCES:

- 1. John M.Senior, "Optical fiber communication!", Pearson Education, second edition.2007.
- 2. Rajiv Ramaswami, "Optical Networks", 2nd Edition, Elsevier, 2004

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	realize basic elements in optical fibers, different modes and configurations	Understanding (K2)
CO2	explain the transmission characteristics associated with dispersion and polarization techniques.	Understanding (K2)
CO3	apply optical sources and detectors with their use in optical communication system.	Applying (K3)
CO4	construct fiber optic receiver systems, measurements and coupling techniques	Applying (K3)
CO5	interpret optical communication systems and its networks.	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	2		2		2	2			2		
CO2	3	2	2	1		2		2				2		
CO3	2	2	3	2					2			2		
CO4	2	2	3	2					2			2		
CO5	2	2	3	2		2		2	2			2		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %					
CAT1	40	60	-	-	-	-	100					
CAT2	20	50	30	-	-	-	100					
CAT3	20	40	40	-	-	-	100					
ESE	20	50	30	-	-	-	100					
±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)												

	22EEO01 – SOLAR AND WIND I	ENERGY SY	STEMS				
Programme & Branch	All BE/BTech Branches Except EEE	Sem.	Categor y	L	Т	Р	Credi
Prerequisites	Nil	5	OE	3	1	0	4
Preamble	This course aims in imparting the concepts a along with its detailed design procedures an		s of solar and	d win	d ene	rgy :	systems
Unit – I	Introduction to Solar PV:						9+3
	rameters of solar cell – Solar PV module – olar PV module arrays – Factor affecting ele						
Unit – II	Types of PV Systems:						9+3
Stand alone, grid – DC-DC convei	d connected and hybrid systems – Battery para rters – Inverters – MPPT – Components of grid	ameters – Bad connected	attery selecti PV systems	on –	Char	ge c	ontroller
Unit – III	Solar PV System Design:						9+3
chart – Look up Unit – IV Power output fro	ology for solar PV system: Approximate designable for solar PV system design – Installation Introduction to WECS: In an ideal turbine – Aerodynamics – Power of the start of generating synchronous powers.	and trouble	shooting of s	solar I	PV po	rgy p	plants. 9+3 production
and capacity fac generators. Unit – V	etor – Methods of generating synchronous pov	ver – DC sni	unt generato	or Witr	1 batt	ery i	
	Wind Power Plant Design: - Electrical network - Selection of low voltage	o and dietrih	ution voltage	0 001	iinma	nt	9+3
TEXT BOOK:			Lecture:4	15, Tu	utoria	al:15	, Total:
1. Chetan Sir Trainees a	ngh Solanki, "Solar Photovoltaic Technology a	te Limited, N	– A Manual lew Delhi, 20	for T	echn or Un	ician	ıs, II & III
1. Chetan Sir Trainees a 2. Gary L.Joh	and Engineers", 1st Edition, PHI learning Privationson, "Wind Energy Systems", Electronic Edi	te Limited, N	– A Manual lew Delhi, 20	for T	echn or Un	ician	ıs, II & III
1. Chetan Sir Trainees a 2. Gary L.Joh REFERENCES:	and Engineers", 1st Edition, PHI learning Priva nnson, "Wind Energy Systems", Electronic Edi ngh Solanki, "Solar Photovoltaics – Fundamer	te Limited, N tion, Manha	– A Manual lew Delhi, 20 tan, KS, 200	for T 013 fo 6 for	echn or Un Units	ician its I,	ns, & k V
Trainees a 2. Gary L.Joh REFERENCES: Chetan Sir Edition, Ph Spera, D.A	and Engineers", 1st Edition, PHI learning Priva nnson, "Wind Energy Systems", Electronic Edi	te Limited, Nation, Manhar	– A Manual lew Delhi, 20 an, KS, 200 blogies and A	for T 013 fo 6 for Applio	echn or Un Units	ician its I, IV 8	is, II & III & V
1. Chetan Sir Trainees a 2. Gary L.Joh REFERENCES: 1. Chetan Sir Edition, Ph 2. Spera, D.A Edition, AS	and Engineers", 1st Edition, PHI learning Privationson, "Wind Energy Systems", Electronic Edinason, "Solanki, "Solar Photovoltaics – Fundamental Learning Private Limited, New Delhi, 2011. A., "Wind Turbine Technology: Fundamental cosme, New York, 2009.	te Limited, Nation, Manhar	– A Manual lew Delhi, 20 an, KS, 200 blogies and A	for T 013 fo 6 for Applio	echn or Un Units catior neeri	ician its I, IV 8 ns", 2 ng",	is, II & III & V
1. Chetan Sir Trainees a 2. Gary L.Joh REFERENCES: 1. Chetan Sir Edition, Ph 2. Spera, D.A Edition, AS COURSE OUTO On completion C O outline the	and Engineers", 1st Edition, PHI learning Privationson, "Wind Energy Systems", Electronic Edinason, "Solar Photovoltaics – Fundamental Learning Private Limited, New Delhi, 2011. A., "Wind Turbine Technology: Fundamental commentations (SME, New York, 2009.	te Limited, N tion, Manhar ntals, Techno oncepts of W	– A Manual lew Delhi, 20 an, KS, 200 blogies and A	for T 013 fo 6 for Applio	echnor Units catior neeri	ician its I, IV &	is, II & III & V 2nd 2nd 2nd apped t Level)
1. Chetan Sir Trainees a 2. Gary L.Joh REFERENCES: 1. Chetan Sir Edition, Ph 2. Spera, D.A Edition, AS COURSE OUTO On completion C O outline the 1 C O make use 2	and Engineers", 1st Edition, PHI learning Privationson, "Wind Energy Systems", Electronic Edingh Solanki, "Solar Photovoltaics – Fundament I learning Private Limited, New Delhi, 2011. A., "Wind Turbine Technology: Fundamental comments, New York, 2009. COMES: of the course, the students will be able to	te Limited, N tion, Manhar ntals, Techno oncepts of W	– A Manual lew Delhi, 20 can, KS, 200 blogies and A /ind Turbine	for T 013 fo 6 for Applio	echnor Units Units catior neeri (Hig	ician its I, IV 8	is, II & III & V
1. Chetan Sir Trainees a 2. Gary L.Joh REFERENCES: 1. Chetan Sir Edition, Ph 2. Spera, D.A Edition, AS COURSE OUTO On completion C O outline the 1 C O make use 2 C O apply the constant of	and Engineers", 1st Edition, PHI learning Privationson, "Wind Energy Systems", Electronic Edinason, "Solar Photovoltaics – Fundamental Learning Private Limited, New Delhi, 2011. A., "Wind Turbine Technology: Fundamental comments, New York, 2009. COMES: of the course, the students will be able to parameters and ratings of solar cell and mode.	te Limited, N tion, Manhar ntals, Techno oncepts of W ules	– A Manual lew Delhi, 20 can, KS, 200 blogies and A /ind Turbine	for T 013 fo 6 for Applio	Cation neeri High	ician its I, IV 8 ns", 2 ng", T Ma ghes	ex V Pind 2nd 2nd apped t Level)
1. Chetan Sir Trainees a 2. Gary L.Joh REFERENCES: 1. Chetan Sir Edition, Ph 2. Spera, D.A Edition, AS COURSE OUTO On completion C O outline the 1 C C make use 2 C C apply the c 3 C	and Engineers", 1st Edition, PHI learning Privationson, "Wind Energy Systems", Electronic Edinason, "Solar Photovoltaics – Fundamental Learning Private Limited, New Delhi, 2011. A., "Wind Turbine Technology: Fundamental comments, New York, 2009. COMES: of the course, the students will be able to parameters and ratings of solar cell and modulof various components intended for solar PV sections.	te Limited, Notion, Manhard Ma	– A Manual lew Delhi, 20 can, KS, 200 blogies and A /ind Turbine	for T 013 fc 6 for Applic	Catior Recri (High	ician its I, IV 8 IV 8 IN	es, II & III E V Pind 2nd apped t Level) anding (Kang (Kang (Kang))

	Mapping of COs with POs and PSOs														
COs/P Os	P O 1	PO2	PO 3	PO4	P O 5	P O 6	P O 7	PO 8	PO 9	PO10	PO 11	PO12	PSO1	PSO2	
CO1	3	2	3			1	1					1			
CO2	3	3	2			1	1					1			
CO3	3	3	2			1	1					1			
CO4	3	2	3			1	1					1			
CO5	3	3	2			1	1					1			

^{1 –} Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembe ring (K1) %	Understan ding (K2) %	Applyi ng (K3) %	Analyzin g (K4) %	Evaluating (K5) %	Creating (K6) %	Tota I %
CAT1	40	40	20				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	30	40	30				100

^{* ±3%} may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

D													
Program Branch	nme &	All BE	BTech E	Branches	Except EEE			Sem.	Category	L	Т	Р	Credit
Prerequ	iisites	Nil						5	OE	3	1	0	4
Preambl	le	necess to edu	ary to ed	ucate an electrical	f the essential r engineer in the a engineers on th iminaires and Lig	spects of Doi ne aspect of	mestic a	and Indu	strial Lightin	g. Th	e idea	a of the	subject is
Jnit – I		Introdu		grit aria La	minanes and Lig	grit dourced.							9+3
and acce	essories –	Example	circuits -	- Panel B	ools and its interp oards – Earthing Tools – IE rules	g – Different t							
Unit – II			stic Wirir										9+3
Types of	f Loads – S	ervice co	nnection	s – Servio	rotection – Gener ce mains – Sub-C ce of wires – safe	Circuits – Loc	ents of e cation o	electrical f main bo	installations pard and Dis	s – Te tribut	esting ion b	g of ins oard –	tallations Guideline
Jnit – III	=		rial Wirir										9+3
					Estimating and cial buildings –Ele					or res	sident	tial buil	dings with
Jnit – IV	/	Illumin	ation:										9+3
ntroduct _ighting	tion – Term Schemes –	ıs & Defir - Design	nitions – I of Lightin	Laws of III	lumination – Pola es – Methods of I	ar curves – P Lighting calcu	hotome	etry – Ba with Prob	sic principles lems – Fact	of L	ight c Street	control of	– Types o od Lighting
Unit – V	1	Light S	Sources:										9+3
					ndescent Lamps	- Gaseous o	dischar	ge lamps	Sodium va	apour	discl	harge I	amn Hiak
	<u> </u>	apour dis	scharge i	amp, Mero	cury iodide lamp,				bes, CFL – I	LED's	;		
TEXT B (OOK: Raina K.B o	& Bhattao	charya S	.K, "Electr	ical Design Estin	, Neon lamp,	Fluores	scent Tu	Lecturion, New Ag	re:45	, Tut e	orial:1	5, Total:6 ublishers,
TEXT B (1	OOK: Raina K.B o 2017 for Ur Gupta J.B,	& Bhattao	charya S	.K, "Electr		, Neon lamp,	Fluores	scent Tu	Lecturion, New Ag	re:45	, Tut e	orial:1	5, Total:6 ublishers,
1	OOK: Raina K.B a 2017 for Ur Gupta J.B,	& Bhattao nit I,II,III "Utilizatio	charya S	.K, "Electr	rical Design Estin	, Neon lamp,	Fluores	scent Tu	Lecturion, New Ag	re:45	, Tut e	orial:1	5, Total:6 ublishers,
1	OOK: Raina K.B. a 2017 for Ur Gupta J.B, ENCES: Pritchard D	& Bhattac nit I,II,III "Utilizatio D.C, "Ligh	charya S on of Elec ting", 6th	K, "Electr ctric Powe Edition, F	rical Design Estiner and Electric Trans	, Neon lamp, nating and Co	osting",	2nd Edit	Lecturion, New Agaria& Sons,	ED's	, Tute ernati	orial:1: ional P Jnit IV	5, Total:6 ublishers,
1	OOK: Raina K.B. a 2017 for Ur Gupta J.B, ENCES: Pritchard D	& Bhattac nit I,II,III "Utilizatio D.C, "Ligh	charya S on of Elec ting", 6th	K, "Electr ctric Powe Edition, F	rical Design Estin	, Neon lamp, nating and Co	osting",	2nd Edit	Lecturion, New Agaria& Sons,	ED's	, Tute ernati	orial:1: ional P Jnit IV	5, Total:6 ublishers,
1	OOK: Raina K.B. a 2017 for Ur Gupta J.B, ENCES: Pritchard D Ronald N. I	& Bhattac nit I,II,III "Utilizatio D.C, "Ligh Helms, "I	charya S on of Elec ting", 6th	K, "Electr ctric Powe Edition, F	rical Design Estiner and Electric Trans	, Neon lamp, nating and Co	osting",	2nd Edit	Lecturion, New Agaria& Sons,	ED's	ernati	orial:1: ional P Jnit IV	5, Total:6 ublishers,
TEXT BO 1. 2. REFERE 1. 2. COURSI	OOK: Raina K.B. a 2017 for Ur Gupta J.B, ENCES: Pritchard D Ronald N. I 1980	& Bhattac nit I,II,III "Utilizatio D.C, "Ligh Helms, "I	charya S on of Elec ting", 6th	.K, "Electr ctric Powe Edition, F on Engine	rical Design Estiner and Electric Trans	, Neon lamp, nating and Co	osting",	2nd Edit	Lecturion, New Agaria& Sons,	ED's	ernati	orial:1	5, Total:6 ublishers,
TEXT BO 1. 2. REFERE 1. 2. COURSI On com	OOK: Raina K.B. a 2017 for Ur Gupta J.B, ENCES: Pritchard D Ronald N. I 1980	& Bhattac nit I,II,III "Utilization D.C, "Ligh Helms, "I	charya Son of Electing", 6th	.K, "Electr ctric Powe Edition, F on Engine	er and Electric Trans Routledge, 2016 Pering for energy	, Neon lamp, nating and Co	osting",	2nd Edit	Lecturion, New Agaria& Sons,	ED's	Prent	orial:1: ional P Jnit IV tice—Ha	5, Total:6 ublishers,
REFERE COURSI CO1	OOK: Raina K.B. a 2017 for Ur Gupta J.B, ENCES: Pritchard D Ronald N. I 1980 E OUTCOM pletion of to	& Bhattac nit I,II,III "Utilization D.C, "Ligh Helms, "I MES: the cour	charya S on of Electing", 6th Illumination se, the se methods	Edition, Fon Engine	er and Electric Trans Routledge, 2016 Pering for energy	nating and Coaction", 10th	osting",	2nd Edit	Lecturion, New Agaria& Sons,	ED's	Prent (Hi	orial:1	5, Total:6 ublishers, V all, Inc, pped Level)
REFERE COURSI CO1 CO2	OOK: Raina K.B. a 2017 for Ur Gupta J.B, ENCES: Pritchard D Ronald N. I 1980 E OUTCOM pletion of to	& Bhattace it I,II,III "Utilization O.C, "Ligh Helms, "I MES: the cour e various iferent de	charya S on of Electing", 6th Illumination se, the se methods	Edition, Fon Engine tudents vin wiring	rical Design Estiner and Electric Transcription (Control of the Property of th	nating and Coaction", 10th	osting",	2nd Edit	Lecturion, New Agaria& Sons,	ED's	Prent (Hi	orial:1	bped Level) ding (K2)
TEXT BO 1	OOK: Raina K.B. a 2017 for Ur Gupta J.B, ENCES: Pritchard D Ronald N. I 1980 E OUTCOM pletion of to discuss the	& Bhattachit I,II,III "Utilization D.C, "Ligh Helms, "I MES: the cour e various ferent de te the var	charya S on of Electing", 6th Illumination se, the se methods esign con rious Elections	Edition, Fon Engine tudents vin wiring sideration	rical Design Estiner and Electric Transcription	nating and Coaction", 10th	osting",	2nd Edit	Lecturion, New Agaria& Sons,	ED's	Prent (Hi Und	orial:1	bped Level) ding (K2)
TEXT BO 1	Raina K.B. a 2017 for Ur Gupta J.B, ENCES: Pritchard D Ronald N. I 1980 E OUTCOM pletion of the discuss the infer the difference demonstrate.	& Bhattadhit I,II,III "Utilization D.C, "Lightelms, "I MES: the courter various if erent detected the various te the various	charya S on of Electing", 6th Illumination se, the sesign contributes Elections is lighting	Edition, Fon Engine tudents vin wiring sideration etrical Inst	rical Design Estiner and Electric Transcription	nating and Coaction", 10th	osting",	2nd Edit	Lecturion, New Agaria& Sons,	ED's	Prent Und A	orial:1	by the state of th
COURSIDE COS (COS)	OOK: Raina K.B. a 2017 for Ur Gupta J.B, ENCES: Pritchard D Ronald N. I 1980 E OUTCOM pletion of to discuss the infer the diff demonstrate describe th	& Bhattadhit I,II,III "Utilization D.C, "Lightelms, "I MES: the courter various if erent detected the various te the various	charya S on of Electing", 6th Illumination se, the sesign contributes Elections is lighting	Edition, Fon Engine tudents vin wiring sideration etrical Inst	rical Design Estiner and Electric Transcription	nating and Coaction", 10th	osting",	2nd Edit	Lecturion, New Agaria& Sons,	ED's	Prent Und A	orial:1: ional P Jnit IV tice—Ha ighest erstand erstand applying erstand	by the state of th
TEXT BO 1	Raina K.B. a 2017 for Ur Gupta J.B, ENCES: Pritchard D. Ronald N. I 1980 E OUTCOM pletion of the discuss the infer the different demonstrated describe the demonstrated demonstrated in the demonstrated describe the demonstrated described demonstrated demonstrated described demonstrated described demonstrated described demonstrated described demonstrated demon	& Bhattadhit I,II,III "Utilization D.C, "Lightelms, "I MES: the courter various if erent detected the various te the various	charya S on of Electing", 6th Illumination se, the sesign contributes Elections is lighting	Edition, Fon Engine Students vin wiring sideration ctrical Inst and its co	rical Design Estiner and Electric Transcer a	nating and Coaction", 10th efficient lumi	osting", Edition	2nd Edit	Lecturion, New Agaria& Sons,	ED's	Prent Und A	orial:1: ional P Jnit IV tice—Ha ighest erstand erstand applying erstand	bing (K2) g (K3) ding (K2)

CO2	3	2	1						1	
CO3	3	2	1	1	1				1	
CO4	3	2	1						1	
CO5	3	2	1	1	1				1	

	ASSESSMENT PATTERN - THEORY											
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %					
CAT1	40	60					100					
CAT2	20	50	30				100					
CAT3	20	50	30				100					
ESE	20	40	40				100					

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

Branch	nme &	All B.E/B.	Tech Branches	s Except EEE			Sem.	Category	L	Т	Р	Cre
Prerequi	isites	Nil					5	OE	3	1	0	4
										_		
Preamble	е	This cours	e imparts the k	nowledge abou	ut the electrica	l hazard	s and its	safety meas	sures	in el	ectrica	l syste
Unit – I		Hazards (Of Electricity:									9+
HazardImpact of	ds associate f electric sh - incident e	ed with electock – Influentergy – mea	- Safety Oath, I crical current and noing factors. A asurement – cop I Protection Ed	d voltage – Ele Arc – Initiation o oper calorimete	ectrical safety. of Arc – Impac er – Stoll curve	Definition	n of tern	ns: Electric s	hock,	Arc	and bla	ast. Sh
breakthro guideline glasses, thumb ru leg prote Unit – III	ough (EBT es for selec goggles – ule. Arm an ection and r) – ASTM tion – Flash selection - I d Hand Pro espiratory p Electrical	Glossary of t standard for clo Suit. Head Pro Face shield. He tection: Rubber rotection. Safety Equipn :: Safety voltage	othing materia tection: Hard I aring Protection gloves – AST	ls – choice o nats – ANSI Z on – Requirem M standards -	f clothin 89.1 sta ent –ea - leathei	g – flan andard – r plugs a r protect	ne and non- Eye Protect and ear muff ive glove – l	flame ion - s – N evel (requ requ loise of pro	istant iremer reduct otection	materiates of striction rates. Foot
Insulating hot sticks	g equipmer s – cherry p	nt: Rubber n oicker – stan	nats, blankets, c dards for tools - e – types of ext	covers, line hos - safety barrier	ses and sleeve	es – Insp	ection t	echniques -	stand	dards	. Insul	ated to
Unit – IV	1	Safety Ea	rthing Practice	es:								9+
Function	al requirem		types of ground ing systems – e									
-compos	ition of RCI	D-operation	- advantages.		, 1, poo							
Unit – V First Aid:	: First aid a	First Aid against electricated		king, poisoning	, wounds and ds – Americar	bleedin n Red C	ross me	thod. Types	: elev	/ated		islocat
Unit – V First Aid: heat stro space re	: First aid a bke and snascue and g	First Aid against electricated	and Rescue: tric shock, chokescue: Primary	king, poisoning	, wounds and ds – Americar	bleedin n Red C	ross me	thod. Types	: elev	/ated HA.	rescu	islocat e, con
Unit – V First Aid: heat stro space re	: First aid a oke and sn scue and g	First Aid against elec ake bite. Re round level	and Rescue: tric shock, chokescue: Primary	king, poisoning rescue metho tory Bodies: Fi	, wounds and ds – Americar unctionality – I	bleedin Red C EEE, IE	Pross me C, ASTN	ethod. Types M, NFPA and Lectur	: elev I OSH re:45	/ated IA. , Tut	rescu	islocat e, con 5, Tot a
Unit – V First Aid: heat stro space re TEXT BO	: First aid a bke and sn scue and g OOK: John Cadd Publishers,	First Aid against elec ake bite. Re round level	and Rescue: tric shock, chokescue: Primary rescue. Regula	king, poisoning rescue metho tory Bodies: Fi	, wounds and ds – Americar unctionality – I	bleedin Red C EEE, IE	Pross me C, ASTN	ethod. Types M, NFPA and Lectur	: elev I OSH re:45	/ated IA. , Tut	rescu	islocat e, con 5, Tot a
Unit – V First Aid: heat stro space re TEXT BC 1. REFERE 1.	: First aid a oke and sn scue and g OOK: John Cadd Publishers, ENCES: Rao.S, Jair Publishers,	First Aid against electake bite. Referenced level ack., Mary C 2012.	and Rescue: tric shock, chokescue: Primary rescue. Regula apelli Schellpfet	rescue methor tory Bodies: Fo ffer& Dennis N	i, wounds and ds – Americar unctionality – I eit zell., "Elect	bleedin Red C EEE, IE	ross me C, ASTN fety Han	ethod. Types M, NFPA and Lectur dbook" , 4th	: elevi I OSH re:45 Edition	vated HA. , Tut on, M	orial:1	islocat e, con 5, Tota Hill
Unit – V First Aid: heat stro space re TEXT BC 1. REFERE	: First aid a oke and sn scue and g OOK: John Cadd Publishers, ENCES: Rao.S, Jair Publishers,	First Aid against electake bite. Referenced level fick., Mary C 2012.	and Rescue: tric shock, chokescue: Primary rescue. Regula	rescue methor tory Bodies: Fo ffer& Dennis N	i, wounds and ds – Americar unctionality – I eit zell., "Elect	bleedin Red C EEE, IE	ross me C, ASTN fety Han	ethod. Types M, NFPA and Lectur dbook" , 4th	: elevi I OSH re:45 Edition	vated HA. , Tut on, M	orial:1	islocat e, con 5, Tota Hill
Unit – V First Aid: heat stro space re TEXT BC 1. REFERE 1. 2. COURSE	: First aid a pke and snescue and grown Cook: John Cadd Publishers, ENCES: Rao.S, Jair Publishers, Peter E. Sudersy, Marc	First Aid against electround level fick., Mary C 2012. In R.K & Salut 1997. In the rland., "In the rland., "In the rland."	and Rescue: tric shock, chokescue: Primary rescue. Regula apelli Schellpfet	sing, poisoning rescue metho- tory Bodies: Fo ffer& Dennis N cal Safety, Fire	i, wounds and ds – Americar unctionality – I eit zell., "Elect	bleedin Red C EEE, IE	ross me C, ASTN fety Han	ethod. Types M, NFPA and Lectur dbook" , 4th	: elevi I OSH re:45 Edition	vated HA. , Tut Dn, M Pnd E Wile	orial:1 cGraw dition, y and	5, Tota Hill Khann Sons, I
Unit – V First Aid: heat stro space re TEXT BO 1. REFERE 1. 2. COURSE On complete	: First aid a pice and some scue and grown cadd Publishers, ENCES: Rao.S, Jair Publishers, Peter E. Su Jersy, Marc	First Aid against electorists ake bite. Referenced level ack., Mary C 2012. a R.K &Salu 1997. Atherland., "In the right and acknowledged level and acknowledged level and acknowledged level acknowledged level and acknowledged level acknowled	and Rescue: tric shock, chokescue: Primary rescue. Regula apelli Schellpfer a H.L., "Electric	ting, poisoning rescue methor tory Bodies: For Bodies:	eit zell., "Elect Safety Engine	bleedin n Red C EEE, IE crical Saf eering ar eries on	fety Han	ethod. Types M, NFPA and Lectur dbook" , 4th	: elevi I OSH re:45 Edition	vated HA. , Tut Pnd E Wile	rescu orial:1 cGraw dition, y and BT Ma ighest	5, Tota Hill Khann Sons, I
TEXT BO 1. REFERE 2. COURSE On comp	: First aid a pke and snascue and grown cadd Publishers, ENCES: Rao.S, Jair Publishers, Peter E. Sudersy, Marcon pletion of the understand	First Aid against electorists ake bite. Referenced level ack., Mary C 2012. a R.K & Salu 1997. attherland., "In the 2018. MES: the course, the various	and Rescue: tric shock, chokescue: Primary rescue. Regula apelli Schellpfet a H.L., "Electric Principles of Ele	sing, poisoning rescue methodory Bodies: For Bodies: F	eit zell., "Elect Safety Engine	bleeding Red CEEE, IE	fety Han	ethod. Types M, NFPA and Lectur dbook" , 4th	: elevi I OSH re:45 Edition	vated HA. , Tut Don, M Pnd E Wile Un	orial:1 cGraw dition, y and BT Ma ighest dersta	islocatie, constitution of the constitution of
TEXT BC 1. Text REFERE 1. Text COURSE On complete on c	: First aid a poke and snapscue and grown of the second of	First Aid against electake bite. Referenced level ack., Mary C 2012. The R.K & Salutan 1997. The Aid against electake bite. Referenced level ack., Mary C 2012. The R.K & Salutan 1997. The Aid against electar level	and Rescue: tric shock, chokescue: Primary rescue. Regula apelli Schellpfer a H.L., "Electric Principles of Ele the students v terminologies a ersonnel protect	ting, poisoning rescue methor tory Bodies: For the second	eit zell., "Elect Safety Engine IEEE Press Si lated to electri	bleeding Red CEEE, IE	fety Han and Safety Power E	ethod. Types M, NFPA and Lectur dbook" , 4th	: elevi I OSH re:45 Edition	rated HA. , Tut Dn, M Pnd E Wile Un	orial:1 cGraw dition, y and BT Ma ighest dersta	islocati e, conf 5, Tota Hill Khann Sons, I pped t Level and (K2 g (K3)
TEXT BO 1. TEXT B	: First aid a poke and snapply the same and grown and grown apply the same are same apply the sa	First Aid against electake bite. Reference ake	and Rescue: tric shock, chokescue: Primary rescue. Regula apelli Schellpfer a H.L., "Electric Principles of Ele the students v terminologies a sersonnel protect suring and insula	rescue methor tory Bodies: For ffer& Dennis N cal Safety, Fire ectrical Safety" will be able to and hazards re- ction equipmentating equipmentating equipmentating	i, wounds and ds – Americar unctionality – I eit zell., "Elect Safety Engine IEEE Press Sillated to electricat for a typical int's for electricatem	bleeding Red CEEE, IE	fety Han And Safety Power B	ethod. Types M, NFPA and Lectur dbook", 4th y Manageme Engineering,	: elevi I OSH re:45 Edition	vated HA. , Tut Dn, M Pnd E Wile Un	orial:1 cGraw dition, y and BT Ma ighest dersta	islocatie, con 5, Tota Hill Khann Sons, I pped Level and (K2
TEXT BO 1. TEXT B	: First aid a poke and snapply the same and grown and grown apply the same are same apply the sa	First Aid against electake bite. Reference ake	and Rescue: tric shock, chokescue: Primary rescue. Regula apelli Schellpfer a H.L., "Electric Principles of Ele the students v terminologies a ersonnel protect	rescue methor tory Bodies: For ffer& Dennis N cal Safety, Fire extrical Safety" will be able to and hazards re- ction equipmentating equipmentating equipmentating	i, wounds and ds – Americar unctionality – I eit zell., "Elect Safety Engine IEEE Press Sillated to electricat for a typical int's for electricatem	bleeding Red CEEE, IE	fety Han And Safety Power B	ethod. Types M, NFPA and Lectur dbook", 4th y Manageme Engineering,	: elevi I OSH re:45 Edition	rated HA. , Tut on, M end E Wilee (H Un	orial:1 cGraw dition, y and BT Ma ighest dersta applyin applyin	sislocatie, constitute, consti
TEXT BO 1. TEXT B	: First aid a poke and snapply the same and grown and grown apply the same are same apply the sa	First Aid against electake bite. Reference ake	and Rescue: tric shock, chokescue: Primary rescue. Regula apelli Schellpfer a H.L., "Electric Principles of Ele the students v terminologies a sersonnel protect suring and insula ag practices for nality of internat	rescue methor tory Bodies: For ffer& Dennis N cal Safety, Fire extrical Safety" will be able to and hazards re- ction equipmentating equipmentating equipmentating	i, wounds and ds – Americar unctionality – I eit zell., "Elect Safety Engine IEEE Press Sillated to electricat for a typical int's for electricatem	bleeding Red CEEE, IE	fety Han And Safety Power I	ethod. Types M, NFPA and Lectur dbook", 4th y Manageme Engineering,	: elevi I OSH re:45 Edition	rated HA. , Tut on, M end E Wilee (H Un	orial:1 cGraw dition, y and BT Ma ighest dersta applyin applyin	islocatie, consider, consi

CO1	3	2	1		1	1		1	1	
CO2	3	1	2		1	1		1	1	
CO3	3	1	2		1	1		1	1	
CO4	2	1	3		1	1		1	1	
CO5	1	2	3		1	1		1	1	

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	30	30	-	-	-	100
CAT2	40	20	40	-	-	-	100
CAT3	50	40	10	-	-	-	100
ESE	30	40	30	-	-	-	100

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

Progra Branc	amme &	All B.I	/B.Tech Br	anches Ex	cept EEE		Sem.	Category	L	Т	Р	Credit
	quisites	Nil					5	OE	3	1	0	4
Pream	nble				owledge on the a			onics that aids	s the	stude	ents to	o perform
Unit –			r Junction									9+3
CC co		Current	gain in CE, (CB and CC	nts in transistor - configurations - (
Unit –			IOSFET and									9+3
charac		MOSFET	n Depletion	and Enhan	ameters of JFET cement mode – <i>P</i> r.							
Unit –	· III	Comb	national Ci	rcuits:								9+3
					ction – Decoders - ry to BCD – Mag				lexe	rs – C	ode (Conversion
Olay t	o binary, bir	nary to gr	iy, DOD to L	ilialy, billa	ry to bob – iviagi	induc compare	ators. 1 t	nt, Z Dit.				
Unit –		•	ntial Circui		- Master slave Fl							9+3
$\hat{}$	ting characte	:				Indicate and Chiff	registers					
Jnit – Transi Semic	stor Transist	Logic stor Logic SMOS) Logic	Families ar TTL): Two-ii iic – Compa	nd Memory nput TTL Narison of Log	Shift registers – Ur devices: AND Gate – Emit gic families for the emory (ROM) organization.	ter Coupled Lo	gic (ECL) - Inverter: C ry Types: Me OMs: PROM	mory I, EP	Devi ROM	ces: \$	Static RAN PROM.
Unit – Transi Semic (SRAN	stor Transist	Logic stor Logic SMOS) Logic	Families ar TTL): Two-ii iic – Compa	nd Memory nput TTL Narison of Log	v devices: AND Gate – Emit gic families for the	ter Coupled Lo	gic (ECL) - Inverter: C ry Types: Me OMs: PROM	mory I, EP	Devi ROM	ces: \$	Metal Oxid
Unit – Transi Semic (SRAM	stor Transist conductor (CI Ms) - Dynami	Logic stor Logic SMOS) Logic RAMs	Families ar TTL): Two-ii iic – Compa DRAMs). Ro	nd Memory nput TTL N. rison of Log ead-Only M	v devices: AND Gate – Emit gic families for the	ter Coupled Lo eir performance ganization – Ty	gic (ECL e. Memo pes of R) - Inverter: C ry Types: Me OMs: PROM Lectur	mory I, EPI e: 45	Devi ROM	ces: 9	Metal Oxid Static RAN PROM.
Unit – Transi Semic (SRAM TEXT	stor Transist conductor (CI Ms) - Dynami BOOK:	Logic stor Logic MOS) Logic RAMs S., "A Texas Kumar M	Families ar TTL): Two-ir jic – Compa DRAMs). Ro	nd Memory nput TTL N. rison of Log ead-Only M	r devices: AND Gate – Emit gic families for the emory (ROM) org	ter Coupled Lo eir performance ganization – Ty n, S.Chand & 0	gic (ECL e. Memo /pes of R) - Inverter: Cry Types: Me OMs: PROM Lectur New Delhi, 2	mory l, EPI e:45	Devi ROM , Tuto	ces: \$ & EE orial:	Metal Oxid Static RAM PROM. 15, Total:6
Unit – Transi Semic (SRAM TEXT	stor Transist conductor (CI Ms) - Dynami BOOK: Sedha R.S	Logic stor Logic MOS) Logic RAMs S., "A Texas Kumar M	Families ar TTL): Two-ir jic – Compa DRAMs). Ro	nd Memory nput TTL N. rison of Log ead-Only M	r devices: AND Gate – Emit gic families for the emory (ROM) orgonics ", 4th Edition	ter Coupled Lo eir performance ganization – Ty n, S.Chand & 0	gic (ECL e. Memo /pes of R) - Inverter: Cry Types: Me OMs: PROM Lectur New Delhi, 2	mory l, EPI e:45	Devi ROM , Tuto	ces: \$ & EE orial:	Metal Oxid Static RAM PROM. 15, Total:6
Unit – Transi Semic (SRAM TEXT 1.	stor Transist conductor (CI Ms) - Dynami BOOK: Sedha R.S Soumithra New Delhi	Logic stor Logic sMOS) Logic RAMs S., "A Texa a Kumar Mai, 2017	Families ar TTL): Two-in jic – Compa DRAMs). Ro	nd Memory nput TTL N. rison of Log ead-Only M blied Electron tal Electron	r devices: AND Gate – Emit gic families for the emory (ROM) orgonics ", 4th Edition	ter Coupled Lo bir performance ganization – Ty n, S.Chand & O d Applications",	gic (ECL e. Memo pes of R Co. Ltd.,) - Inverter: Cry Types: Me OMs: PROM Lectur New Delhi, 2 h Reprint Edi	mory , EP e:45	, Tuto	orial:	Metal Oxid Static RAM PROM. 15, Total:6
Unit – Transi Semic (SRAM TEXT 1. 2. REFE	stor Transist conductor (CI Ms) - Dynami BOOK: Sedha R.S Soumithra New Delhi RENCES: Salivahana Company,	Logic stor Logic sMOS) Logic RAMs S., "A Texa a Kumar M ii, 2017	Families ar TTL): Two-in ic – Compa DRAMs). Re tbook of App andal, "Digi Suresh Kur hi, 2017.	nd Memory nput TTL N. rison of Log ead-Only M blied Electron tal Electron	r devices: AND Gate – Emit gic families for the emory (ROM) orgonics ", 4th Editionics Principles and	ter Coupled Lo bir performance ganization – Ty n, S.Chand & (d Applications",	gic (ECL e. Memo pes of R Co. Ltd., Elevent) - Inverter: Cry Types: Me OMs: PROM Lectur New Delhi, 2 h Reprint Edi	e:45 014 ftion,	, Tuto	orial:	Metal Oxid Static RAM PROM. 15, Total:6
Unit – Transi Semic (SRAM TEXT 1.	stor Transist conductor (CI Ms) - Dynami BOOK: Sedha R.S. Soumithra New Delhi RENCES: Salivahana Company, Anand Kui	Logic stor	Families ar TTL): Two-in jic – Compa DRAMs). Ro thook of App landal, "Digi Suresh Kur hi, 2017. undamentals	nd Memory nput TTL N. rison of Log ead-Only M blied Electron tal Electron mar N., "Ele	r devices: AND Gate – Emit gic families for the emory (ROM) orgonics ", 4th Editionics Principles and ectronic Devices a	ter Coupled Lo bir performance ganization – Ty n, S.Chand & G d Applications", and Circuit ", 4 th n, Prentice Ha	gic (ECL e. Memo pes of R Co. Ltd., Elevent) - Inverter: Cry Types: Me OMs: PROM Lectur New Delhi, 2 h Reprint Edi	mory , EP e:45 014 f tion, w Hil	Devi ROM , Tuto for Ur Tata	ces: \$ & EE orial: its I,II Mc G	Metal Oxid Static RAN PROM. 15, Total:6
Unit – Transi Semic (SRAM TEXT 1. 2. REFE 1. 2. 3.	stor Transist conductor (CI Ms) - Dynami BOOK: Sedha R.S. Soumithra New Delhi RENCES: Salivahana Company, Anand Kui Salivahana	Logic stor	Families ar TTL): Two-in ic – Compa DRAMs). Ro thook of App landal, "Digi Suresh Kur hi, 2017. undamentals Arivazhagar	nd Memory nput TTL N. rison of Log ead-Only M blied Electron tal Electron mar N., "Ele s of Digital on, —Digital	r devices: AND Gate – Emit gic families for the emory (ROM) orgonics ", 4th Editionics Principles and ectronic Devices a Circuits" 4th Editionics Circuits and Desi	ter Coupled Lo bir performance ganization – Ty n, S.Chand & G d Applications", and Circuit ", 4 th n, Prentice Ha	gic (ECL e. Memo pes of R Co. Ltd., Elevent) - Inverter: Cry Types: Me OMs: PROM Lectur New Delhi, 2 h Reprint Edi	mory , EP e:45 014 f tion, w Hil	r Devir ROM , Tuto for Ur Tata	ces: \$ & EE orial: mits I,II Mc G lishin td., N	Metal Oxid Static RAN PROM. 15, Total:6
Jnit – Fransi Semic SRAN FEXT 1. 2. REFE 1. 2. 3.	stor Transist conductor (CI Ms) - Dynami BOOK: Sedha R.S. Soumithra New Delhi RENCES: Salivahana Company, Anand Kui Salivahana 2012.	Logic stor Logic stor Logic stor Logic stor Logic stor Logic store a Kumar Mai, 2017 The store a Kumar	Families ar TTL): Two-in ic – Compa DRAMs). Ro thook of App landal, "Digi Suresh Kur hi, 2017. undamentals Arivazhagar	nd Memory nput TTL N. rison of Log ead-Only M blied Electron mar N., "Ele s of Digital on, —Digital	r devices: AND Gate – Emit gic families for the emory (ROM) orgonics ", 4th Editionics Principles and ectronic Devices a Circuits" 4th Editionics Circuits and Designation of the emory (ROM) orgonics ", 4th Editionics Principles and Editionics Principles Pri	ter Coupled Lo bir performance ganization – Ty n, S.Chand & G d Applications", and Circuit ", 4 th n, Prentice Ha	gic (ECL e. Memo pes of R Co. Ltd., Elevent) - Inverter: Cry Types: Me OMs: PROM Lectur New Delhi, 2 h Reprint Edi	mory , EP e:45 014 f tion, w Hil	r Devir ROM , Tuto for Ur Tata	ices: \$ & EE orial: mits I,II Mc G lishin td., N	Metal Oxid Static RAN PROM. 15, Total:6
Unit – Transi Semic (SRAM) TEXT 1. 2. REFE 1. 2. COUR On co CO1	stor Transist conductor (CI Ms) - Dynami BOOK: Sedha R.S. Soumithra New Delhi RENCES: Salivahana Company, Anand Kur Salivahana 2012. RSE OUTCO Empletion of Analyse the	Logic stor Logic stor Logic stor Logic stor Logic stor Logic store a Kumar Mai, 2017 The store a Kumar Mai, 2017 The store and store a Kumar Mai, 2017 The sto	Families ar TTL): Two-in jic – Compa DRAMs). Ro thook of App landal, "Digi Suresh Kur hi, 2017. undamentals Arivazhagar se, the stud eristics and	nd Memory nput TTL N. rison of Log ead-Only M blied Electron tal Electron mar N., "Ele s of Digital on, —Digital dents will b	r devices: AND Gate – Emit gic families for the emory (ROM) orgonics ", 4th Editionics Principles and ectronic Devices a Circuits" 4th Editionics Circuits and Designation of the emory (ROM) orgonics ", 4th Editionics Principles and Editionics Principles Pri	ter Coupled Loeir performance ganization – Ty n, S.Chand & (d Applications", and Circuit ", 4 th on, Prentice Ha gnll, 4th Edition	gic (ECL e. Memo /pes of R Co. Ltd., , Elevent) - Inverter: Cry Types: Me OMs: PROM Lectur New Delhi, 2 h Reprint Edi	mory , EP e:45 014 f tion, w Hil	r Devir ROM , Tuto , Tuto Tata	orial: mits I,II Mc G lishin td., N BT Maighes pplyir	Metal Oxid Static RAN PROM. 15, Total:6 I. Graw Hill,
Unit – Transi Semic SRAM TEXT 1. 2. REFE 1. 2. 3.	stor Transist conductor (CI Ms) - Dynami BOOK: Sedha R.S. Soumithra New Delhi RENCES: Salivahana Company, Anand Kui Salivahana 2012. SEE OUTCO Impletion of Analyse the acquire kn	Logic stor	Families ar TTL): Two-in jic – Compa DRAMs). Ro thook of App landal, "Digi Suresh Kur hi, 2017. undamentals Arivazhagar se, the stud eristics and	nd Memory nput TTL N. rison of Log ead-Only M blied Electron tal Electron mar N., "Ele s of Digital on, —Digital dents will k stability of	r devices: AND Gate – Emit pic families for the emory (ROM) orgonics ", 4th Editionics Principles and extronic Devices a Circuits" 4th Editionics Circuits and Designation an	ter Coupled Loeir performance ganization – Ty n, S.Chand & (d Applications", and Circuit ", 4 th on, Prentice Ha gnll, 4th Edition	gic (ECL e. Memo /pes of R Co. Ltd., , Elevent) - Inverter: Cry Types: Me OMs: PROM Lectur New Delhi, 2 h Reprint Edi	mory , EP e:45 014 f tion, w Hil	r Devir ROM , Tuto , Tuto Tata	mits I,II Mc Collishin td., N BT Maighes pplyir erstar	Metal Oxid Static RAN PROM. 15, Total:6 I. Graw Hill, g ew Delhi, apped t Level)
Unit – Transi Semic (SRAM TEXT 1. 2. REFE 1. 3.	stor Transist conductor (CI Ms) - Dynami BOOK: Sedha R.S. Soumithra New Delhi RENCES: Salivahana Company, Anand Kur Salivahana 2012. RSE OUTCO Impletion of Analyse the acquire kn	S., "A Texa Kumar Mai, 2017 man S. and Y. New Deumar.A, "Fanan, S and Deumar.A, "Fanan, S and Deumar.A He character of the county of the character of the ch	Families ar TTL): Two-in jic – Compa DRAMs). Ro thook of App landal, "Digi Suresh Kur hi, 2017. undamentals Arivazhagar se, the stud eristics and	nd Memory nput TTL N. rison of Log ead-Only M blied Electron mar N., "Ele s of Digital on, —Digital dents will k stability of peration and	r devices: AND Gate – Emit gic families for the emory (ROM) orgonics ", 4th Editionics Principles and extronic Devices a Circuits" 4th Editionics Circuits and Designation of the emory (ROM) orgonics ", 4th Editionics Principles and extronic Devices a Circuits" 4th Editionics Circuits and Designation of the emory (ROM) orgonics and Designation organics an	ter Coupled Loeir performance ganization – Ty n, S.Chand & (d Applications", and Circuit ", 4 th on, Prentice Ha gnll, 4th Edition	gic (ECL e. Memo /pes of R Co. Ltd., , Elevent) - Inverter: Cry Types: Me OMs: PROM Lectur New Delhi, 2 h Reprint Edi	mory , EP e:45 014 f tion, w Hil	r Devir ROM , Tuto , Tuto Tor Ur Tata I Pub Pvt. L E (Hi A	ces: \$ & EE orial: hits I,II Mc Co lishing ttd., N at Ma ighes pplyinerstar pplyinerstar	Metal Oxid Static RAN PROM. 15, Total:6 I. Graw Hill, g ew Delhi, apped t Level) ng (K4)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1										1		
CO2	3	2	2	1	1							1		
CO3	3	3	2	1	1							1		
CO4	3	2	2	1	1							1		
CO5	3	2	1		1							1		

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	40	30	20			100
CAT2	10	30	60				100
CAT3	10	40	50				100
ESE	5	35	40	20			100

 $^{^{\}ast}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

Programn	ne&			2200	.OU3 - P	OVVER	CLEUI	RUNIC	S AND	DRIVES					
Branch	Πeα	All B.E	/B.Tech	Branch	es Exc	pt EEE				Sem.	Category	L	T	Р	Credit
Prerequis	ites	Nil								5	OE	3	1	0	4
Preamble			urse is de le of recti								f power sem erter	icond	uctor	device	s, working
Unit – I		Unit Ti	tle: Pow	er Semi	-Conduc	tor Dev	ices:								9+3
- Thyristor		n – Serie	es and pa	arallel co	nnectio			ction, P	rinciple	of opera	tion, Static a	and D	ynam	nic char	
Unit – II			tle: AC (9+3
	- Single F										AS load curr se to Single				
Unit – III		Unit Ti	tle: DC (Converte	ers:										9+3
Principle c Single, Sir					Chopper	Control	Strateg	jies – S	MPS - S	Single Pl	hase Bridge	Inver	ters	- PWM	Inverters
Unit – IV			tle: DC [9+3
rectifier co		c separa	tely excit	ed moto	r – chop	per con	trolled s				wbacks – si rives.	ngle p	hase	e fully c	ontrolled
Unit – V			tle: AC a								synchronous				9+3
	ed thyrist	or inver	ter - Bru	shless	DC mot						per motor D	rives	- D	rives f	or specifi
TEXT BO	OK:										Lecture	9: 45,	luto	orial :1	5, Total:6
	imbhra P.	S., "Pow	er Electro	onics", 6	th Editio	n, Khar	nna Pub	lishers,	New D	elhi, 201	8				
											use, New D	elhi, 2	2019.		
REFEREN	ICES:														
1. Si	ingh M.D.	and Kha	ınchanda	ıni, "Pov	ver Elec	ronics",	2nd Ed	dition, Ta	ata McC	Graw-Hill	, New Delhi	2017			
2. Ve	edam Sul	orahman	yam "Ele	ctric Dri	ves: Cor	ncepts a	nd App	lications	s", 2nd l	Edition, N	//dcGraw-Hill	, New	Delh	ni, 2010	
COURSE On compl			se, the s	tudents	s will be	able to	,							BT Map	
CO1 ch	noose var	ious pow						ir const	ruction,	operation	on and				ling (K2)
	naracteris cplain the		nringinla	of oo oo	n vortor	and aan	nnuta ita	n norfor	manaa	naramat	or.		Llad	orotono	
		working	principle	or ac cc	niverter	and coi	iipute iti	s penon	Hallce	paramen	51		Ona	ersiani	lina (K2)
								•							ling (K2)
CO3 C	lassify an	d explair	the work	king prin	ciple of	dc conv	erters	•					Und	erstand	ling (K2)
CO3 CI	pply powe	er conver	ters for s	peed co	ntrol of	DC drive	es							erstand	ling (K2)
CO3 CI	pply powe	er conver	ters for s	peed co	ntrol of	DC drive	es			s control	schemes fo	r	Δ		ling (K2)
CO3 CI	pply powe	er conver	ters for s	peed co	entrol of re and s	DC drive	es	s Drives	and its		schemes fo	r	Δ	npplying	ling (K2)
CO3 CI	oply powe	er conver	ters for s	peed co	entrol of re and s	DC drive	es nachine:	s Drives	and its		schemes fo	r PO1:	Α	npplying	ling (K2) g (K3) g (K3)
CO3 CI	oply powe	er conver I the ope ustrial ap	ters for s ration of plication	peed co	entrol of re and s	DC drive	es nachine: Os with	s Drives	and its	Os			Α	applying applying	ling (K2) g (K3) g (K3)
CO3 CI CO4 AI CO5 UI ve	pply power nderstand arious ind	er conver the ope ustrial ap	ters for s ration of polication	peed co	entrol of re and s	DC drive	es nachine: Os with	s Drives	and its	Os			Α	applying applying	ling (K2)
CO3 CI CO4 AI CO5 UI va CO5/POs CO1	pply power nderstand arious ind	er conver d the ope ustrial ap	ters for s ration of plication PO3 3	peed co	me and s Mappi PO5	DC drivence of Control	es nachine: Os with	s Drives	and its	Os			Α	applying applying	ling (K2) g (K3) g (K3)

CO5	3	1	3	1	1	1		1				
1 – Slight, 2	2 – Mode	erate, 3 -	- Substan	tial, B	T- Bloom's	Taxon	omy					
					ASSES	SSMEN	T PATTERI	N - THEC	DRY			
Test / BI Categ		Rei	memberi (K1) %	ng	Understa (K2) ^c		Applying (K3) %	Analy (K4	_	Evaluating (K5) %	Creating (K6) %	Total %
CAT	T1		20		60		20					100
CAT	Т2		20		50		30					100
CAT	Т3		20		50		30					100
ES	E		20		50		30					100
* ±3% may	be varie	d (CAT	1, 2 & 3 –	50 ma	arks & ESI	= − 100	marks)	'				

Programm Branch	ne &	All B.E/B.		Sem.	Cat	tegory	L	Т	Р	Credi			
Prerequisi	sites	Nil					5		OE	3	1	0	4
		l											
Preamble		This cours		e students to imp	oart the knowled	dge to inte	erface vario	ous ser	nsors ar	nd actu	uators	in emb	edded
Jnit – I			Transduc	ers									9+3
				and transducer-	- Principles- Cla	assification	n of senso	rs- Sta	atic and	Dynar	nic ch	aracter	istics of
nductive	transduc	ers : - Princi	ple of opera	aracterization ation, constructi roximity sensor	on details, char	acteristics	and appli	cations	s of LVD	OT, Inc	luction	poten	tiometer
Jnit – II			-	ion Sensors									9+3
-			parallel pl	late Capacitive	sensor – Serra	ted plate	Capacitive	e senso	or – Va	ariable	Perm	ittivity S	Sensor -
	atic transdu		hotosansis	tors/photo detec	store: The Phot	n emissive	Call and	tha Dh	otomult	inlier -	The E	Photoco	anductiv
				- Position-sensi									
Jnit – III				etic Sensors									9+3
			ometric Se	ensors - Acousti	ic Temperature	Sensor -	Resistan	ce Cha	ange Ty	/pe Th	ermor	metric (Sensors
	nf Sensors Sensors :		nd the prin	nciples – Magne	eto Resistive se	ensors – F	Hall effect	Senso	ors – In	ductar	ice an	d Eddy	/ curren
sensors –		otary move	ment senso	ors – Switching i	magnetic senso								
Unit – IV Smart, Sei	nsors: Int			Applications of nsors, Excitation		Filters (Converter	s Stan	ndards	for Sm	art S	ensor I	9+3
MEMS			•		•								
	Application	ne On-Ro			I I A I'		ro Aoroon		neore-N	Apdica.	I D:00	noctic	concord
Sancare ta				obile Sensors –	- Home Appliar	ice sensoi	is-Aerosp	ace se	7113013-IV	vi c uica	Diag	HOSUC	36113013
		mental moni	toring.	obile Sensors –	- ноте Appliar	ice sensoi	irs-Aerosp	ace se	5113013-N	vicuica	Diag	IIIOSIIC	
Unit – V Thermo Me principles-l	or environr lechnaical -BLDC Mot	mental moni Actuators Actuators -	toring. S Optical Act	obile Sensors – tuators - Capaci er Motors-Linear	tive Actuators	-Magneto	strictive A	ctuator	rs -Moto	ors as	actua	tors: O	9+3 peration
Unit – V Thermo Morinciples-	or environr lechnaical -BLDC Mor	nental moni Actuators Actuators - tors-AC mon	toring. S Optical Act tors-Steppe	tuators - Capaci	itive Actuators Motors-Piezo	-Magneto : electric act	strictive A tuators	ctuator	rs -Moto	ors as	actua	tors: O	9+3 peration
Unit – V Thermo Morinciples-l TEXT BOO	or environr lechnaical -BLDC Mot OK: Patranabi	nental moni Actuators Actuators - tors-AC mon	toring. S Optical Act tors-Steppe	tuators - Capaci er Motors-Linear	itive Actuators Motors-Piezo	-Magneto : electric act	strictive A tuators	ctuator	rs -Moto	ors as	actua	tors: O	9+3 peration
Unit – V Thermo Morinciples-l TEXT BOO 1. REFEREN	or environment env	Actuators - Actuators - tors-AC mod	toring. Optical Act tors-Steppe	tuators - Capaci er Motors-Linear	Motors-Piezo o	-Magneto e electric act	strictive A tuators	ctuator	rs -Moto	ors as e: 45,	actua ⁻	tors: O	9+3 peration Total:6
Unit – V Thermo Meprinciples-l TEXT BOO 1. REFEREN 1.	or environment of env	Actuators - Actuators - tors-AC mod s, Sensors a	toring. Optical Act tors-Steppe and Transd e W, Senso	tuators - Capaci er Motors-Linear lucers, 2nd Editi	Motors-Piezo of Motors, PHI, 2022.	-Magneto e electric act Unit I, II, II	strictive A tuators	ctuator	rs -Motor	e: 45,	actua Tutor	tors: O ial :15,	9+3 peration Total:6
TEXT BOO 1. REFEREN 1.	or environr lechnaical -BLDC Mot OK: Patranabi NCES: De Silva a Nadhan lo	Actuators Actuat	toring. Doptical Act cors-Steppe and Transd e W, Senso , Actuators,	tuators - Capaci er Motors-Linear lucers, 2nd Editi ors and Actuator	itive Actuators Motors-Piezo on, PHI, 2022. The Engineering Staces: A Multidian	-Magneto : electric act Unit I, II, II System Insection	strictive A tuators II, IV strumental	ctuator ion, 2 ⁿ on, Sci	Lectur	e: 45 , n, CRO	actuar Tutor C Pres	tors: O ial :15,	9+3 peration Total:6
Unit – V Thermo Morinciples-I TEXT BOO 1. REFEREN 1. 2.	or environr lechnaical -BLDC Mot OK: Patranabi NCES: De Silva a Nadhan lo	Actuators Actuat	toring. Doptical Act cors-Steppe and Transd e W, Senso , Actuators,	tuators - Capaci er Motors-Linear lucers, 2nd Editi ors and Actuator , and Their Inter	itive Actuators Motors-Piezo on, PHI, 2022. The Engineering Staces: A Multidian	-Magneto : electric act Unit I, II, II System Insection	strictive A tuators II, IV strumental	ctuator ion, 2 ⁿ on, Sci	Lectur	e: 45 , n, CRO	actuar Tutor C Presing, 20	tors: O ial :15, ss, 2015	9+3 peration Total:6
Unit – V Thermo Metalinian Metalian TEXT BOO 1. REFEREN 1. 2. 3.	or environr lechnaical -BLDC Mot OK: Patranabi NCES: De Silva a Nadhan lo Jacob Fra	Actuators Actuators Actuators Actuators Actuators Actuators Actua	toring. Doptical Act cors-Steppe and Transd e W, Senso , Actuators, book of Moo	tuators - Capaci er Motors-Linear lucers, 2nd Editi ors and Actuator , and Their Inter dern sensors: Ph	itive Actuators Motors-Piezo fon, PHI, 2022. The Engineering Straces: A Multidinysics, Design a	-Magneto : electric act Unit I, II, II System Insection	strictive A tuators II, IV strumental	ctuator ion, 2 ⁿ on, Sci	Lectur	e: 45 , n, CRO	actuar Tutor C Presing, 20	tors: O ial :15, ss, 2015 D13	9+3 peration Total:6
Unit – V Thermo Medicinciples-left BOO 1. REFEREN 1. 2. 3. COURSE On comple	or environr lechnaical BLDC Mot OK: Patranabi NCES: De Silva a Nadhan lo Jacob Fra OUTCOM letion of the	Actuators Actuators Actuators Actuators Actuators s, Sensors and Clarence da, Sensors aden, Handb ES: he course,	toring. Optical Act tors-Steppe and Transd e W, Senso , Actuators, book of Moo	tuators - Capaci er Motors-Linear lucers, 2nd Editi ors and Actuator , and Their Inter	itive Actuators Motors-Piezo on, PHI, 2022. Es Engineering S faces: A Multidi hysics, Design a	-Magneto selectric act Unit I, II, II System Inserting is ciplinary and Application	strictive A tuators II, IV strumental	ctuator ion, 2 ⁿ on, Sci	Lectur	n, CRO Publish	actuar Tutor C Presing, 20 015.	tors: O ial :15, ss, 2015 D13 T Mappyhest L	9+3 peration Total:6
Unit – V Thermo Medicinciples-I TEXT BOO 1. REFEREN 1. 2. 3. COURSE On comple	or environr lechnaical -BLDC Mot OK: Patranabi NCES: De Silva a Nadhan lo Jacob Fra OUTCOM letion of the	Actuators Actuat	toring. Optical Act tors-Steppe and Transd e W, Senso , Actuators, book of Moo the studen d working b	tuators - Capacier Motors-Linear Jucers, 2nd Editions and Actuator and Their Interdern sensors: Photos will be able The period of the induction of the induc	itive Actuators Motors-Piezo on, PHI, 2022. The Engineering Straces: A Multidinysics, Design atto	-Magneto selectric act Unit I, II, II System Inserting in the second i	strictive A tuators II, IV strumental Introductions, 5th	ctuator ion, 2 ⁿ on, Sci	Lectur	n, CRO Publish	actuar Tutor C Presing, 20 015. Bi (Hig	tors: O ial :15, ss, 2015 D13 T Mapp phest L rstandii	9+3 peration Total:6
Unit – V Thermo Medicinciples-left BOC 1. REFEREN 1. 2. 3. COURSE (On completion)	or environr lechnaical -BLDC Mor OK: Patranabi NCES: De Silva a Nadhan lo Jacob Fra OUTCOM letion of the explain the	Actuators Actuat	toring. Doptical Act cors-Steppe and Transd e W, Senso , Actuators, book of Moo the studen d working b	tuators - Capacier Motors-Linear Jucers, 2nd Editions and Actuator, and Their Interdern sensors: Photos will be able the behind the inductor orking of Capacier (Capacier (Capacier))	itive Actuators Motors-Piezo on, PHI, 2022. The Engineering Straces: A Multidinysics, Design attocomplete to tive transducers itive and Radian	-Magneto selectric act Unit I, II, II System Institution in the second second sensorem in the second seco	strictive A tuators II, IV strumental Introduction cations, 5th	ctuator ion, 2 ⁿ on, Sci Editior	rs -Motor	n, CRO Publish	actuar Tutor C Presing, 20 015. B' (Hig	tors: O ial :15, iss, 2015 O13 T Mapp phest L rstandii	peration Total:6 5. Ded evel) ng (K2)
TEXT BOO I. COURSE (CO) CO) CO) CO)	or environr lechnaical BLDC Mor OK: Patranabi NCES: De Silva a Nadhan lo Jacob Fra OUTCOM letion of the explain the describe to the silva and the silva	Actuators Actuators Actuators Actuators Actuators Actuators Actuators Actuat	toring. Optical Act cors-Steppe and Transd e W, Senso , Actuators, book of Moo the studer d working b ction and we types of th	tuators - Capacier Motors-Linear Jucers, 2nd Editions and Actuator, and Their Interdern sensors: Photos will be able the behind the induction orking of Capaciermal and magricular seriors.	itive Actuators Motors-Piezo on, PHI, 2022. The Engineering Staces: A Multidinate of the Engineering Staces on the Enginee	-Magneto : electric act Unit I, II, II System Institution in the second Application sensound its prince	strictive A tuators II, IV strumental Introduction cations, 5th cati	ctuator ion, 2 ⁿ on, Sci Editior	rs -Motor	n, CRO Publish	actuar Tutor C Pressing, 20 D15. Bi (Hig Unde Unde Unde	tors: O ial :15, is, 2015 O13 T Mapp phest L rstandii rstandii	peration Total:6 5. Ded evel) ng (K2) ng (K2)
TEXT BOO TEXT BOO 1. COURSE (On comple CO2 CO3	or environr lechnaical BLDC Mor OK: Patranabi NCES: De Silva a Nadhan lo Jacob Fra OUTCOM letion of the explain the describe to the silva and the silva	Actuators Actuators Actuators Actuators Actuators Actuators Actuators Actuat	toring. Optical Act cors-Steppe and Transd e W, Senso , Actuators, book of Moo the studer d working b ction and we types of th	tuators - Capacier Motors-Linear Jucers, 2nd Editions and Actuator, and Their Interdern sensors: Photos will be able the behind the inductor orking of Capacier (Capacier (Capacier))	itive Actuators Motors-Piezo on, PHI, 2022. The Engineering Staces: A Multidinate of the Engineering Staces on the Enginee	-Magneto : electric act Unit I, II, II System Institution in the second Application sensound its prince	strictive A tuators II, IV strumental Introduction cations, 5th cati	ctuator ion, 2 ⁿ on, Sci Editior	rs -Motor	n, CRO Publish	actuar Tutor C Pressing, 20 D15. Bi (Hig Unde Unde Unde	tors: O ial :15, iss, 2015 O13 T Mapp phest L rstandii	peration Total:6 5. Ded evel) ng (K2) ng (K2)
TEXT BOO I. COURSE (CO) CO) CO) CO) CO)	or environr lechnaical -BLDC Mot OK: Patranabi NCES: De Silva a Nadhan lo Jacob Fra OUTCOM letion of tl explain the Elaborate demonstra	Actuators Actuators Actuators Actuators Actuators s, Sensors and Clarence da, Sensors aden, Handb ES: he course, e theory and the various ate the work	toring. Doptical Act tors-Steppe and Transd e W, Senso , Actuators, book of Moo the studen d working b ction and we types of th	tuators - Capacier Motors-Linear Jucers, 2nd Editions and Actuator, and Their Interdern sensors: Photos will be able the behind the induction orking of Capaciermal and magricular seriors.	itive Actuators Motors-Piezo on, PHI, 2022. The Engineering Staces: A Multidinaysics, Design attocomplete transducers and Radian netic sensors are sors used in reasons used in reasons.	-Magneto selectric act Unit I, II, II System Inserting is sciplinary and Application sensored its prince all world applications and the sciplinary and its prince all world applications are sensored its prince all world applications are sensored its prince all world applications are sensored in the sciplinary and the sciplinary are sensored in the science are sensored in the sciplinary are sensored in the sciplinary are sensored in the science are science are sensored in the science are sensored in the science	strictive A tuators II, IV strumental Introduction eations, 5th ors ciple of operations	ctuator ion, 2 ⁿ on, Sci Editior	rs -Motor	n, CRO Publish	actuar Tutor C Presing, 20 015. Brack (Higher Under Under Approximation Approximat	tors: O ial :15, is, 2015 013 T Mapp phest L rstandia rstandia rplying	peration Total:6 5. Ded evel) ng (K2) ng (K2)
TEXT BOO 1. COURSE (CO) CO2 CO3 CO4	or environr lechnaical -BLDC Mot OK: Patranabi NCES: De Silva a Nadhan lo Jacob Fra OUTCOM letion of tl explain the Elaborate demonstra	Actuators Actuators Actuators Actuators Actuators s, Sensors and Clarence da, Sensors aden, Handb ES: he course, e theory and the various ate the work	toring. Doptical Act tors-Steppe and Transd e W, Senso , Actuators, book of Moo the studen d working b ction and we types of th	tuators - Capacier Motors-Linear lucers, 2nd Editions and Actuator, and Their Interdern sensors: Protection of the induction of Capaciermal and magnitudes and the induction of Capacierman and the induction of Capacie	itive Actuators Motors-Piezo on, PHI, 2022. The Engineering Staces: A Multidinaysics, Design attocomplete transducers and Radian netic sensors are sors used in reasons used in reasons.	-Magneto selectric act Unit I, II, II System Institution II, III System Institution III System III System Institution III System III Sys	strictive A tuators II, IV strumental Introduction attions, 5th pors ciple of operations opplications are	ctuator ion, 2 ⁿ on, Sci Editior	rs -Motor	n, CRO Publish	actuar Tutor C Presing, 20 015. Brack (Higher Under Under Approximation Approximat	tors: O ial :15, is, 2015 013 T Mapp phest L rstandia rstandia rplying	peration Total:6 5. Ded evel) ng (K2) ng (K2) ng (K3)
TEXT BOO 1. COURSE (On comple CO2 CO3 CO4	or environr lechnaical -BLDC Mot OK: Patranabi NCES: De Silva a Nadhan lo Jacob Fra OUTCOM letion of the explain the Describe to Elaborate demonstra	Actuators Actuators Actuators Actuators Actuators s, Sensors and Clarence da, Sensors aden, Handb ES: he course, e theory and the various ate the work	toring. Doptical Act tors-Steppe and Transd e W, Senso , Actuators, book of Moo the studen d working b ction and we types of th	tuators - Capacier Motors-Linear lucers, 2nd Editions and Actuator, and Their Interdern sensors: Protection of the induction of Capaciermal and magnitudes and the induction of Capacierman and the induction of Capacie	itive Actuators Motors-Piezo on, PHI, 2022. The Engineering Staces: A Multidination of the Engineering Staces of the Engin	Magneto selectric act Unit I, II, II System Insertions Insertion Sensored Its prince all world applications and System Insertions Sensored Its prince Ing System Ing	strictive A tuators II, IV strumental Introduction attions, 5th pors ciple of operations opplications are	ctuator ion, 2 ⁿ on, Sci Editior	rs -Motor	n, CRO Publish	actuar Tutor C Pressing, 20 D15. Bi (Higher) Unde Unde Unde Unde	tors: O ial :15, is, 2015 013 T Mapp phest L rstandia rstandia rplying	peration Total:6 5. Ded evel) ng (K2) ng (K2) ng (K3)

CO2	3	2	1		1			1	
CO3	3	2	1		1			1	
CO4	3	2	1		1			1	
CO5	3	2	1		1			1	

 $1-Slight,\, 2-Moderate,\, 3-Substantial,\, BT\text{-}\,Bloom's\, Taxonomy$

Danis and banks						
Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
15	85					100
15	85					100
10	60	30				100
10	70	20				100
	(K1) % 15 15 10	(K1) % (K2) % 15 85 15 85 10 60	(K1) % (K2) % (K3) % 15 85 15 85 10 60 30	(K1) % (K2) % (K3) % (K4) % 15 85 15 85 10 60 30	(K1) % (K2) % (K3) % (K4) % (K5) % 15 85 10 60 30	(K1) % (K2) % (K3) % (K4) % (K5) % (K6) % 15 85

^{* ±3%} may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

Programme Branch	& All B	.E/B.Tech Br	ranches Exce	pt EEE			Sem.	Category	L	Т	Р	Credit
Prerequisite	es Nil						6	OE	3	1	0	4
	\							l				
Preamble	Also	it aims to imp	n imparting the part knowledge and in buildings	e on energy o								
Unit – I	Intro	duction:										9+3
			rio - Energy Ne :: Types and Me									
Unit – II	Ther	mal Utilities:										9+3
			am, Steam dis Conservation op									
Unit – III	Elec	rical and Lig	hting System):								9+3
improvemen	t and its benef	it, Basic Para	Systems - E meters and Te portunities in lig	erms in Lightin	g system							
Unit – IV	<u> </u>		tion in Buildi									9+3
	: – Building Er g for existing b		estrations, Insu	ılation, HVAC,	, Lighting	g, Wate	r pumpin	g, Inverter –	Elev	ators	and E	scalators
Investment - present valu	- need, Appra	ate of return	ement: eria, financial a n – Cash flow					nancing opti	ons -	- Ene	ergy po	
Investment - present valu contracting a TEXT BOOK	- need, Appra le - Internal and role of ES	isal and crite ate of return COs.	eria, financial a	s, Risk and s	sensitivity	y analy	sis – Fii	nancing opti	ons - re:45	- Ene	ergy po	ment – N erformand 5, Total:6
Investment - present valu contracting a TEXT BOOK 1. Guid Effici	- need, Appra le - Internal and role of ES (: de Books for Noiency,2010	isal and crite ate of return COs.	eria, financial a n – Cash flows	s, Risk and s	sensitivity	y analy	sis – Fii	nancing opti	ons - re:45	- Ene	ergy po	ment – N erformand 5, Total:6
TEXT BOOK 1. Guid Effic REFERENC	- need, Appraie - Internal and role of ES (: de Books for Note of ES:	isal and crite ate of return COs.	eria, financial a n – Cash flows	s, Risk and s	gy mana	y analy	sis – Fii	Lectuors, 3rd Editi	ons - re:45 on, B	- Ene	orial:1	ment – N erformand 5, Total:6
TEXT BOOK 1. Guid Effic REFERENC 1. Way Barr	- need, Appraie – Internal and role of ES (: de Books for Notiency,2010 ES: rne C. Turner	isal and crite ate of return COs.	eria, financial a n – Cash flows fication Examir	s, Risk and s	gy mana	y analy agers ar	nd Audito	Lectuors, 3rd Editi	ons - re:45 on, B	, Tut	orial:1 u of En	ment – N erformand 5, Total:6
TEXT BOOP 1. Guid Effic REFERENC 1. Way 2. Barr Pres	- need, Appraie – Internal and role of ES de Books for Notiency,2010 ES: one C. Turner my L. Capehar ss, GA, 2012	isal and crite ate of return COs.	eria, financial and	s, Risk and s	gy mana	y analy agers ar	nd Audito	Lectuors, 3rd Editi	ons - re:45 on, B	, Tut ureau GA,20	orial:1 u of En	ment – Nerformand 5, Total:6 ergy
TEXT BOOP 1. Guid Effic REFERENC 1. Way 2. Barr Pres	- need, Appraie - Internal and role of ES de Books for Notiency,2010 ES: ne C. Turner ny L. Capehar ss, GA, 2012	isal and crite ate of return COs. lational Certif	eria, financial and	nation for ener agement Hand	gy mana	y analy agers ar	nd Audito	Lectuors, 3rd Editi	ons - re:45 on, B	, Tut	orial:1 u of En 006 he Fair	ment – Nerformand 5, Total:6 ergy
Investment - present valu contracting a TEXT BOOK 1. Guid Effic REFERENC 1. Way 2. Barr Pres COURSE Of On complete	- need, Appraie - Internal and role of ES de Books for Notiency,2010 ES: rne C. Turner my L. Capehar as, GA, 2012 UTCOMES: ion of the co	isal and crite ate of return COs. lational Certif & Steve Doty , Wainey C.	eria, financial and — Cash flows Tication Examin Turner, William	nation for ener agement Hand n J. Kennedy,	gy mana dbook", 6 "Guide to	agers an	nd Audito	Lectuors, 3rd Editi	ons - re:45 on, B	- End , Tute ureau GA,20 On, T	orial:1 u of En 006 he Fair BT Ma ighest	ment – Nerformand 5, Total:6 ergy mont pped Level)
TEXT BOOP TEXT BOOP 1. Guid Effic REFERENC 1. Barr 2. Barr COURSE OF On complet CO1 inter	- need, Appraie - Internal and role of ES de Books for Noiency,2010 ES: ne C. Turner ny L. Capehar ss, GA, 2012 UTCOMES: ion of the compret the impo	isal and crite ate of return COs. lational Certif & Steve Doty , Wainey C. urse, the stu tance of enel	eria, financial and — Cash flows Tication Examination Turner, William dents will be a	nation for ener agement Hand In J. Kennedy,	gy mana dbook", 6 "Guide to	agers an	nd Audito	Lectuors, 3rd Editi	ons - re:45 on, B	- End , Tute uureau GA,20 on, T (H	orial:1 u of En 006 he Fair ighest	ment – Nerformand 5, Total:6 ergy mont pped Level) ding (K2)
TEXT BOOP TEXT BOOP 1. Guid Effic REFERENC 1. Barr Pres COURSE OF On complet CO1 inter CO2 app	- need, Appraie - Internal and role of ES de Books for Notiency,2010 ES: Vine C. Turner my L. Capehar ss, GA, 2012 UTCOMES: ion of the contract the impontance of the energians of the ene	isal and crite ate of return COs. lational Certif & Steve Doty , Wainey C. urse, the stu tance of energy saving opp	eria, financial and and and another Cash flows Tication Examination Turner, William Turner, William dents will be another control Turner, energy control	nation for ener agement Hand a J. Kennedy, able to nservation and	gy mana dbook", 6 "Guide to	agers an	nd Audito	Lectuors, 3rd Editi	ons - re:45 on, B	GA,20	orial:1 u of En 006 he Fair ighest	ment – Nerformand 5, Total:6 ergy mont pped Level) ding (K2)
TEXT BOOK 1. Guid Effic REFERENC 1. Way 2. Barr Pres COURSE Of On complet CO1 inter CO2 appres CO3 pres	- need, Appraie – Internal and role of ES de Books for Notiency,2010 ES: Vine C. Turner ass, GA, 2012 UTCOMES: ion of the compret the importance of the energy	isal and crite ate of return COs. lational Certif & Steve Doty , Wainey C. urse, the stu tance of ener gy saving oppo	eria, financial and and another Cash flows fication Examination, "Energy Mana Turner, William dents will be a programmed contunities in the contu	nation for ener agement Hand a J. Kennedy, able to nservation and termal system	gy mana dbook", 6 "Guide to	agers an	nd Audito	Lectuors, 3rd Editi	ons - re:45 on, B	GA,20 I (H Und	orial:1 u of En 006 he Fair lerstand	ment – Nerformand 5, Total:6 ergy mont pped Level) ding (K2)
Investment - present valu contracting a TEXT BOOK 1. Guid Effic REFERENC 1. Way 2. Barr Pres COURSE Of On complet CO1 inter CO2 appr CO3 prec CO4 appr	- need, Appraire – Internal and role of ES de Books for Notiency,2010 ES: Vine C. Turner ass, GA, 2012 UTCOMES: ion of the compret the importance of the energy arise the e	isal and crite ate of return COs. lational Certif & Steve Doty , Wainey C. urse, the stu tance of ener gy saving oppo saving oppo gy conservation	eria, financial and and and another continuities in light another continuities in li	agement Handa J. Kennedy, able to nservation and ermal system ting systems and ECBC	gy mana dbook", 6 "Guide to	agers an	nd Audito	Lectuors, 3rd Editi	ons - re:45 on, B	- End , Tuti ureau GA,20 Don, T (H Und Und	orial:1 u of En 006 he Fair lerstand	ment – Nerformand 5, Total:6 ergy mont pped Level) ding (K2) ding (K2) ding (K3)
Investment - present value contracting a TEXT BOOK 1. Guid Effic REFERENC 1. Way 2. Barr Pres COURSE Of On complet CO1 inter CO2 appr CO3 prec CO4 appr	- need, Appraire – Internal and role of ES de Books for Notiency,2010 ES: Vine C. Turner ass, GA, 2012 UTCOMES: ion of the compret the importance of the energy arise the e	isal and crite ate of return COs. lational Certif & Steve Doty , Wainey C. urse, the stu tance of ener gy saving oppo saving oppo gy conservation	eria, financial and and and another content of the	agement Handa J. Kennedy, able to nservation and ting systems and ECBC achniques	gy manadbook", 6 "Guide to	agers an age	nd Audito	Lectuors, 3rd Editi	ons - re:45 on, B	- End , Tuti ureau GA,20 Don, T (H Und Und	orial:1 u of En 006 he Fair erstand	ment – Nerformand 5, Total:6 ergy mont pped Level) ding (K2) ding (K2) ding (K3)
TEXT BOOK 1. Guic Effic REFERENC 1. Way 2. Barr Pres COURSE Of On complet CO1 inter CO2 appr CO3 prec CO4 appr	- need, Appraire – Internal and role of ES de Books for Notiency,2010 ES: Vine C. Turner ass, GA, 2012 UTCOMES: ion of the compret the importance of the energy arise the e	isal and crite ate of return COs. lational Certif & Steve Doty , Wainey C. urse, the stu tance of ener gy saving oppo saving oppo gy conservation ant financial m	eria, financial and and and another content of the	agement Handa J. Kennedy, able to nservation and ermal system ting systems and ECBC	gy manadbook", 6 "Guide to	agers an age	nd Audito	Lectuors, 3rd Editi	ons - re:45 on, B	GA,20 I (H Und A Und	orial:1 u of En 006 he Fair erstand	ment – Nerformand 5, Total:6 ergy mont pped Level) ding (K2) ding (K2) ding (K3)

CO2	3	1			1	1	1		1	
CO3	3	2	1		1	1	1		1	
CO4	3	1			1	1	1		1	
CO5	3	3	2	1	1	1	1		1	

ASSESSMENT PATTERN - THEORY													
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %						
CAT1	40	60					100						
CAT2	20	40	40				100						
CAT3	20	40	30	10			100						
ESE	20	40	30	10			100						

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

Progra Branc	amme &	All BE/BTech Branches except EEE	Sem.	Category	L	Т	Р	Credit
	quisites	Nil	6	OE	3	1	0	4
Pream	nble	To get acquaintance with the architecture of 8085 programming concepts for interfacing peripherals microcontrollers						
Unit –	· I	8085 Microprocessor:						9+3
		85 Microprocessor - Architecture - Pin Configuration - y Interfacing –Simple Assembly Language Programs			essir	ng Mc	des-	Timing
Unit –		8051 Microcontroller:						9+3
		51 Microcontroller – Architecture – Memory Organiza nstruction set –Addressing modes	ation–Special Function	on Registers	– Pro	ogran	n Cou	nter – PSV
Unit –		8051 Programming:						9+3
		(Mode 1) / Counter– Serial Communication –Interrupt mming–Timer programming-Counter programming-Se						Embedde
Unit –		Peripheral Interfacing with 8051:						9+3
– Serv Unit – Smart	vo motor. V card reader	Applications of Microcontrollers: Automated meter reading system, Washing machine approaches)		printers, Hea	althca	are m	onitori	9+3 ng system
– Serv Unit – Smart	vo motor. V card reader	Applications of Microcontrollers:						
– Serv Unit – Smart (only b	vo motor. V card reader	Applications of Microcontrollers: , Automated meter reading system, Washing machin						ng system
– Serv Unit – Smart (only b	Vo motor. V card reader block diagrar BOOK: Muhamma	Applications of Microcontrollers: , Automated meter reading system, Washing machin	e, Speedometer, 3D	Lectu	re:45	i, Tut	orial:	ng system
Unit – Serv Unit – Smart (only b	Vo motor. V card reader block diagrar BOOK: Muhamma Using Ass Soumitra I	Applications of Microcontrollers: , Automated meter reading system, Washing machin mapproaches) ad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinl.	ay, "The 8051 Microo Delhi, 2013	Lectu	re:45	i , Tut pedde	orial:	ng system 15, Total:6
Unit - Smart (only b	Vo motor. V card reader block diagrar BOOK: Muhamma Using Ass Soumitra I	Applications of Microcontrollers: , Automated meter reading system, Washing maching approaches) ad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinleembly and C", 2nd Edition, Pearson Education, New Kumar Mandal, "Microprocessors and Microcontroller	ay, "The 8051 Microo Delhi, 2013	Lectu	re:45	i , Tut pedde	orial:	ng system 15, Total:6
Unit - Smart (only b	BOOK: Muhamma Using Ass Soumitra I and 8051"	Applications of Microcontrollers: , Automated meter reading system, Washing maching approaches) ad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlembly and C", 2nd Edition, Pearson Education, New Kumar Mandal, "Microprocessors and Microcontroller", 8th Edition, McGraw Hill Education (India) Pvt. Ltd, umar N., Saravanan M., Jeevananthan S, "Microprocessors and Microprocessors a	ay, "The 8051 Microo Delhi, 2013 rs Architecture, Prog New Delhi, 2013	Lectu controller and ramming and	Emb	oedde em D	orial: ed Sys	ng system 15, Total:6 tems 8085,8086
Unit - Smart (only but to the second	BOOK: Muhamma Using Ass Soumitra I and 8051" RENCES: Senthil Ku Press, Ne	Applications of Microcontrollers: Automated meter reading system, Washing maching approaches) ad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlembly and C", 2nd Edition, Pearson Education, New Kumar Mandal, "Microprocessors and Microcontroller', 8th Edition, McGraw Hill Education (India) Pvt. Ltd,	ay, "The 8051 Microo Delhi, 2013 rs Architecture, Prog New Delhi, 2013	Lecture controller and ramming and roller", 12 th Im	Emb Syst	em D	orial: ed Sys esign Oxfor	ng system 15, Total:6 tems 8085,8086
Unit – Smart (only but to the second	BOOK: Muhamma Using Ass Soumitra I and 8051" RENCES: Senthil Ku Press, Ne	Applications of Microcontrollers: Automated meter reading system, Washing maching approaches) ad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlembly and C", 2nd Edition, Pearson Education, New Kumar Mandal, "Microprocessors and Microcontroller,", 8th Edition, McGraw Hill Education (India) Pvt. Ltd, umar N., Saravanan M., Jeevananthan S, "Microprocessors w Delhi, 2015 ant, "Microprocessors and Microcontrollers: Architect	ay, "The 8051 Microo Delhi, 2013 rs Architecture, Prog New Delhi, 2013	Lecture controller and ramming and roller", 12 th Im	Emb Syst	em D	orial: ed Sys esign Oxfor	ng system 15, Total:6 tems 8085,8086
Unit – Smart (only but to the state of the s	BOOK: Muhamma Using Ass Soumitra I and 8051" RENCES: Senthil Ku Press, Ne Krishna Ka 8096", 2nd	Applications of Microcontrollers: Automated meter reading system, Washing maching approaches) ad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlembly and C", 2nd Edition, Pearson Education, New Kumar Mandal, "Microprocessors and Microcontroller,", 8th Edition, McGraw Hill Education (India) Pvt. Ltd, Immar N., Saravanan M., Jeevananthan S, "Microprocew Delhi, 2015 ant, "Microprocessors and Microcontrollers: Architect dedition, PHI Learning Pvt. Ltd, New Delhi, 2012	ay, "The 8051 Microo Delhi, 2013 rs Architecture, Prog New Delhi, 2013	Lecture controller and ramming and roller", 12 th Im	Emb Syst	sion, Tut	orial: ed Sys esign Oxfor 8086	ng system 15, Total:6 tems 8085,8086 d Universit , 8051,
Unit – Serv Unit – Smart (only but to the content of the content o	BOOK: Muhamma Using Ass Soumitra I and 8051" RENCES: Senthil Ku Press, Ne Krishna Ka 8096", 2nd	Applications of Microcontrollers: Automated meter reading system, Washing maching approaches) ad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlembly and C", 2nd Edition, Pearson Education, New Kumar Mandal, "Microprocessors and Microcontroller,", 8th Edition, McGraw Hill Education (India) Pvt. Ltd, Jumar N., Saravanan M., Jeevananthan S, "Microprocew Delhi, 2015 ant, "Microprocessors and Microcontrollers: Architect dedition, PHI Learning Pvt. Ltd, New Delhi, 2012	ay, "The 8051 Microo Delhi, 2013 rs Architecture, Prog New Delhi, 2013	Lecture controller and ramming and roller", 12 th Im	Emb Syst	sion, Tut	orial: ed Sys esign Oxfor 8086	ng system 15, Total:6 tems 8085,8086 d Universit , 8051,
Unit – Smart (only but to the control of the contro	BOOK: Muhamma Using Ass Soumitra I and 8051" RENCES: Senthil Ku Press, Ne Krishna Ka 8096", 2nd	Applications of Microcontrollers: Automated meter reading system, Washing maching approaches) and Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinle Bembly and C", 2nd Edition, Pearson Education, New Kumar Mandal, "Microprocessors and Microcontroller,", 8th Edition, McGraw Hill Education (India) Pvt. Ltd, Immar N., Saravanan M., Jeevananthan S, "Microprocessors and Microcontrollers: Architect and Edition, PHI Learning Pvt. Ltd, New Delhi, 2012 MES: If the course, the students will be able to	ay, "The 8051 Microo Delhi, 2013 rs Architecture, Prog New Delhi, 2013	Lecture controller and ramming and roller", 12 th Im	Emb Syst	sion, B085, (Hi	orial: ed Sys esign Oxfor 8086	ng system 15, Total:6 tems 8085,8086 d Universit , 8051, pped t Level)
TEXT 1. 2. REFEI 1. 2. COUR On co CO1 CO2	BOOK: Muhamma Using Ass Soumitra I and 8051" RENCES: Senthil Ku Press, Ne Krishna Ka 8096", 2nd	Applications of Microcontrollers: Automated meter reading system, Washing maching approaches) ad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlembly and C", 2nd Edition, Pearson Education, New Kumar Mandal, "Microprocessors and Microcontroller,", 8th Edition, McGraw Hill Education (India) Pvt. Ltd, Immar N., Saravanan M., Jeevananthan S, "Microprocew Delhi, 2015 ant, "Microprocessors and Microcontrollers: Architect dedition, PHI Learning Pvt. Ltd, New Delhi, 2012 MES: In the course, the students will be able to be basic concepts of 8085 microprocessor	ay, "The 8051 Microo Delhi, 2013 rs Architecture, Prog New Delhi, 2013	Lecture controller and ramming and roller", 12 th Im	Emb Syst	sion, E (Hi Unde	orial: ed Sys esign Oxfor 8086 BT Ma ighes erstan erstan	ng system 15, Total:6 tems 8085,8086 d Universit , 8051, pped t Level) ding (K2)
Unit – Smart (only but to the second	BOOK: Muhamma Using Ass Soumitra I and 8051" RENCES: Senthil Ku Press, Ne Krishna Ka 8096", 2nd	Applications of Microcontrollers: Automated meter reading system, Washing maching approaches) ad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlatembly and C", 2nd Edition, Pearson Education, New Kumar Mandal, "Microprocessors and Microcontroller," 8th Edition, McGraw Hill Education (India) Pvt. Ltd, Immar N., Saravanan M., Jeevananthan S, "Microprocew Delhi, 2015 ant, "Microprocessors and Microcontrollers: Architected edition, PHI Learning Pvt. Ltd, New Delhi, 2012 MES: If the course, the students will be able to be basic concepts of 8085 microprocessor e the basic concepts of 8085 microprocessor	ay, "The 8051 Microo Delhi, 2013 rs Architecture, Prog New Delhi, 2013	Lecture controller and ramming and roller", 12 th Im	Emb Syst	sion, E (Hi Unde	orial: ed Sys esign Oxfor 8086 BT Ma ighes erstan applyir	ng system 15, Total:6 tems 8085,8086 d Universit , 8051, pped t Level) ding (K2) ding (K2)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1				1		1		1	1	1		
CO2	3	1				1	2				2	1		
CO3	3	2	1	1	1	1		1		1	1	1		
CO4	3	2	1	1	1	1	2				2	1		
CO5	3	1				1		1		1	1	1		

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	85	-	-	-	-	100
CAT2	10	45	45	-	-	-	100
CAT3	10	45	45	-	-	-	100
ESE	5	55	40	-	-	-	100

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

Branc	amme &	All BE/BTech Branches except EEE	Sem.	Category	L	Т	Р	Credit
	quisites	Nil	6	OE	3	1	0	4
Pream	nble	This course imparts knowledge about basic conce languages, advanced PLC programming, process develop automation system in industrial application	of SCADA system a					
Unit –	=	Introduction to Programmable Logic Controller	•					9+3
	fications - C	rammable Logic Controller – Parts of PLC – Principle CPU – Memory design and types – Programming de						
Unit –		Basic PLC Programming:						9+3
addres	ssing – Bran	Logic – Hardwired logic versus Programmed Logich and Internal relay instructions – Entering the Lado Manual operated switches and mechanically operated	ler diagram – Electi					
Unit –		Advanced PLC Programming:						9+3
– Prog	amming Time gram Control ic light contro	ers: On delay timer and off delay timer instruction – re Instructions - Math Instructions – Sequencer and Shift ol system	tentive and cascade Register Instruction	timer functions. PLC Applic	ns- P ation	rogra ns: Bo	ammin ottle fil	g Counters ling systen
Unit –		PLC Installation and Troubleshooting:						9+3
		 Electrical Noise – Leaky Inputs and Outputs – Grou Monitoring – Preventive Maintenance – Connecting P 						
		Sensor and Tank.	о апат 2017 фр.:00					
with Le Unit – Introdu	evel Control V uction to SC	Sensor and Tank. SCADA and its application: ADA – A brief history of SCADA –Real-time systems -	- Remote control –	Communication	ons: (comn	nunica	9+3
with Le	evel Control V uction to SC onents – pro	Sensor and Tank. SCADA and its application:	- Remote control –	ITUs) Applica	tions	: Rea	al time	tion syster Revisited
with Le Unit – Introducompo Scann	evel Control V uction to SC onents – pro	Sensor and Tank. SCADA and its application: ADA – A brief history of SCADA –Real-time systems - tocol-modems- Remote terminal units (RTUs) – Mast	- Remote control –	ITUs) Applica	tions	: Rea	al time	tion syster Revisited
with Le Unit - Introdu compo Scann	evel Control V uction to SC onents – pro ning and com BOOK:	Sensor and Tank. SCADA and its application: ADA – A brief history of SCADA –Real-time systems - tocol-modems- Remote terminal units (RTUs) – Mast	- Remote control – er terminal units (N	ITUs) Applica	e:45	: Rea	al time	tion syster Revisited
with Le Unit - Introducompo Scann TEXT	evel Control V uction to SC onents – pro ning and com BOOK: Frank D. I	Sensor and Tank. SCADA and its application: ADA – A brief history of SCADA –Real-time systems - tocol-modems- Remote terminal units (RTUs) – Mast numerications.	- Remote control – er terminal units (M	ITUs) Applica Lectur Hill , New Del	e:45	: Rea	al time	tion syster Revisited
with Le Unit - Introdu compo Scann TEXT 1.	evel Control V uction to SC onents – pro ning and com BOOK: Frank D. I	Sensor and Tank. SCADA and its application: ADA – A brief history of SCADA –Real-time systems - stocol-modems- Remote terminal units (RTUs) – Massimunications. Petruzella, "Programmable Logic Controllers", 5th Edice SCADA – Real-time systems - stocol-modems Petruzella, "Programmable Logic Controllers", 5th Edice Petruzella, "Programmable Logic Controllers", Petruzella, "Programmable Lo	- Remote control – er terminal units (M	ITUs) Applica Lectur Hill , New Del	e:45	: Rea	al time	tion syster Revisited
with Le Unit - Introducompo Scann TEXT 1. 2. REFEI	evel Control V uction to SC onents – pro ning and com BOOK: Frank D. I Stuart A. I RENCES: Webb Joh	Sensor and Tank. SCADA and its application: ADA – A brief history of SCADA –Real-time systems - stocol-modems- Remote terminal units (RTUs) – Massimunications. Petruzella, "Programmable Logic Controllers", 5th Edice SCADA – Real-time systems - stocol-modems Petruzella, "Programmable Logic Controllers", 5th Edice Petruzella, "Programmable Logic Controllers", Petruzella, "Programmable Lo	- Remote control – rer terminal units (M	Lectur Hill , New Del	e:45 hi, 20 A, 20	: Rea	orial:1	tion syster Revisited
with Le Unit - Introducompo Scann TEXT 1. 2. REFEI 1.	evel Control V uction to SC onents – pro ning and com BOOK: Frank D. I Stuart A. I RENCES: Webb Joh Learning	Sensor and Tank. SCADA and its application: ADA – A brief history of SCADA –Real-time systems - stocol-modems- Remote terminal units (RTUs) – Mast nmunications. Petruzella, "Programmable Logic Controllers", 5th Edi Boyer, "SCADA: Supervisory Control and Data Acquis	tion, Tata McGraw-sition", 4th Edition, I	Lectur Hill , New Del SA Press, US	e:45 hi, 20 A, 20	: Rea	orial:1	tion syster Revisited
with Le Unit - Introductompo Scann TEXT 1. 2. REFEI 1. 2.	evel Control V uction to SC onents – pro ning and com BOOK: Frank D. I Stuart A. I RENCES: Webb Joh Learning I Bolton W,	Sensor and Tank. SCADA and its application: ADA – A brief history of SCADA –Real-time systems - stocol-modems- Remote terminal units (RTUs) – Mast nmunications. Petruzella, "Programmable Logic Controllers", 5th Edi Boyer, "SCADA: Supervisory Control and Data Acquis nn W and Reis Ronald A, "Programmable Logic Controllers", 5th edition, ELSE "Programmable Logic Controllers", 5th edition, ELSE	tion, Tata McGraw-sition", 4th Edition, I	Lectur Hill , New Del SA Press, US	e:45 hi, 20 A, 20	; Reactive (1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	orial:1	tion syster Revisited
with Le Unit - Introductompo Scann TEXT 1. 2. REFEI 1. 2. COUR On co	evel Control V uction to SC onents – pro ning and com BOOK: Frank D. I Stuart A. I RENCES: Webb Jor Learning I Bolton W,	Sensor and Tank. SCADA and its application: ADA – A brief history of SCADA –Real-time systems - stocol-modems- Remote terminal units (RTUs) – Mast nmunications. Petruzella, "Programmable Logic Controllers", 5th Edi Boyer, "SCADA: Supervisory Control and Data Acquis nn W and Reis Ronald A, "Programmable Logic Control Private Limited, New Delhi, 2002. "Programmable Logic Controllers", 5th edition, ELSE	- Remote control – er terminal units (Nation, Tata McGraw-sition", 4th Edition, Incollers - Principles and VIER, New York, 20	Lectur Hill , New Del SA Press, US	e:45 hi, 20 A, 20	: Ready, Tuto 2019. 2016. Element (H)	orial:1	tion system Revisited 15, Total:6
with Le Unit - Introducompo Scann TEXT 1. 2. REFEI 1. 2. COUR On co	evel Control V uction to SC onents – pro ning and com BOOK: Frank D. I Stuart A. I RENCES: Webb Joh Learning Bolton W, RSE OUTCO mpletion of identify th	Sensor and Tank. SCADA and its application: ADA – A brief history of SCADA –Real-time systems - stocol-modems- Remote terminal units (RTUs) – Mast munications. Petruzella, "Programmable Logic Controllers", 5th Edi Boyer, "SCADA: Supervisory Control and Data Acquis In W and Reis Ronald A, "Programmable Logic Control Private Limited, New Delhi, 2002. "Programmable Logic Controllers", 5th edition, ELSE In MES: Ithe Course, the students will be able to	- Remote control – er terminal units (Nation, Tata McGraw-sition", 4th Edition, Incollers - Principles and VIER, New York, 20	Lectur Hill , New Del SA Press, US	e:45 hi, 20 A, 20	: Read , Tuto	dition, BT Maighes erstar	tion systed Revisited 15, Total:6
with Le Unit - Introducompo Scann TEXT 1. 2. REFEI 1. 2. COUR On co CO1	evel Control V uction to SC onents – pro ning and com BOOK: Frank D. I Stuart A. I RENCES: Webb Joh Learning I Bolton W, RSE OUTCO ompletion of identify th	Sensor and Tank. SCADA and its application: ADA – A brief history of SCADA –Real-time systems - stocol-modems- Remote terminal units (RTUs) – Mast nmunications. Petruzella, "Programmable Logic Controllers", 5th Edi Boyer, "SCADA: Supervisory Control and Data Acquis nn W and Reis Ronald A, "Programmable Logic Control Private Limited, New Delhi, 2002. "Programmable Logic Controllers", 5th edition, ELSE SMES: f the course, the students will be able to PLC hardware and programming languages for variety.	tion, Tata McGraw- sition", 4th Edition, I ollers - Principles a VIER, New York, 20	Lectur Hill , New Del SA Press, US	e:45 hi, 20 A, 20	: Read :	dition, BT Maighes erstar	tion system Revisited Revisited 5, Total:6
with Le Unit - Introductompo Scann TEXT 1. 2. REFEI 1. 2. COUR On co CO1 CO2 CO3	evel Control V uction to SC onents – pro ning and com BOOK: Frank D. I Stuart A. I RENCES: Webb Joh Learning I Bolton W, RSE OUTCO ompletion of identify th develop P design a I	Sensor and Tank. SCADA and its application: ADA – A brief history of SCADA –Real-time systems - stocol-modems- Remote terminal units (RTUs) – Mast nmunications. Petruzella, "Programmable Logic Controllers", 5th Edi Boyer, "SCADA: Supervisory Control and Data Acquis nn W and Reis Ronald A, "Programmable Logic Control Private Limited, New Delhi, 2002. "Programmable Logic Controllers", 5th edition, ELSE MES: f the course, the students will be able to PLC hardware and programming languages for variable Controllers PLC ladder logic programming for industrial problems	tion, Tata McGraw- sition", 4th Edition, I ollers - Principles a VIER, New York, 20	Lectur Hill , New Del SA Press, US	e:45 hi, 20 A, 20	; Reading to the control of the cont	al time orial:1 dition, BT Ma ighes erstar pplyir	tion system Revisited 15, Total:6 PHI pped t Level) ding (K2)
with Le Unit - Introductompo Scann TEXT 1. 2. REFEI 1. 2.	evel Control V uction to SC onents – pro ning and com BOOK: Frank D. I Stuart A. I RENCES: Webb Joh Learning I Bolton W, RSE OUTCO ompletion of identify th develop P design a I install and	Sensor and Tank. SCADA and its application: ADA – A brief history of SCADA –Real-time systems - stocol-modems- Remote terminal units (RTUs) – Mast munications. Petruzella, "Programmable Logic Controllers", 5th Edi Boyer, "SCADA: Supervisory Control and Data Acquis mn W and Reis Ronald A, "Programmable Logic Control Private Limited, New Delhi, 2002. "Programmable Logic Controllers", 5th edition, ELSE MES: f the course, the students will be able to e PLC hardware and programming languages for variable Controllers PLC ladder logic programming for industrial problems PLC system, component, or process to meet a set of second controllers PLC system, component, or process to meet a set of second controllers PLC system, component, or process to meet a set of second controllers PLC system, component, or process to meet a set of second controllers PLC system, component, or process to meet a set of second controllers PLC system, component, or process to meet a set of second controllers PLC system, component PLC system, component PLC system PL	- Remote control – Per terminal units (Note termina	Lectur Hill , New Del SA Press, US	e:45 hi, 20 A, 20	; Reactive (Hindurch A	dition, BT Maighes erstar pplyir pplyir	PHI pped t Level) ding (K2) g (K3)

CO1	3	2	1	1	1		1		1	
CO2	3	2	1	1	1		1		1	
CO3	3	2	1	1	1		1		1	
CO4	3	1			1		1		1	
CO5	3	2	1	1	1		1		1	

 $1-Slight,\, 2-Moderate,\, 3-Substantial,\, BT-\,Bloom's\, Taxonomy$

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	50	20				100
CAT2	30	50	20				100
CAT3	40	40	20				100
ESE	40	40	20				100

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

		22EEEO10 – VLSI SYS	TEM DESIGN					
Progr Branc	amme & :h	All BE/BTech Branches except EEE	Sem.	Category	L	Т	Р	Credit
Prere	quisites	Nil	6	OE	3	1	0	4
Pream	nble	To expose the knowledge of VLSI System Design logic circuits with its fabrication techniques and Hardware Description Language in different mode	d programming var					
Unit –	.	Introduction	59					9+3
CMOS	S Logic – CN	nOS Fabrication and Layout – Physical Design – Des	sign Verification – Fa	brication, pac	ckagi	ng ar	nd Tes	ting
Unit –	·	Unit Title: MOS Transistor Theory						9+3
	uction – MO cteristics	S transistor operating regions – Long Channel VI cl	haracteristics - Nor	ideal I-V effe	ects ·	- DC	transf	er
Unit –	· []]	Unit Title: CMOS Processing Technology						9+3
		OS technologies – Stick Diagram – Layout diagram d CAD Issues – Manufacturing Issues	ı – Layout Design R	ules – CMOS	S Pro	cess	Enha	ncement
Unit –	· IV	Unit Title: VERILOG HDL-I						9+3
– Data	aflow modelli	 Dataflow modelling – Continuous Assignments – D Examples – Behavioural modelling – Structured F ents - Multiway branching -Loops - Behavioural model 	Procedures - Proced					
Unit –	· V	Unit Title: VERILOG HDL-II						9+3
Tasks	and Functio	ns - Difference between tasks and functions - Task	s - Functions - Use	ful Modelling	Tech	niau	-s	witch lev
		ts - Switch level modelling Examples	3 Functions Coc	iai woaeiiing	1001	miqui		
			o i unctions osc					
model			3 Turicuona Cae					
model	BOOK: Neil H. E.			Lectur	e:45	, Tuto	orial:1	5, Total:
model TEXT	BOOK: Neil H. E. Pearson 6	Weste & David Money Harris, "CMOS VLSI Design Aducation, New Delhi, 2017 Unit I, II, III nitkar, "Verilog HDL: Guide to Digital Design and Syn	A Circuits and Syste	Lectur ms Perspecti	e:45 ve" F	, Tuto	orial:1	5, Total:
TEXT 1. 2.	BOOK: Neil H. E. Pearson 6 Samir Pal	Weste & David Money Harris, "CMOS VLSI Design Aducation, New Delhi, 2017 Unit I, II, III nitkar, "Verilog HDL: Guide to Digital Design and Syn	A Circuits and Syste	Lectur ms Perspecti	e:45 ve" F	, Tuto	orial:1	5, Total: con,
TEXT 1. 2.	BOOK: Neil H. E. Pearson e Samir Pal 2017. Unit	Weste & David Money Harris, "CMOS VLSI Design Aducation, New Delhi, 2017 Unit I, II, III nitkar, "Verilog HDL: Guide to Digital Design and Syn	A Circuits and Syste	Lectur ms Perspecti tion, Pearson	e:45 ve" F	, Tuto	Edition, Nev	5, Total:
TEXT 1. 2. REFE	BOOK: Neil H. E. Pearson e Samir Pal 2017. Unit RENCES: Pucknell,	Weste & David Money Harris, "CMOS VLSI Design And Education, New Delhi, 2017 Unit I, II, III nitkar, "Verilog HDL: Guide to Digital Design and Syntal IV, V	A Circuits and Systenthesis", Second Edi	Lectur ms Perspecti tion, Pearson Hall India, Pv	e:45 ve" F	, Tuto	Edition, Nev	5, Total: 0
TEXT 1. 2. REFE 1. 2.	BOOK: Neil H. E. Pearson e Samir Pal 2017. Unit RENCES: Pucknell, A.Albert R	Weste & David Money Harris, "CMOS VLSI Design And Learn Company of the Property of the Propert	A Circuits and Systenthesis", Second Edi	Lectur ms Perspecti tion, Pearson Hall India, Pv	e:45 ve" F	, Tuto	Edition, Nev	5, Total: on, v Delhi,
TEXT 1. 2. REFE 1. 2. COUR	BOOK: Neil H. E. Pearson e Samir Pal 2017. Unit RENCES: Pucknell, A.Albert R	Weste & David Money Harris, "CMOS VLSI Design And Leducation, New Delhi, 2017 Unit I, II, III nitkar, "Verilog HDL: Guide to Digital Design and Synt IV, V Douglas A & Eshragian, K., "Basic VLSI Design", Thie Raj & T.Latha, "VLSI Design", Prentice Hall India Lear	A Circuits and Systenthesis", Second Ediird Edition, Prentice	Lectur ms Perspecti tion, Pearson Hall India, Pv	e:45 ve" F	, Tuto	Edition, Nev	5, Total:
TEXT 1. 2. REFE 1. 2. COUR On co	BOOK: Neil H. E. Pearson e Samir Pal 2017. Unit RENCES: Pucknell, A.Albert R RSE OUTCO Impletion of Comprehe	Weste & David Money Harris, "CMOS VLSI Design And Education, New Delhi, 2017 Unit I, II, III nitkar, "Verilog HDL: Guide to Digital Design and Synt IV, V Douglas A & Eshragian, K., "Basic VLSI Design", Thickai & T.Latha, "VLSI Design", Prentice Hall India Lear	A Circuits and Systenthesis", Second Ediird Edition, Prentice	Lectur ms Perspecti tion, Pearson Hall India, Pv	e:45 ve" F	, Tuto	Edition, Nev	5, Total: on, v Delhi, pped t Level)
TEXT 1. 2. REFE 1. 2. COUR On co	BOOK: Neil H. E. Pearson e Samir Pal 2017. Unit RENCES: Pucknell, A.Albert R SSE OUTCO Impletion of Comprehe Explain M	Weste & David Money Harris, "CMOS VLSI Design And Education, New Delhi, 2017 Unit I, II, III nitkar, "Verilog HDL: Guide to Digital Design and Synta IV, V Douglas A & Eshragian, K., "Basic VLSI Design", Thickar, "VLSI Design", Prentice Hall India Lear MES: If the course, the students will be able to end the principles of CMOS Logic and its physical design.	A Circuits and Systenthesis", Second Ediird Edition, Prentice rning Private Limited sign process.	Lectur ms Perspecti tion, Pearson Hall India, Pv	e:45 ve" F	, Tuto Fourth cation , 201:	Edition, New 5. 3T Maighest great an pplyin	5, Total: on, v Delhi, pped t Level) ding (K2)
TEXT 1. 2. REFE 1. 2.	BOOK: Neil H. E. Pearson e Samir Pal 2017. Unit RENCES: Pucknell, A.Albert R Completion of Explain M Describe (Apply Veri	Weste & David Money Harris, "CMOS VLSI Design And Deducation, New Delhi, 2017 Unit I, II, III nitkar, "Verilog HDL: Guide to Digital Design and Syntal IV, V Douglas A & Eshragian, K., "Basic VLSI Design", Thickar, "VLSI Design", Prentice Hall India Lear MES: If the course, the students will be able to end the principles of CMOS Logic and its physical decourse.	A Circuits and Syste Inthesis", Second Edi Ird Edition, Prentice Irning Private Limited Isign process. In different manufact	Lectur ms Perspecti tion, Pearson Hall India, Pv , 2008.	e:45 ve" F	, Tuto cation , 201s (Hi Undo	Edition, Nevents. BT Maighest erstan pplyin erstan	pped Level) ding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1							1		
CO2	3	2	1	1	1							1		
CO3	3	2	1	1	1							1		
CO4	3	3	3	1	3				2		2	2		

CO5	3	3	3	1	3				2		2		2		
1 – Slight, 2	– Mode	erate, 3 -	- Substan	tial, B	T- Bloom's	s Taxon	omy							·	
					ASSES	SMEN	T PATTE	ERN -	THEORY	<u> </u>					
Test / Blo Catego		Re	memberi (K1) %	ng	Understa (K2)	_	Applyi (K3) ⁹		Analyzir (K4) %	_	Evalua (K5)	_		Creating (K6) %	Total %
CAT	⁻ 1		10		70		20								100
CAT	2		10		60		30								100
CAT	3		10		30		60								100
ESE	E		10		40		50								100
* ±3% may l	be varie	d (CAT	1, 2 & 3 –	50 ma	arks & ES	E – 100	marks)						ı		

							- 1			1			
Programme Branch	e &	All BE/E	BTech Brai	nches excep	t EEE			Sem.	Category	L	Т	Р	Credit
Prerequisit	tes	Nil						6	OE	3	1	0	4
Preamble		This cou	ırse is aime	ed to impart k	nowledge	on the techno	logies u	sed for t	he automati	on in i	ndust	ries.	
Unit – I		Introdu	ction:										9+3
Control leve	el for pro	cess and	motion cor	ntrol functions	s, Distribut	mation System ted control systed ated automation	stem - S	Supervis	ory level for	Data	loggir	ng and	art devices Acquisitio
Jnit – II				ment-Senso									9+3
low measu		technique	s – Measuı	rement of lev	el, humidit	Temperature, ty, pH.	Pressu	re, Force	, Displacem	ent ar	nd spe	eed me	asuremen
Jnit – III				ment- Actua		Fl O	41 1/-1	1	ll l А -	4 4	0		9+3
Components	ts and Sy	/mbols – F	Pumps, fan			nal Flow Con atic Control Sy							
Jnit – IV	1 301301		S Controls										9+3
ntroduction of Processe	s – First	ess contro , Second a	l – Automa and Higher	tic Process C Order Proces	ss Systems	leed for Auton s – Feed Forw ferential Conti	ard Cor	ntrol – Ca	scade Cont	rol – F	Ratio (Control	Selective
Jnit – V			d HMI Con	<u> </u>	1111010 111	TOTOTILIAI OOTILI	101 1110	raoung		.01110	iviait	· variat	9+3
	to PLC-				C process	sor modules -ii	nput/out	put mod	ules – Paral	lel /Lo	cal ar	nd Seria	
						based on I/C timer / counter							
EXT BOOI	K:	Math ins	tructions –	sequencer In	structions.				Lect	ure:4	5, Tut	torial:1	5, Total:6
FEXT BOOI	K: Krishnasv	Math ins	Process Co	sequencer In	structions.		ional(P)	Ltd, Ne	Lect	ure:4 5	5, Tut Inits I	torial:1	5, Total:6
1. K 2. F	K: Krishnasv Frank D.	Math ins	Process Co	sequencer In ontrol", 2nd E mable Logic	structions. dition, Nev	w Age Internat	ional(P) McGra	Ltd, Ne w Hill, Ne	Lect wDelhi, 2019 ew Delhi, 20	ure:4: 5 for U	5, Tut Inits I	torial:1	5, Total: 6
I. K 2. F REFERENCE I. N	K: Krishnasv Frank D. CES:	vamy K, "l Petruzella	Process Co , "Program on Industria	ontrol", 2nd E mable Logic	dition, Nev	w Age Internat s", 5th edition,	ional(P) McGra	Ltd, Ne w Hill, No dhyay ai	Lect wDelhi, 2019 ew Delhi, 20 and Mr.S.Sen	5 for U 19 for of IIT	Inits I	t orial:1 , II, III, I V. ragpur.	5, Total:6
FEFERENCE N	K: Krishnasv Frank D. CES: NPTEL w Bill Drury,	vamy K, "I Petruzella eb book c	Process Co , "Program on Industria	ontrol", 2nd E mable Logic I Automation iques Drives	dition, Nev Controllers and control	w Age Internat s", 5th edition, ols by Mr. S.M	ional(P) McGrav lukhopa ", 2nd E	Ltd, Ne w Hill, No dhyay ar dition, IE	wDelhi, 2019 wDelhi, 2019 and Mr.S.Sen	5 for U 19 for of IIT	Inits I	t orial:1 , II, III, I V. ragpur.	5, Total:6
REFERENCE B COURSE O	K: Krishnasv Frank D. CES: NPTEL w Bill Drury, ukas, Mic	wamy K, "I Petruzella eb book c "The Cor	Process Co , "Program on Industria ntrol Techni	ontrol", 2nd E mable Logic I Automation iques Drives	dition, Nev Controllers and control and Control stemsll, Va	w Age Internat s", 5th edition, ols by Mr. S.M	ional(P) McGrav lukhopa ", 2nd E	Ltd, Ne w Hill, No dhyay ar dition, IE	wDelhi, 2019 wDelhi, 2019 and Mr.S.Sen	5 for U 19 for of IIT	Jnits I, Unit \(\) , Khai	torial:1 , II, III, I V. ragpur. eries, 2	5, Total:6
REFERENCE B. B. Lu COURSE O Course of the complete	K: Krishnasv Frank D. CES: NPTEL w Bill Drury, ukas, Michael Company	wamy K, "I Petruzella eb book c "The Cor chael P., -	Process Co , "Program on Industria ontrol Techni — Distribute e, the stud	ontrol", 2nd E mable Logic I Automation iques Drives	dition, Nev Controllers and control and Control stems , Va	w Age Internat s", 5th edition, ols by Mr. S.M ols Handbook	ional(P) McGrav lukhopa ", 2nd E	Ltd, Ne w Hill, No dhyay ar dition, IE	wDelhi, 2019 wDelhi, 2019 and Mr.S.Sen	5 for U 19 for of IIT	Jnits I, Unit \(\) , Khai rgy S (Hi	torial:1 , II, III, I V. ragpur. eries, 2 3T Mapighest	5, Total:6
REFERENCE 1. N 2. B 3. Lu COURSE O On complete CO1 ur	K: Krishnasv Frank D. CES: NPTEL w Bill Drury, ukas, Midention of tenderstan	wamy K, "I Petruzella eb book c "The Cor chael P., -	Process Co , "Program on Industria ntrol Techni — Distribute e, the stud grated indu	ontrol", 2nd E mable Logic I Automation iques Drives ed Control Sy	dition, Nev Controllers and control and Control stemsll, Va	w Age Internat s", 5th edition, ols by Mr. S.M ols Handbook	ional(P) McGrav ukhopa ", 2nd E	Ltd, Ne w Hill, No dhyay ar dition, IE	wDelhi, 2019 wDelhi, 2019 and Mr.S.Sen	5 for U 19 for of IIT	Jnits I, Unit \(\) , Khai rgy S (Hi Unde	torial:1 , II, III, I V. ragpur. eries, 2 3T Mapighest	5, Total:6 V 009. pped Level)
REFERENCE 1. N 2. B 3. Lu COURSE O On complete CO1 ur	K: Krishnasv Frank D. CES: NPTEL w Ukas, Mid OUTCOM Stion of t Inderstan	wamy K, "I Petruzella eb book of "The Corr chael P., -	Process Co , "Program on Industria on Industria on Industria on Industria on Industria on Industria on Industria	ontrol", 2nd E mable Logic I Automation iques Drives ed Control Sy lents will be ustrial automa	dition, Nev Controllers and control and Control stemsII, Va able to	w Age Internates", 5th edition, ols by Mr. S.M ols Handbook an Nostrand R	ional(P) McGrav Jukhopa ", 2nd E einfold (Ltd, Ne w Hill, No dhyay ar dition, IE Compan	wDelhi, 2019 wDelhi, 2019 and Mr.S.Sen	5 for U 19 for of IIT	Jnits I, Unit \(\) , Khai rgy S (Hi Und	torial:1 , II, III, I V. ragpur. eries, 2 BT Mapighest erstand	5, Total:6 V 009. pped Level) ling (K2)
REFERENCE B. B. Lu COURSE O CO1 ur CO2 ur CO3 ur	K: Crishnasv Frank D. CES: NPTEL w Bill Drury, ukas, Mic OUTCOM etion of t nderstan utilize the	wamy K, "I Petruzella eb book c "The Cor chael P., - IES: he course d the inte	Process Co , "Program on Industria ntrol Techni — Distribute e, the stud grated indu	ontrol", 2nd E mable Logic I Automation iques Drives ed Control Sy lents will be ustrial automa	dition, Nev Controllers and control and Control stems , Va	w Age Internates", 5th edition, ols by Mr. S.M ols Handbook an Nostrand R m	ional(P) McGrav Jukhopa ", 2nd E einfold (Ltd, Ne w Hill, No dhyay ar dition, IE Compan	wDelhi, 2019 wDelhi, 2019 and Mr.S.Sen	5 for U 19 for of IIT	Jnits I, Unit \(\) , Khai rgy Si (Hi Und	torial:1 , II, III, I V. ragpur. eries, 2 3T Marighest erstand pplying	5, Total:6 V 009. pped Level) ling (K2)
REFERENCE I. N B. B. Lu COURSE O On complete CO1 ur CO2 ur CO3 ur CO4 ur	K: Crishnasv Frank D. CES: NPTEL w Bill Drury, ukas, Mid OUTCOM etion of t nderstan utilize the	wamy K, "I Petruzella eb book c "The Cor chael P., - IES: he course d the inte Field leve	Process Co , "Program on Industria ntrol Techni — Distribute e, the stud grated indu el equipmer el equipmer cess contro	ontrol", 2nd E mable Logic I Automation iques Drives ed Control Sy lents will be ustrial automa nt-sensors for	dition, New Controllers and control and Control stemsII, Va able to tion system or different interesting the control tion different interesting the control differ	w Age Internates", 5th edition, ols by Mr. S.M ols Handbook an Nostrand R m	ional(P) McGrav lukhopa ", 2nd E einfold (Ltd, Ne w Hill, No dhyay ar dition, IE Compan	wDelhi, 2019 wDelhi, 2019 and Mr.S.Sen	5 for U 19 for of IIT	Jnits I, Unit \(\) Try	torial:1 , II, III, I V. ragpur. eries, 2 3T Marighest erstand pplying	5, Total:6 V 009. pped Level) ling (K2) I (K3) I (K3)
REFERENCE COURSE OF COOL OF C	K: Crishnasv Frank D. CES: NPTEL w Bill Drury, ukas, Mid OUTCOM etion of t nderstan utilize the	wamy K, "I Petruzella eb book c "The Cor chael P., - IES: he course d the inte Field leve	Process Co , "Program on Industria ntrol Techni — Distribute e, the stud grated indu el equipmer el equipmer cess contro	control", 2nd E mable Logic I Automation iques Drives ed Control Sy lents will be ustrial automa nt-sensors fo nt-Actuators fo ols in Industri	dition, Nev Controllers and control and Control stems , Va	w Age Internates", 5th edition, ols by Mr. S.M ols Handbook an Nostrand R	ional(P) McGrav lukhopa ", 2nd E einfold (Ltd, Ne w Hill, No dhyay ar dition, IE Compan	wDelhi, 2019 wDelhi, 2019 and Mr.S.Sen	5 for U 19 for of IIT	Jnits I, Unit \(\) Try	torial:1 , II, III, I V. ragpur. eries, 2 3T Marighest erstance pplying erstance	5, Total:6 V 009. pped Level) ling (K2) (K3) (K3)
K K C F C C C C C C C C	K: Crishnasv Frank D. CES: NPTEL w Bill Drury, ukas, Mid OUTCOM etion of t nderstan utilize the understar apply the	wamy K, "I Petruzella eb book c "The Cor chael P., - IES: he course d the inte Field leve	Process Co , "Program on Industria ontrol Technic — Distribute e, the stud grated indu el equipmen el equipmen cess contro of PLC in co	control", 2nd E mable Logic I Automation iques Drives ed Control Sy lents will be ustrial automa nt-sensors fo nt-Actuators fo ols in Industri	dition, Nev Controllers and control and Control stemsII, Va able to tion system or different in for different in es and Industria	w Age Internates", 5th edition, ols by Mr. S.M ols Handbook an Nostrand R m industrial applet industrial applet al applications	ional(P) McGrav lukhopa ", 2nd E einfold (Ltd, Ne w Hill, No dhyay ar dition, IE Compan	wDelhi, 2019 wDelhi, 2019 and Mr.S.Sen	5 for U 19 for of IIT	Inits I, Unit ' , Khai rgy Si (Hi Und	torial:1 , II, III, I V. ragpur. eries, 2 3T Marighest erstance pplying erstance	5, Total:6 V 009. pped Level) ling (K2) (K3) (K3)
1. K 2. F REFERENC 1. N 3. Lu COURSE O On complet CO1 ur CO2 ur CO3 ur CO4 ur	K: Krishnasv Frank D. CES: NPTEL w Bill Drury, ukas, Mid etion of t nderstan utilize the understar	wamy K, "I Petruzella eb book of "The Cor chael P., - IES: he course d the inte Field leve nd the Pro concepts	Process Co , "Program on Industria ontrol Techni — Distribute e, the stud grated indu el equipmen cess contro of PLC in o	pontrol", 2nd E mable Logic I Automation iques Drives ed Control Sy lents will be ustrial automa nt-sensors for nt-Actuators for ols in Industri	dition, Nev Controllers and control and Control stemsII, Va able to tion system or different in for different in es and Industria	w Age Internates", 5th edition, ols by Mr. S.M ols Handbook an Nostrand R m industrial applate industrial applated an applications of the control of the con	iional(P) McGrav lukhopa ", 2nd E einfold (Ltd, Ne w Hill, Ne dhyay ar dition, IE Compan	Lect wDelhi, 2019 ew Delhi, 20 and Mr.S.Sen T Power and y, 2002.	5 for U 19 for of IIT d Ene	Inits I, Unit ' , Khai rgy Si (Hi Und	torial:1 , II, III, I V. ragpur. eries, 2 BT Marighest erstance pplying pplying erstance	5, Total:6 V 009. pped Level) ling (K2) (K3) (K3) ling (K2)

CO3	3	2	1	1		1	1		1	
CO4	3	1				1	1		1	
CO5	3	2	1	1		1	1		1	

		ACCECOMEN					
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	20	40	40				100
CAT3	10	50	40				100
ESE	20	50	30				100

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

Programm	ne &	AUDE	/DT D	· · · · · · · · · · · · · · · · · · ·				0	0-1		_	_	0
Branch			Blech B	ranches	s except EEE			Sem.	Category		Т	Р	Credit
Prerequisi	ites	Nil						7	OE	3	0	0	3
Preamble					ntroduce the f								
Unit – I		Introdu	uction to	EVs:									9
Movement	- Conf	igurations	s of EVs	- Perfo	opment Strate rmance of E' e Effort in Nor	Vs: Traction	ion Motor	Characte	istics - Tra				
Unit – II		Electri	c Propuls	sion Sys	stems:								9
Source Inv	erter fo	r FOC -	Permane	ent Magr	iples of Induct netic BLDC M :: Basic Magne	lotor Drive	es: Basic	Principles	of BLDC N	Notor D	rives	- BLD	
Jnit – III					ergy Storage								9
		atteries:	Electroch	nemical I	Reactions -	Thermodyı							
					d Battery - Nie rgy Storage.	ckel-Base	ed Batteries	- Lithium	-Based Bat	teries –	Ultrac	apacit	ors - Ultra
Unit – IV	a i iyvvii		Electric		· ·								9
	f Hybrid				nitectures of H	lybrid Elec	ctric Drive	rains: Se	ries Hybrid	Electric	Drive	Trains	
Coupling) -	- Paralle	l Hybrid E	Electric Di	rive Trair	ns (Mechanica	al Coupling	g) - Hybrid	Drive Tra	ns with Bot	n Torqu	e and	Speed	Coupling
Jnit – V													
) L — V		Fuel C	all Hybrid	d Flactri	ic Drive Train	١•							a
Operating I Orive Train	Principle Design	s of Fuel	Cells - Fu	uel Cell S	ic Drive Train System Charac trategy - Para	cteristics -	Fuel Cell 1 sign.	echnolog	ies - Fuel Sı	ıpply - F	uel Ce	ell Hyb	
Drive Train	Design	s of Fuel	Cells - Fu	uel Cell S	System Charac	cteristics -	Fuel Cell 7	echnolog	ies - Fuel Sı	upply - F	uel Ce	ell Hyb	rid Electric
Drive Train	OK: Mehro Theor	es of Fuel : Configu	Cells - Furation - C	uel Cell S Control St Gao& Ali	System Charac	cteristics - metric Des	esign. c, Hybrid E						rid Electrid
Operating Invited Train TEXT BOO 1. REFEREN	OK: Mehro Theor	es of Fuel : Configu dedEhsar y and De	Cells - Furation - C	uel Cell S Control Sf Sao& Ali d Edition	System Charac trategy - Para Emadi, "Mode I, CRC Press,	ern Electric USA, 201	esign. c, Hybrid E 10.	ectric, ar	d Fuel Cell	Vehicle	s: Fun	damer	rid Electrid
Drive Train TEXT BOO 1. REFEREN	OK: Mehro Theor CES:	es of Fuel : Configu dedEhsar y and De	Cells - Furation - C	uel Cell S Control St Gao& Ali d Edition	System Charac trategy - Para Emadi, "Mode n, CRC Press,	ern Electric USA, 201	c, Hybrid E	ectric, ar	d Fuel Cell tion, CRC F	Vehicle ress, U	s: Fun SA, 20	damer	Total:4
Drive Train TEXT BOO 1. REFEREN 1.	Mehror Theor	dedEhsar y and De Hussain, '	Cells - Furation - C	uel Cell S Control St Gao& Ali d Edition and Hybri	System Charac trategy - Para Emadi, "Mode I, CRC Press,	ern Electric USA, 201 Lesign Fun	c, Hybrid E	ectric, ar	d Fuel Cell tion, CRC F	Vehicle ress, U	s: Fun SA, 20	damer	Total:4
TEXT BOO 1. REFEREN 1.	Mehro Theor CES: Iqball Chris Persp	es of Fuel : Configu dedEhsar y and De Hussain, ' Mi, Abull ectives",	Cells - Furation - C	uel Cell S Control St Gao& Ali d Edition and Hybri	Emadi, "Mode n, CRC Press, d WenzhongG	ern Electric USA, 201 Lesign Fun	c, Hybrid E	ectric, ar	d Fuel Cell tion, CRC F	Vehicle ress, U	s: Fun SA, 20	damer 011. ns Wit	Total:4 ntals,
TEXT BOO 1. REFEREN 1. COURSE (Mehro Theor CES: Iqball Chris Persp	es of Fuel : Configu dedEhsar y and De Hussain, ' Mi, Abull ectives",	Cells - Fu ration - C ni, YiminG sign", 2nd 'Electric a Wasrur M 1st Editio	uel Cell S Control St Gao& Ali d Edition and Hybri & David on, Wiley	Emadi, "Mode n, CRC Press, d WenzhongG	ern Electric USA, 201 resign Fun iao, "Hybri	c, Hybrid E	ectric, ar	d Fuel Cell tion, CRC F	Vehicle ress, U	s: Fun SA, 20 lication	damer 011. ns With	Total:4
TEXT BOO 1. REFEREN 1. 2. COURSE (On comple	DK: Mehro Theor CES: Iqball Chris Persp OUTCO etion of	dedEhsar y and De Hussain, ' Mi, Abull ectives",	Cells - Furation - Contraction	Gao& Alida Edition Band Hybrick Band Hybri	Emadi, "Mode n, CRC Press, d WenzhongG Publication, U	ern Electric USA, 201 design Fun isao, "Hybri JK, 2011.	c, Hybrid E 10. ndamentals rid Electric	ectric, an	d Fuel Cell tion, CRC F	Vehicle ress, U	s: Fun	damer 011. ns With BT M Higher	Total:4 Total:4 Intals, h Practical Impled st Level)
TEXT BOO 1. REFEREN 1. COURSE (On comple	Mehro Theor Ices: Iqball Chris Persp OUTCO etion of explain	dedEhsar y and De Hussain, ' Mi, Abull ectives", MES: the coun	Cells - Furation - Contraction	Gao& Alid Edition Band Hybrick Band Hybrick Band Wiley Band differ	Emadi, "Mode in, CRC Press, and Vehicles: Del id WenzhongG in Publication, U	ern Electric USA, 201 esign Fun ao, "Hybri JK, 2011. to	c, Hybrid E 10. ndamentals rid Electric	ectric, an	d Fuel Cell tion, CRC F	Vehicle ress, U	s: Fun	damer 011. ns With BT M Higher dersta	Total:4 Total:4 Intals, Int
TEXT BOO I. COURSE (CO) CO) CO)	Mehror Theorem CES: Iqball Chris Persp OUTCO etion of explain disting	es of Fuel : Configu dedEhsar y and De dussain, ' Mi, Abull ectives", MES: the coul n the imp	Cells - Furation - Contraction	Gao& Alide Edition and Hybride Daviden, Wiley students and differ	Emadi, "Mode trategy - Para Emadi, "Mode n, CRC Press, rid Vehicles: D d WenzhongG r Publication, U	ern Electric USA, 201 esign Fun iao, "Hybri JK, 2011. to tions of ele	c, Hybrid E 10. Indamentals rid Electric ectric vehic	ectric, an	d Fuel Cell tion, CRC F	Vehicle ress, U	s: Fun SA, 20 lication Un	damer 011. ns With Higher dersta	Total:4 Total:4 ntals, h Practical lapped st Level) nding (K2
COURSE (CO)	Mehror Theorem CES: Iqball-Chris Persp OUTCO etion of explair disting identification of the control of the co	es of Fuel : Configu dedEhsar y and De Hussain, ' Mi, Abull ectives", MES: the coul n the imp	Cells - Furation - Continue of the contance of	Gao& Ali de Edition and Hybride Davidon, Wiley and differents of energy	Emadi, "Mode n, CRC Press, d WenzhongG Publication, U	ern Electric USA, 201 esign Fun fao, "Hybri JK, 2011. to tions of ele r drives for	c, Hybrid E 10. Indamentals rid Electric ectric vehic	ectric, an	d Fuel Cell tion, CRC F	Vehicle ress, U	s: Fun SA, 20 lication Un	damer 011. BT M Higher dersta dersta	Total:4 Total:4 htals, h Practica apped st Level) nding (K2
TEXT BOO 1. REFEREN 1. COURSE (On comple	Mehror Theorem CES: Iqball-Chris Perspetion of explaid disting identification in the control of	dedEhsar y and De Hussain, ' Mi, Abull ectives", the coul n the imp	Cells - Furation - Continue of the second of	Gao& Ali de Edition and Hybride Ali de Edition by the Edition Ali de Edition and different Ali de Edition	Emadi, "Mode trategy - Para Emadi, "Mode n, CRC Press, rid Vehicles: D d WenzhongG r Publication, l s will be able rent configura various motor y storage syste	ern Electric USA, 201 esign Fun tao, "Hybri JK, 2011. to tions of ele r drives for ems in EV	c, Hybrid E 10. Indamentals rid Electric ectric vehic r EVs	ectric, an	d Fuel Cell tion, CRC F	Vehicle ress, U	s: Fun	damer 011. BT M Higher dersta dersta Applyi	Total:4 Total:4 Intals, Int
TEXT BOO 1. REFEREN 1. COURSE (On comple	Mehror Theorem CES: Iqball-Chris Perspetion of explaid disting identification in the control of	dedEhsar y and De Hussain, ' Mi, Abull ectives", the coul n the imp	Cells - Furation - Continue of the second of	Gao& Ali de Edition and Hybride Ali de Edition by the Edition Ali de Edition and different Ali de Edition	Emadi, "Mode n, CRC Press, rid Vehicles: D d WenzhongG Publication, l s will be able rent configurations various motor	ern Electric USA, 201 esign Fun tao, "Hybri JK, 2011. to tions of ele r drives for ems in EV	c, Hybrid E 10. Indamentals rid Electric ectric vehic r EVs	ectric, an	d Fuel Cell tion, CRC F	Vehicle ress, U	s: Fun	damer 011. BT M Higher dersta dersta Applyi	Total:4 Total:4 Intals, Int
COURSE (CO) CO2 CO3 CO4 CO5	Mehror Theorem CES: Iqball Chris Perspection of explair disting identification of the control o	dedEhsarry and De Hussain, ' Mi, Abull ectives", MES: the coult the important the important the country and the important the country that the country the important the country that the country the important the country that the co	Cells - Furation - Contact of the concept of the co	Gao& Ali de Edition and Hybride And Baviden, Wiley students and differentiation of energy hybrid electron of fuel of	Emadi, "Mode trategy - Para Emadi, "Mode n, CRC Press, id Vehicles: De d WenzhongG Publication, Use will be able rent configurar various motor v storage syste ectric drive train	ern Electric USA, 201 esign Fun iao, "Hybri JK, 2011. to tions of ele r drives for ems in EV ains in Hybrid COs with	c, Hybrid E 10. Indamentals rid Electric ectric vehic r EVs /s	ectric, and ', 2nd Ed	d Fuel Cell tion, CRC F Principles A	Vehicle ress, U	s: Fun	damer 011. BT M Higher dersta dersta Applyi Applyi dersta	Total:4 Total:4 Intals, Intals, In Practical Inding (K2 Inding (K3) Ing (K3) Ing (K3) Inding (K2
TEXT BOO 1. REFEREN 1. 2. COURSE (Mehror Theorem CES: Iqball-Chris Perspetion of explaid disting identification in the control of	dedEhsar y and De Hussain, ' Mi, Abull ectives", the coul n the imp	Cells - Furation - Contact of the concept of the co	Gao& Ali de Edition and Hybride And Baviden, Wiley students and differentiation of energy hybrid electron of fuel of	Emadi, "Mode trategy - Para Emadi, "Mode n, CRC Press, rid Vehicles: D d WenzhongG r Publication, l s will be able rent configura various motor r storage syste ectric drive train	ern Electric USA, 201 esign Fun iao, "Hybri JK, 2011. to tions of ele r drives for ems in EV ains in Hybrid COs with	c, Hybrid E 10. Indamentals rid Electric ectric vehic r EVs	ectric, and ', 2nd Ed	d Fuel Cell tion, CRC F	Vehicle ress, U	s: Fun	damer 011. BT M Higher dersta dersta Applyi	Total:4 Total:4 Intals, h Practical apped st Level) Inding (K2 Inding (K3)

CO3	2	3	1	1	1	1	1		1	
CO4	3	2		1	1	1	1		1	
CO5	3	2	1	1	1	1	1		1	

		ACCECCIVIE					
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	30	40	30				100
CAT3	20	40	40				100
ESE	30	40	30				100

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

Programme & Branch	All BE/BTech Branches except EEE Sem	n. Category	L	Т	Р	Credit
Prerequisites	Nil 7	OE	3	0	0	3
Preamble	This course covers various aspects of Waste from Electrical and Elealong with recycling with an integrated approach. It also gives an inswaste and domestic hazardous waste.					•
Unit – I	Introduction					9
WEEE - Material Safety Implications	and Electronic Equipment (WEEE) - The Scale of the Problem - Electromposition of WEEE - Socio-economic Factors - International Pers - Influence factors - Materials Used in Manufacturing Electrical and Elembly - Printed Circuit Board Materials - Mobile Phones - Televisions - Waste Disposal and Recycling	pective - Barrie ectronic Product	rs to s - S	Rec older	ycle - ing ar	Health and the Move
Waste (EFW) - A	dfill - Pollution from Landfills - Landfill Gas - Landfill-site Construction dvanced Thermal Processing - Pollution from Incineration – Recyclin its and Markets - Emerging Technologies – Separation – Treatments –	g and recovery				
Unit – III	Integrated Approach to E-waste Recycling					9
and Recovery Te Extraction - Dry (cling and Recovery Technologies - Sorting/Disassembly - Crushing/Dirchnologies - Automated Disassembly - Comminution – Separation - Capture Technologies - Biotechnological Capture - Sensing Technolorinted Circuit Boards - Recycling - Characteristics of PCB Scrap - Em	Thermal Treati ogies - Design	ment for I	s - ⊢ Recy	lydror	netallurgica and Invers
Unit – IV	Recycling of Display Devices and ERP					9
Manufacturing Pro	rview of Liquid Crystals - Classification - Architecture - Liquid Crystal cess – Environmental Lifecycle Analysis – Toxicity of LCD Constituents Principles – Structure - Scope of services - Operational Model - Key Pe	- Recycling. E	urope	ean R		
Unit – V	Special Waste & Domestic Hazardous Waste Management					9
Hierarchy - Plastic	sting Rules for the management of wastes - Guidance from the Inte waste - Bio-medical Waste - Slaughterhouse Waste – E-Waste Man ction Points for Awareness Generation.					
TEXT BOOK:						
	E., Harrison R.M., "Electronic waste management", 1st Edition, Royal Se-UK, 2009	Society of Chem	nistry	(RS	C) pul	olishers,
2. "Municipa New Delh		stry of Urban De	velo	pmer	it, Go	vt. of. India
REFERENCES:	l Solid waste Management Manual Part II", 1st Edition, CPHEEO, Minis i, 2016					
		<u>, </u>				
1. Press, Ne	i, 2016 E-waste: implications, regulations, and management in India and curre w Delhi, 2008.		raction			dition, TER
Press, Ne	i, 2016 E-waste: implications, regulations, and management in India and curre	: Engineering, F	raction			dition, TER
Press, Ne Tchobanc issues", 1 COURSE OUTCO On completion or	E-waste: implications, regulations, and management in India and curre w Delhi, 2008. glous G., Theisen H., Viquel S.A., "Integrated Solid Waste Management st Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 201. MES: If the course, the students will be able to	: Engineering, F 4.	raction	ples a	and M	dition, TER
Press, Ne Tchobanc issues", 1 COURSE OUTCO On completion or	E-waste: implications, regulations, and management in India and curre w Delhi, 2008. glous G., Theisen H., Viquel S.A., "Integrated Solid Waste Management st Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 201. MES: if the course, the students will be able to due to the challenges and issues of E-wastes and its source of emerging with the course.	: Engineering, F 4.	raction	ples a	and M BT Ma	dition, TER anagemen
Press, Ne COURSE OUTCO On completion or understar recycling	E-waste: implications, regulations, and management in India and curre w Delhi, 2008. glous G., Theisen H., Viquel S.A., "Integrated Solid Waste Management st Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 201. MES: if the course, the students will be able to due to the challenges and issues of E-wastes and its source of emerging with the course.	: Engineering, F 4.	raction	ples a	and M BT Ma ighes erstar	dition, TER anagemen apped t Level)
Press, Ne Tchobanc issues", 1 COURSE OUTCO On completion or CO1 understar recycling CO2 infer hanc CO3 apply the	E-waste: implications, regulations, and management in India and curre w Delhi, 2008. glous G., Theisen H., Viquel S.A., "Integrated Solid Waste Management at Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 201. MES: If the course, the students will be able to add the challenges and issues of E-wastes and its source of emerging with t. Iling and processing the E wastes and its disposal & recovery.	: Engineering, F 4. h its barriers for	raction	ples a (Hi Und	and M BT Ma ighes erstar erstar	dition, TER anagemen apped t Level) ading (K2)
Press, Ne Tchobanc issues", 1 COURSE OUTCO On completion or CO1 understar recycling CO2 infer hanc CO3 apply the CO4 understar scheme	E-waste: implications, regulations, and management in India and curre w Delhi, 2008. glous G., Theisen H., Viquel S.A., "Integrated Solid Waste Management st Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 201 MES: If the course, the students will be able to add the challenges and issues of E-wastes and its source of emerging with it. Illing and processing the E wastes and its disposal & recovery. It reatment methods for the E waste recycling technologies. In the thick the trecycling procedures of LCD devices and infer the European Recovery.	: Engineering, F 4. h its barriers for cycling Platform	raction	Ples a (Hi Unde	BT Maighes erstar erstar	dition, TEF anagemer apped t Level) ading (K2)
1. Press, Ne 2. Tchobanc issues", 1 COURSE OUTCO On completion or CO1 understar recycling CO2 infer hanc CO3 apply the CO4 understar scheme CO5 utilize the	E-waste: implications, regulations, and management in India and curre w Delhi, 2008. glous G., Theisen H., Viquel S.A., "Integrated Solid Waste Management at Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 201. MES: If the course, the students will be able to add the challenges and issues of E-wastes and its source of emerging with t. Iling and processing the E wastes and its disposal & recovery.	: Engineering, F 4. h its barriers for cycling Platform	raction	Ples a (Hi Unda Unda Unda	and M BT Ma ighes erstar erstar pplyir erstar	dition, TE anageme apped t Level) ading (K2) ading (K2)

					Mappi	ng of C	Os with	POs a	nd PSC)s				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1				1						1		
CO2	3	1				1	2					1		
CO3	3	2	1	1		1						1		
CO4	3	1				1	2					1		
CO5	3	2	1	1		1						1		

ASSES	SMFNT	PATI	FRN .	- THEORY

				_			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	50					100
CAT2	30	50	20				100
CAT3	30	50	20				100
ESE	30	50	20				100
+3% may be varied	(CAT 1 2 8 2 50)	marks & ESE 100	marke)				

^{* ±3%} may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

Program			220014 - 0	EMBEDDED SY	OTEN DEGIG	V				1	
Branch	me &	All BE/BTech	Branches except El	EE	Se	m.	Category	L	Т	P	Credit
Prerequi	isites	Nil			7	,	OE	3	0	0	3
reamble	Э	networking pr	nparts knowledge abo otocolsand provides a								
Jnit – I		Introduction	ure. t o Embedded Syste r	ns:							9
ntroducti Memory		pedded System ent methods –	s – Structural units in Timer and Counting	Embedded prod							es – DMA
Jnit – II		Embedded N	etworking Protocols	:							9
			n, I/O Device Ports & eral Interface (SPI) – I							andard	– RS422 -
Jnit – III		ARM Proces	sor and Programmin	g:							9
Data ali	gnment ar	nd byte ordering	SC features - Levels i - ARM Instruction Set Languages - System	t Architecture (IS	SA) - pipelining	-S	mple Assem				
Jnit – IV	1	ARM7TDMI b	ased SoC:								9
Nested v		terrupt controlle	apping for data, code & Interrupts in LPC2								
Jnit – V		ARM7 protoc	ols and Operating S	ystems:							9
			Introduction: RTOS N n cycle in the develop		ating system se	rvice	es - CPU me	trics	- RTO	S Tasl	c schedulin
FEXT BC	OS securi DOK: Camal R, " Delhi, 201	ty issues - Desiq Embedded syst	Introduction: RTOS N n cycle in the develop	ecessity - Ópera oment phase for a	ating system se an embedded s design", second	rvice syste	es - CPU me em - Issues i tion, Tata M	trics n Em	- RTO	S Tasked Sys	c schedulin tem Design Total:4 ation, New
FEXT BC	OS securi DOK: Kamal R, " Delhi, 201 Wayne Wo Publishers	ty issues - Designment Embedded syst I. If, "Computers a	Introduction: RTOS N n cycle in the develop	ecessity - Ópera oment phase for a ogramming and c iples of Embedd	ating system se an embedded s design", second	rvice syste	es - CPU me em - Issues i tion, Tata M	trics n Em	- RTO	S Tasked Sys	c schedulin tem Design Total:4 ation, New
FEXT BC	OS securi OOK: Kamal R, " Delhi, 201' Wayne Wo Publishers ENCES:	Embedded syst I. If, "Computers a	Introduction: RTOS N n cycle in the develop	ecessity - Ópera oment phase for a ogramming and c iples of Embedd	design", second	rvice syste	es - CPU me em - Issues i tion, Tata M em Design"	trics n Em	- RTO	S Tasked Sys	c schedulin tem Design Total:4 ation, New
FEXT BC	OS securi OOK: Kamal R, " Delhi, 201' Wayne Wo Publishers INCES: Furber SB,	Embedded syst I. If, "Computers a, San Francisco"	Introduction: RTOS N n cycle in the develop ems: architecture, prosecond edition, 2008 n-chip architecture", s	ecessity - Opera oment phase for a ogramming and c iples of Embedd in the control of the control	design", seconded Computing	rvice syste d ed Sys	es - CPU me em - Issues i tion, Tata M em Design"	trics n Em	- RTO	S Tasked Sys	c schedulin tem Design Total:4 ation, New
FEFERE	OS securi OOK: Kamal R, " Delhi, 201' Wayne Wo Publishers INCES: Furber SB,	Embedded syst I. If, "Computers a, San Francisco"	Introduction: RTOS N n cycle in the develop	ecessity - Opera oment phase for a ogramming and c iples of Embedd in the control of the control	design", seconded Computing	rvice syste d ed Sys	es - CPU me em - Issues i tion, Tata M em Design"	trics n Em	- RTO	S Tasked Sys	c schedulin tem Design Total:4 ation, New
TEXT BC I. C REFERE I. F	OS securi OOK: Kamal R, " Delhi, 201' Wayne Wo Publishers ENCES: Furber SB, Chattopadl	Embedded syst I. If, "Computers a, San Francisco" "ARM system-onyay S, "Embed	Introduction: RTOS N n cycle in the develop ems: architecture, prosecond edition, 2008 n-chip architecture", s	ecessity - Opera oment phase for a orgramming and consiples of Embeddes.	design", second ed Computing Pearson Educa	rvice system d ed Sys	es - CPU me em - Issues i tion, Tata M tem Design" 2000.	trics n Em	- RTO	S Tasked Sys	c schedulin tem Desigr Total:4 ation, New
TEXT BC 1.	OS securi OOK: Kamal R, " Delhi, 201' Wayne Wo Publishers ENCES: Furber SB, Chattopadl	Embedded syst I. If, "Computers a, San Francisco "ARM system-onyay S, "Embed - Ipc214x User i	introduction: RTOS N n cycle in the develop ems: architecture, pro s Components: Princi second edition, 2008 n-chip architecture", s	ecessity - Opera oment phase for a orgramming and consiples of Embeddes.	design", second ed Computing Pearson Educa	rvice system d ed Sys	es - CPU me em - Issues i tion, Tata M tem Design" 2000.	trics n Em	- RTO	S Tasked Sys	Total:4 ation, New
TEXT BO	OS securi OOK: Kamal R, " Delhi, 201' Wayne Wo Publishers ENCES: Furber SB, Chattopadl JM10139	Embedded syst I. If, "Computers a, San Francisco "ARM system-onyay S, "Embed - lpc214x User I	introduction: RTOS N n cycle in the develop ems: architecture, pro s Components: Princi second edition, 2008 n-chip architecture", s	ecessity - Opera oment phase for a orgramming and contiples of Embeddes. second edition, F second edition, F second edition, F	design", second ed Computing Pearson Educa	rvice system d ed Sys	es - CPU me em - Issues i tion, Tata M tem Design" 2000.	trics n Em	- RTO	S Tasked Sys	c schedulintem Design Total:4 ation, New
FEXT BC REFERE 1. F 2. F 3. C COURSE On comp	OS securi DOK: Kamal R, " Delhi, 201' Wayne Wo Publishers ENCES: Furber SB, Chattopadl JM10139 -	Embedded syst I. If, "Computers a San Francisco "ARM system-o hyay S, "Embed - lpc214x User i	introduction: RTOS N n cycle in the develop ems: architecture, pro s Components: Princi second edition, 2008 n-chip architecture", s ded System Design", s nanual - https://www.r	ecessity - Opera oment phase for a orgramming and complete of Embedden iples of Embedden second edition, For second edition, F	design", second ed Computing Pearson Educa	rvice system d ed Sys	es - CPU me em - Issues i tion, Tata M tem Design" 2000.	trics n Em	- RTO hbedde	S Tasked Sys Educa aufma 3T Makighest	Total:4 ation, New
FEXT BC REFERE B. COURSE COURSE CO1 6	OS securi OOK: Kamal R, " Delhi, 201' Wayne Wo Publishers ENCES: Furber SB, Chattopadl JM10139 E OUTCOM pletion of explain the	Embedded syst I. If, "Computers a, San Francisco "ARM system-onyay S, "Embed - Ipc214x User I	Introduction: RTOS N n cycle in the develop ems: architecture, prosecond edition, 2008 n-chip architecture", seded System Design", senanual - https://www.r	ecessity - Opera oment phase for a orgramming and complete of Embedden iples of Embedden second edition, For second edition edition edition edition edition edition.	design", second ed Computing Pearson Educa PHI Learning F	d ed Sys tion:	es - CPU me em - Issues i tion, Tata M tem Design" 2000.	trics n Em	- RTO hbedde w-Hill gan K	S Tasked Sys Educa aufma 3T Makighest	Total:4 ation, New n pped Level) ding (K2)
FEXT BC REFERE COURSE COURSE CO1 6 CO2 id	OS securi OOK: Kamal R, " Delhi, 201' Wayne Wo Publishers ENCES: Furber SB, Chattopadl JM10139 - E OUTCOR pletion of explain the	Embedded syst I. If, "Computers a, San Francisco "ARM system-onyay S, "Embedded syst I. Ithe course, the basic building the distinguish the	introduction: RTOS N n cycle in the develop ems: architecture, prosecond edition, 2008 n-chip architecture", seded System Design", senanual - https://www.r	ecessity - Ópera oment phase for a orgramming and contiples of Embedded. second edition, Foresecond editio	design", second ed Computing Pearson Educa PHI Learning For the computing of the computing	d ed Sys tion:	es - CPU me em - Issues i tion, Tata M tem Design" 2000.	trics n Em	- RTO hbedde w-Hill gan K (H Und	S Tasked Sys Educa aufma BT Make ighest erstand	Total:4 ation, New n pped Level) ding (K2)
TEXT BO 1. E 2. F REFERE 1. C 3. L COURSE On comp CO1 E CO2 id CO3 L	OS securion OOK: Kamal R, " Delhi, 201: Wayne Wo Publishers ENCES: Furber SB, Chattopadl JM10139 - E OUTCOM Poletion of explain the dentify and	Embedded syst I. If, "Computers a, San Francisco "ARM system-onyay S, "Embedded syst In the course, the basic building the distinguish the street the course the street system of the architecture system of the	introduction: RTOS N n cycle in the develop ems: architecture, pross Components: Principle second edition, 2008 en-chip architecture", second edition, 2008 en-chip architecture en-chip	ecessity - Ópera oment phase for a orgramming and contiples of Embedded. second edition, For second editi	design", second design", second design", second design des	d ed Sys tion:	es - CPU me em - Issues i tion, Tata M tem Design" 2000.	trics n Em	- RTO hbedde lw-Hill gan K (H Und	S Tasked Sys Educa aufma BT Make ighest erstand	Total:4 Action, New In
TEXT BC 1.	OS securion OOK: Kamal R, " Delhi, 2011 Wayne Wo Publishers NCES: Furber SB, Chattopadl JM10139 E OUTCOM pletion of explain the dentify and understand	Embedded syst I. If, "Computers a, San Francisco "ARM system-onyay S, "Embedded system-onyay	introduction: RTOS N n cycle in the developments: architecture, pross Components: Principle second edition, 2008 n-chip architecture", second edition, 2008 n-chip architecture, prosserious edition, 2008 n-chip architecture", second edition, 2008 n-chip architecture arch	ecessity - Opera oment phase for a orgramming and of iples of Embeddis. second edition, For second edition, For exp.com/docs/er	design", second design", second design", second design des	rvicesystem died ed Sys tion; Pvt. L	es - CPU me em - Issues i tion, Tata M em Design" 2000. td.; 2013.	trics n Em	- RTO hbedde uw-Hill gan K (H Und A	Educa aufma BT Ma ighest erstand pplying	Total:4 Action, New In
FEXT BC I. E REFERE I. F 2. C COURSE CO1 6 CO2 id CO3 U CO4 II	OS securion OOK: Kamal R, " Delhi, 2011 Wayne Wo Publishers NCES: Furber SB, Chattopadl JM10139 E OUTCOM pletion of explain the dentify and understand	Embedded syst I. If, "Computers a, San Francisco "ARM system-onyay S, "Embedded system-onyay	Introduction: RTOS N n cycle in the develop ems: architecture, prosecond edition, 2008 n-chip architecture", seeded System Design", seeded System Design seeded System System seeded System System seeded System System seeded System System seeded System	ecessity - Opera oment phase for a orgramming and of iples of Embeddis. second edition, For second edition, For exp.com/docs/er	design", second design", second design", second design des	rvicesystem died ed Sys	es - CPU me em - Issues i tion, Tata M em Design" 2000. td.; 2013.	trics n Em	- RTO hbedde uw-Hill gan K (H Und A	Educa aufma BT Ma ighest erstand pplying	Total:4 Total:4 ation, New n pped Level) ding (K2) g (K3) ding (K2)

CO1	3	1	2	1	1	1		1	1	1	1	
CO2	3	2	1	1	1	1	2			2	1	
CO3	3	1	2	1	1	1		1	1	1	1	
CO4	3	2	2	2	1	1	2			2	1	
CO5	3	1	2	1	1	1		1	1	1	1	

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	50	20				100
CAT2	30	50	20				100
CAT3	30	50	20				100
ESE	20	55	35				100
	(OAT 4 0 0 0 = 50				·		

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

	22EE015 - ENERGY STORAGE SYSTEMS AND CONTROLLERS				
Programme& Branch	All BE/BTech Branches except EEE Sem. Categor	y L	т	Р	Credit
Prerequisites	Nil 7 OE	3	0	0	3
Preamble	This course aimed to introduce the fundamental concepts and principles of vario that aids in various real time applications.	s ener	gy st	orage	systems
Unit – I	Introduction to Energy Storage Systems				9
	ergy storage systems (ESS) - Historical context of ESS - Drivers for ESS deploy attery: Components of Cells and Batteries – Classification - Operation of a Cell - Theo				
Unit – II	Electrochemical and Mechanical Energy Storage Technologies				9
batteries Mechanical E	cal Energy Storage Systems: Construction, operation and Working Principle of Lithiun nergy Storage Systems: Construction, operation and Working Principle of Pumped Fir Energy Storage (CAES) - Flywheel Energy Storage Systems (FESS)				
Jnit – III	Other Energy Storage Technologies				9
Jltracapacitors: cells, hydrogen	Features- Basic Principles of Ultracapacitors - Hydrogen Storage Systems: Types of air cell, alkaline fuel cell, and phosphoric fuel cellThermal Energy Storage using Pha	uel cel se Cha	ls -hy inge l	droge Materi	n oxygen als (PCM)
Unit – IV	Energy Storage Applications:				9
Integration, Blac Distributed En	rgy Storage Applications: Load Shifting, Frequency Regulation, Voltage Support, Po		_		
Micro grids					
Unit – V Principles of ch Systems (BMS)	Controllers for Energy Storage Systems arge controllers -Types of charge controllers-Charging strategies for energy storage strategies of BMS-Functions and components of BMS-Battery safety and performance.				
Unit - V Principles of ch Systems (BMS) controllers	arge controllers -Types of charge controllers-Charging strategies for energy storage				lanageme n with oth
Unit – V Principles of ch Systems (BMS) controllers TEXT BOOK:	arge controllers -Types of charge controllers-Charging strategies for energy storage so Principles of BMS-Functions and components of BMS-Battery safety and performan	ce-BM	S inte		lanageme n with oth
Unit – V Principles of ch Systems (BMS) controllers TEXT BOOK: 1. David L	arge controllers -Types of charge controllers-Charging strategies for energy storage so Principles of BMS-Functions and components of BMS-Battery safety and performant performant inden, Thomas B. Reddy, "Handbook of Batteries", 4th Edition, McGraw-Hill, New Delands	ce-BM	S inte		lanageme n with oth
Principles of ch Systems (BMS) controllers TEXT BOOK: 1. David L REFERENCES Mehrda	arge controllers -Types of charge controllers-Charging strategies for energy storage so Principles of BMS-Functions and components of BMS-Battery safety and performance of BMS-Battery	ni, 201	S inte	gratio	lanageme n with oth Total:4
Principles of ch Systems (BMS) controllers TEXT BOOK: 1. David L REFERENCES 1. Mehrda New Do NihalKi Elseivie	arge controllers -Types of charge controllers-Charging strategies for energy storage so Principles of BMS-Functions and components of BMS-Battery safety and performance of BMS-Battery	ni, 201 ", 2nd	S inte	on, CR 2nd E	lanageme n with oth Total:4 C Press, dition,
Principles of ch Systems (BMS) controllers TEXT BOOK: 1. David L REFERENCES 1. Mehrda New Do NihalKi Elseivie	arge controllers -Types of charge controllers-Charging strategies for energy storage so Principles of BMS-Functions and components of BMS-Battery safety and performance inden, Thomas B. Reddy, "Handbook of Batteries", 4th Edition, McGraw-Hill, New Delad Ehsani, YiminGao, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicle Ihi, 2018. Ilaratna, KosalaGunawardane, "Energy Storage Devices for Renewable Energy-Base	ni, 201 ", 2nd	S inte	on, CR 2nd E	lanageme n with oth Total:4 C Press, dition,
Unit – V Principles of ch Systems (BMS) controllers TEXT BOOK: 1. David L REFERENCES 1. Mehrda New Do NihalKu 2. Elseivie 3. Sandee	arge controllers -Types of charge controllers-Charging strategies for energy storage so Principles of BMS-Functions and components of BMS-Battery safety and performance inden, Thomas B. Reddy, "Handbook of Batteries", 4th Edition, McGraw-Hill, New Del de Ehsani, YiminGao, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehiclelhi, 2018. Ilaratna, KosalaGunawardane, "Energy Storage Devices for Renewable Energy-Base r, 2021 pDhundhara, Yajvender Pal Verma, "Energy Storage for Modern Power System Oper	ni, 201 ", 2nd	Edition Wile	on, CR 2nd E y, 202	lanageme n with oth Total:4 C Press, dition,
Principles of ch Systems (BMS) controllers FEXT BOOK: 1. David L REFERENCES 1. Mehrda New Do NihalKi 2. Elseivie 3. Sandee COURSE OUTCOn completion	arge controllers -Types of charge controllers-Charging strategies for energy storage so Principles of BMS-Functions and components of BMS-Battery safety and performance inden, Thomas B. Reddy, "Handbook of Batteries", 4th Edition, McGraw-Hill, New Del de Ehsani, YiminGao, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicle Ilhi, 2018. Ilaratna, KosalaGunawardane, "Energy Storage Devices for Renewable Energy-Baser, 2021 pDhundhara, Yajvender Pal Verma, "Energy Storage for Modern Power System Oper	ni, 201 ", 2nd Syste	Edition Wile	on, CR 2nd E y, 202 BT Ma ighes	Total:4
Principles of ch Systems (BMS) controllers TEXT BOOK: 1. David L REFERENCES 1. Mehrda New Do NihalKo 2. Elseivie 3. Sandee COURSE OUTO On completion CO1 unders	arge controllers -Types of charge controllers-Charging strategies for energy storage so Principles of BMS-Functions and components of BMS-Battery safety and performance inden, Thomas B. Reddy, "Handbook of Batteries", 4th Edition, McGraw-Hill, New Del de Ehsani, YiminGao, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehiclelhi, 2018. Ilaratna, KosalaGunawardane, "Energy Storage Devices for Renewable Energy-Base r, 2021 pDhundhara, Yajvender Pal Verma, "Energy Storage for Modern Power System Oper Comes: of the course, the students will be able to	ni, 201 ", 2nd Syste	Edition Wile (H	on, CR 2nd E y, 202 BT Ma ighes	Total:4 CC Press, dition, 1
Principles of ch Systems (BMS) controllers TEXT BOOK: 1. David L REFERENCES 1. Mehrda New Do NihalKi Elseivie 3. Sandee COURSE OUT On completion CO1 unders CO2 summa	Principles of BMS-Functions and components of BMS-Battery safety and performance of BMS-Functions and components of BMS-Battery safety and performance of BMS-BMS-Battery safety and performance of BMS-BMS-Battery safety and performance of BMS-BMS-Battery safety and performance of BMS-BMS-BMS-BMS-BMS-BMS-BMS-BMS-BMS-BMS-	ni, 201 ", 2nd Syste	S inte	on, CR 2nd E y, 202 BT Ma ighes	anageme n with oth Total:4 CC Press, dition, 1 apped t Level) ang (K2) ang (K2)
Principles of ch Systems (BMS) controllers TEXT BOOK: 1. David L REFERENCES 1. Mehrda New Do NihalKo Elseivie 3. Sandee COURSE OUTO On completion CO1 unders CO2 summa	Arge controllers -Types of charge controllers-Charging strategies for energy storage so Principles of BMS-Functions and components of BMS-Battery safety and performance of BMS-Battery	ni, 201 ", 2nd Syste	Edition Wilee (H Inders	on, CR 2nd E y, 202 3T Ma ighes standin	lanageme n with oth Total:4 CC Press, dition, 1 Ipped t Level) Ing (K2) Ing (K2) Ing (K2)
Unit – V Principles of ch Systems (BMS) controllers TEXT BOOK: 1. David L REFERENCES 1. Mehrda New Do NihalKo Elseivie 3. Sandee COURSE OUT On completion CO1 unders CO2 summa CO3 describ CO4 explain	arge controllers -Types of charge controllers-Charging strategies for energy storage so Principles of BMS-Functions and components of BMS-Battery safety and performance of BMS-Battery	ni, 201 ", 2nd Syste	S inte	on, CR 2nd E y, 202 BT Ma ighes standir standi	anagemen with oth Total:4 CC Press, dition, 1 apped t Level) ng (K2) ng (K2) K2) K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			1			1		1	1		
CO2	3	2	2			1			1		1	1		
CO3	2	1	3			1			1		1	1		
CO4	3	2	1			1			1		1	1		
CO5	2	1	3			1			1		1	1		

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70	-	-	-	-	100
CAT2	30	70	-	-	-	-	100
CAT3	30	50	20	-	-	-	100
ESE	10	70	20	-	-	-	100

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

				2200	ווטוט - סול	TAL IMAGE P	KOCE 55	ING					
Program Branch	nme &	All BE	/BTech B	ranches ex	cept EEE			Sem.	Category	L	Т	Р	Credit
Prerequi	isites	Nil						7	PE	3	0	0	3
Preamble	e	This co		oles the stud	lents to lea	rn and apply t	he various	s Digital	Image Proce	essin	g tec	hniqu	es on real
effect, Im		mage pr	ocessing		ements of v	isual percept tween pixels,							
Unit – II		Image	Transfor	ms:									9
Need for and SVD.		, DFT ar	nd its Prop	perties: Sepa	arable – Sp	atial shift – P	eriodicity -	-Scaling	j – Orthogon	ality -	- Rot	ation,	DCT, KLT
Unit – III				ment and lı		oration cewise linear							9
Image Romean filter ISNR-App Unit – IV	estoration ers – Order plications	: Degrad Statistic	dation mo s filters –	del – Noise Inverse and ation, Repr	distribution wiener filte esentation	in filtering: Sn ns- Median - ering - Consti n & Description ling - Region	Geometrained lea	ic mean st squar	– Harmonio e filtering- Po	erforn	an – nanc	Contr e met	a harmonio rics-BSNR- 9
						y descriptors				gion	mig	rtog	orr opinuing
Unit – V				Multiresolut									9
	m – The Fa			The Wavel	et Series Ex	xpansion – Th	e Discrete	e Wavel		ı – Th	e Co	ntinuo	
Transforn Steganog	m – The Fagraphy	ast Wave	let Transf	- The Wavel form – Wave	et Series Ex elet transfor	xpansion – Th	e Discrete ensions—	e Wavel Applicat	et Transform ions in imag	n – Th e der	e Co noisir	ontinuo ng - Im	nage fusior Total:4
Transform Steganog TEXT BC 1. F	m – The Fagraphy OOK: Rafael C G	onzalez	elet Transf	-The Wavel form – Wave	et Series Ex elet transfor , "Digital Im	xpansion – The main two dimensions	e Discrete ensions— ng",4th E	e Wavel Applicat dition, P	et Transform ions in imag earson Educ	n – The der	e Co noisir	entinuo ng - Im ennai,	Total:4
Transform Steganog TEXT BC 1. F REFERE	m – The Fagraphy OOK: Rafael C G NCES: Jayaraman	onzalez	elet Transf	-The Wavel form – Wave	et Series Ex elet transfor , "Digital Im	xpansion – Th	e Discrete ensions— ng",4th E	e Wavel Applicat dition, P	et Transform ions in imag earson Educ	n – The der	e Co noisir	entinuo ng - Im ennai,	Total:4
Transform Steganog TEXT BC 1. F REFERE 1. J	m – The Fagraphy OOK: Rafael C G NCES: Jayaraman Delhi,2016	onzalez a	elet Transf and Richa kirajan S	The Wavel form – Wave ard E Woods	et Series Ex elet transfor , "Digital Im ımar T, "Diç	xpansion – The main two dimensions	e Discretensions— ng",4th Educedocessing"	e Wavel Applicat dition, P	et Transform ions in imag earson Educ	n – The der	ne Conoisir	entinuo ng - Im ennai,	Total:4 2016. v Hill, New
TEXT BO 1. F REFERE 1. C COURSE On comp	m – The Fagraphy OOK: Rafael C G NCES: Jayaraman Delhi,2016 Chanda B, E OUTCOM pletion of tillustrate th	onzalez a S, Esak Dutta Ma	and Richa kirajan Sa ajumder D	The Wavel form – Wave and E Woods and Veeraku , "Digital Ima	et Series Exelet transfor , "Digital Im umar T, "Digital generated be able to	xpansion – The man in two dimension in two dimensions and an analysis of the man in two dimensions and an analysis of the man in two dimensions and an analysis of the man in two dimensions and an analysis of the man in two dimensions and an analysis of the man in two dimensions and an analysis of the man in two dimensions and an analysis of the man in two dimensions and the man in the man	e Discrete ensions— ng",4th Ed ocessing' ysis", 2nd	e Wavel Applicat dition, P ',1st Edit	et Transform ions in imag earson Educ ion 17 th repri	n – The der	, Che	entinuong - Im ennai, lcGrav lhi,201	Total:4 2016. v Hill, New
TEXT BO 1. F REFERE 2. COURSE On comp	m – The Fagraphy DOK: Rafael C G NCES: Jayaraman Delhi,2016 Chanda B, E OUTCOM pletion of the control of the	onzalez a S, Esak Dutta Ma IES: the cour e fundam	and Richa kirajan Sa ajumder D se, the st	and Veeraku , "Digital Ima	et Series Ezelet transfor , "Digital Im umar T, "Digital Im age Proces be able to tal image p	xpansion – The man in two dimensions and English Image Processions and English	e Discretensions— ng",4th Education occessing' ysis", 2nd	e Wavel Applicat dition, P ',1st Edit	et Transform ions in imag earson Educ ion 17 th repri	n – The der	, Che	entinuong - Im ennai, lcGrav lhi,20° BT Ma ighes	Total:4 2016. v Hill, New 11. apped t Level)
TEXT BO 1. F REFERE 2. COURSE On comp CO1 III CO2 A	m – The Fagraphy DOK: Rafael C G NCES: Jayaraman Delhi,2016 Chanda B, E OUTCON pletion of the control of the	onzalez a S, Esak Dutta Ma IES: the cour e fundam DCT, KI	and Richa kirajan S a ajumder D se, the st nental con	The Wavel- form – Wave and E Woods and Veeraku , "Digital Ima cudents will cepts of dig	et Series Ezelet transfor , "Digital Im umar T, "Dig age Proces be able to tal image p	rpansion – Them in two dimensionage Processing and analytrocessing, 20	e Discretensions— ng",4th Education occessing' ysis", 2nd	e Wavel Applicat dition, P ',1st Edit	et Transform ions in imag earson Educ ion 17 th repri	n – The der	ne Conoisir , Che I (H	entinuo ng - Im ennai, lcGrav lhi,20° BT Ma ighes applyir	Total:4 2016. v Hill, New 11. apped t Level)
Transform Steganog TEXT BC 1. F REFERE 1. C COURSE On comp CO1 II n CO2 A CO3 II	m – The Fagraphy DOK: Rafael C G ENCES: Jayaraman Delhi,2016 Chanda B, E OUTCON pletion of to Illustrate th models. Apply DFT, Implement	S, Esak Dutta Ma IES: the cour e fundam DCT, KI	and Richa kirajan S a ajumder D se, the st nental con _T, SVD a e enhance	The Wavel- form – Wave and E Woods and Veeraku , "Digital Ima cudents will cepts of dig	et Series Exelet transfor , "Digital Im umar T, "Digital Im age Proces be able to tal image p	ricessing and analytrocessing, 2D	e Discretcensions— ng",4th Ecocessing' ysis", 2nd sampling e	e Wavel Applicat dition, P ',1st Edit I Edition	et Transformions in image	n – The der	, Cha	ennai, ennai, ennai, ennai, ennai, cGrav lhi,20	Total:4 2016. v Hill, New 11. apped t Level) ng (K3)
Transform Steganog TEXT BC 1. F REFERE 1. C COURSE On comp CO1 II n CO2 A CO3 II CO4 E	m – The Fagraphy DOK: Rafael C G ENCES: Jayaraman Delhi,2016 Chanda B, E OUTCON pletion of the completion of the comp	onzalez a S, Esak Dutta Ma IES: the cour e fundam DCT, KI the imag	and Richa kirajan S a ajumder D se, the st nental con -T, SVD a e enhance nentation,	The Wavel- form – Wavel- form – Wavel- and E Woods and Veeraku , "Digital Ima udents will cepts of dig and Haar trail ement & ima representati	et Series Exelet transfor , "Digital Im Imar T, "Digital Im age Proces be able to tal image period tal im	mage Processing and analytion technique	e Discrete ensions— ng",4th Edited occessing yesis", 2nd sampling essiques for	e Wavel Applicat dition, P ',1st Edit I Edition	et Transformions in image	n – The der	, Chaata M (H A Und	ennai, en	Total:4 2016. W Hill, New 11. Apped t Level) ag (K3) ag (K3)
Transform Steganog TEXT BC 1. F REFERE 1. C COURSE On comp CO1 II n CO2 A CO3 II CO4 E	m – The Fagraphy DOK: Rafael C G ENCES: Jayaraman Delhi,2016 Chanda B, E OUTCON pletion of the completion of the comp	onzalez a S, Esak Dutta Ma IES: the cour e fundam DCT, KI the imag	and Richa kirajan S a ajumder D se, the st nental con -T, SVD a e enhance nentation,	The Wavel- form – Wavel- form – Wavel- and Veeraku and Veeraku , "Digital Ima cudents will cepts of dig and Haar trainement & ima representation	et Series Exelet transfor , "Digital Im umar T, "Digital Im age Proces be able to tal image prosformation age restorat on and des images us	expansion – The man in two dimensions of the mage Processing and analysis on an image tion technique accription technique sing wavelet to the mage tion technique accription	e Discrete ensions— ng",4th Edited occessing yesis", 2nd esampling essiques for ansform.	e Wavel Applicat dition, P ',1st Edit I Edition g and Co	et Transformions in image	n – The der	, Chaata M (H A Und	ennai, en	Total:4 2016. W Hill, New 11. Apped t Level) ng (K3) ng (K3) ng (K3)
Transform Steganog TEXT BC 1. F REFERE 1. C COURSE On comp CO1 II n CO2 A CO3 II CO4 E	m – The Fagraphy DOK: Rafael C G NCES: Jayaraman Delhi,2016 Chanda B, E OUTCOM Pletion of the completion of the compl	onzalez a S, Esak Dutta Ma IES: the cour e fundam DCT, KI the imag	and Richa kirajan S a ajumder D se, the st nental con -T, SVD a e enhance nentation,	The Wavel- form – Wavel- form – Wavel- and Veeraku and Veeraku , "Digital Ima cudents will cepts of dig and Haar trainement & ima representation	et Series Ezelet transfor , "Digital Im mar T, "Digital Im age Proces be able to tal image proces on and desertimages us pping of Company of Compan	erocessing, 2E as on an image tion technique	e Discrete ensions— ng",4th Educes sing yesis", 2nd sampling estimates for ansform.	e Wavel Applicat dition, P ',1st Edit I Edition g and Co	et Transformions in image	n – The der	, Cheata M	ennai, en	Total:4 2016. W Hill, New 11. Apped t Level) ng (K3) ng (K3) nd (K3)
Transform Steganog TEXT BO 1. F REFERE 1. C COURSE On comp CO1 III n CO2 A CO3 III CO4 E CO5 A	m – The Fagraphy DOK: Rafael C G NCES: Jayaraman Delhi,2016 Chanda B, E OUTCOM Pletion of the completion of the compl	onzalez a S, Esak Dutta Ma IES: the cour te fundam DCT, KI the image segmenulti reso	and Richa kirajan Sa ajumder D se, the st nental con T, SVD a e enhance nentation, lution products	The Wavel- form – Wavel- form – Wavel- and Veeraku and Veeraku , "Digital Ima cudents will acepts of dig and Haar tra- ement & ima representation	et Series Ezelet transfor , "Digital Im mar T, "Digital Im age Proces be able to tal image proces on and desertimages us pping of Company of Compan	mage Processing and analyticon technique cription cription technique c	e Discrete ensions— ng",4th Educes sing yesis", 2nd sampling estimates for ansform.	e Wavel Applicat dition, P ',1st Edit I Edition, g and Co	et Transformions in image earson Eduction 17 th repri PHI learning	n – The der	, Cheata M	ennai, en	Total:4 2016. W Hill, New 11. Apped t Level) ng (K3) ng (K3) ng (K3)

CO3	3	3	3	1	2			1	1	
CO4	3	3	3	1	2			1	1	
CO5	3	2	1	1				1	1	

400500		D 4 T			
ASSESS	MFNI	PAI	IFKN	- IH	IF()KY

	, 100_00					
Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
10	20	70	-	-	-	100
10	20	70	-	-	-	100
10	20	70	-	-	-	100
10	20	70	-	-	-	100
	(K1) % 10 10 10	Remembering (K1) % Understanding (K2) % 10 20 10 20 10 20	(K1) % (K2) % (K3) % 10 20 70 10 20 70 10 20 70	Remembering (K1) % Understanding (K2) % Applying (K3) % Analyzing (K4) % 10 20 70 - 10 20 70 - 10 20 70 - 10 20 70 -	Remembering (K1) % Understanding (K2) % Applying (K3) % Analyzing (K4) % Evaluating (K5) % 10 20 70 - - 10 20 70 - - 10 20 70 - - 10 20 70 - -	Remembering (K1) % Understanding (K2) % Applying (K3) % Analyzing (K4) % Evaluating (K5) % Creating (K6) % 10 20 70 - - - 10 20 70 - - - 10 20 70 - - - 10 20 70 - - -

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

			22E	EO17-A	I TECH	NIQUES	IN EN	GINEEI	RING AI	PPLICA	TIONS				
Programm Branch	ie &	All BE	/BTech E	Branche	es					Sem.	Category	L	Т	Р	Credit
Prerequisi	tes	Nil								7	OE	3	0	0	3
Preamble		This co		ables the	e studen	ts to lea	rn and a	apply th	e Artific	ial Intelli	gence techr	niques	on r	eal tin	ne
Unit – I			TICS IN												9
Introduction Algorithms											of Robots	and t	heir	Applic	ations - Al
Unit – II			//ANUFA												9
driven Sup		n Optimiz	zation - P	redictive	e Mainte	nance a	nd Cost	t Reduc	tion in N	/lanufac	trol and Def turing	ect D	etect	ion us	
Unit – III	of Logicti		TICS AN								Domond	Fore	no oti	22.22	9 d lavontoni
											n - Demand Implementa				
Unit – IV			NOMOUS	•	•	•	•	•			-				9
											Autonomo		nes	and S	Spacecraft -
	s ot Al ir		-		-				ns tor A	utonom	ous System	S			
Unit – V	ictural D		Ontim						Fngine	erina Pi	rojects - Al	in Δ	rnen	ace [9 Design and
											tion in Civil				
															Total:45
TEXT BOO		II D				1 - A - 1		Dl-	- 4 N 4		. 0	Λ - 4		A I	ide ee ell Tle e
	kolaus C T Press,		adley Ha	iyes, int	roductio	n to Aut	onomo	us Rob	ots: ivied	cnanism	s, Sensors,	Actua	tors,	Aigoi	itnms" ine
REFEREN	CES:														
1.															
2.															
3.															
COURSE O			se, the s	tudents	will be	able to									apped t Level)
CO1													А	pplyir	ng (K3)
CO2															
CO3															
CO4															
CO5															
						ng of Co							_		
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO1:	2		
CO1	3	2	1	1											
CO2	3	3	2	2											
CO3	3	2	1	1											
CO4	3	3	2	1											

CO5	3	2	2	2						
1 – Slight, 2	2 – Mode	rate, 3 -	- Substantia	al, BT- B	Bloom's Taxono	omy				
					ASSESSMENT	PATTERN	- THEORY			
Test / Bl Categ		Re	memberin (K1) %	g Un	derstanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT	Γ1		20		40	40				100
CAT	Γ2		20		40	40				100
CAT	Г3		20		40	40				100
ES	Е		20		40	40				100
* ±3% may	be varie	d (CAT	1, 2 & 3 – 5	0 marks	s & ESE – 100	marks)	,			

Branch	ımme &	All BE	/BTech Br	ranches exce	ept EEE			Sem.	Category	L	Т	Р	Credit
	uisites	Nil						7	OE	3	0	0	3
Preamb	ble	techno	ologies, info	ormation and	d to study abou communication ems. The cours	technolo	ogies. It	is used	to get famil	iarize	d witl	n smar	t metering
Unit –	ı		grid Conce	ept:									9
	ction – Ren ire – Operat	ewable P	ower Gene		Connected Wir	nd Powe	r – Grid	Connec	ted PV Pow	er – N	/licro	grid Co	ncept an
Unit –	<u> </u>			ing and Ener	gy Manageme	nt:							9
					iques – Energy l onnected Micro		ment – E	Emission	reduction a	nd Eco	onom	ical Op	otimizatio
Unit –	III	Smart	Grid and	Communicat	ion Technolog	ies							9
technol	logies – Da	ta commu	ınication –	Communicati	verview of techr on technologies	for sma	rt grid –	- Informa					municatior
		nd deman	d side inte		trol and Autom tribution automa				oution mana	geme	nt sy	stems	9
Unit –	V	Power	Electroni	cs and Energ	gy Storage:								9
Power	electronic c	onverters	– Power e	electronics in s	smart grid – Pov	ver elect	ronics f	or bulk p	ower flows -	- Ene	rgy s	torage.	
TEXT E	BOOK:												
1.	Hassan B	evrani, Br	uno Franc	ois &Toshifun	nilse, "Microgrid	Dynami	cs and	Control",	1st Edition,	Wiley	, 201	7 for L	Jnits I & II
	JanakaEk	anayake,	Nick Jenki	ins, KithsiriLiy	anage, Jianzho	ng Wu, A	AkihikoY						
2.	JanakaEk	anayake,	Nick Jenki	ins, KithsiriLiy		ng Wu, A	AkihikoY						
2. REFER	JanakaEk Applicatio RENCES: Chowdhui	anayake, ns", 1st E ry S, Cho	Nick Jenki dition, Wile wdhury S.I	ins, KithsiriLiy ey & Sons Ltd P &Crossley	anage, Jianzho	ng Wu, A	AkihikoY V.	′okoyam	a, "Smart G	rid: Te	echno	ology a	nd
2. REFER	JanakaEk Applicatio RENCES: Chowdhui Engineerii	anayake, ns", 1st E ry S, Cho ng and Te	Nick Jenki dition, Wile wdhury S.I echnology,	ins, KithsiriLiy ey & Sons Ltd P &Crossley 2009.	anage, Jianzho , 2012 for Units	ng Wu, A	AkihikoY V. ve Distri	okoyam	a, "Smart G	rid: Te	tion,	ology a	nd stitution o
2. REFER 1. 2. COURS	JanakaEk Applicatio RENCES: Chowdhui Engineerii Tony Flick	anayake, ns", 1st E y S, Cho ng and Te & Justin MES:	Nick Jenki dition, Wile wdhury S.l echnology, Morehouse	ins, KithsiriLiy ey & Sons Ltd P &Crossley 2009. e, "Securing th	anage, Jianzho I, 2012 for Units P, "Microgrids a ne Smart Grid N	ng Wu, A	AkihikoY V. ve Distri	okoyam	a, "Smart G	rid: Te	tion,	The In:	stitution o
2. REFER 1. 2. COURS	JanakaEk Applicatio RENCES: Chowdhui Engineerii Tony Flick	anayake, ns", 1st E y S, Cho ng and Te & Justin MES:	Nick Jenki dition, Wile wdhury S.l echnology, Morehouse	ins, KithsiriLiy ey & Sons Ltd P &Crossley 2009.	anage, Jianzho I, 2012 for Units P, "Microgrids a ne Smart Grid N	ng Wu, A	AkihikoY V. ve Distri	okoyam	a, "Smart G	rid: Te	tion,	The In:	nd stitution o
2. REFER 1. 2. COURS On cor	JanakaEk Applicatio RENCES: Chowdhui Engineerii Tony Flick	anayake, ns", 1st E y S, Cho ng and Te & Justin MES:	Nick Jenki dition, Wile wdhury S.l echnology, Morehouse	P &Crossley 2009. e, "Securing the	anage, Jianzho I, 2012 for Units P, "Microgrids a ne Smart Grid N	ng Wu, A	AkihikoY V. ve Distri	okoyam	a, "Smart G	rid: Te	tion, Edition	The Institute of the In	stitution o
2. REFER 1. 2. COURS On cor	JanakaEk Applicatio RENCES: Chowdhur Engineerir Tony Flick SE OUTCO mpletion of understan	anayake, ns", 1st E ry S, Cho ng and Te & Justin MES: the coul d the con	Nick Jenki dition, Wile wdhury S.l echnology, Morehouse rse, the str	P &Crossley 2009. e, "Securing the	anage, Jianzho I, 2012 for Units P, "Microgrids a ne Smart Grid N e able to	ng Wu, A	AkihikoY V. ve Distri	okoyam	a, "Smart G	rid: Te	tion, Edition	The Ins	stitution ovier, 2017
2. REFER 1. 2. COURS On cor CO1 CO2	JanakaEk Applicatio RENCES: Chowdhui Engineerii Tony Flick SE OUTCO mpletion of understan assess the	anayake, ns", 1st E y S, Cho ng and Te & Justin MES: the coul d the con	Nick Jenki dition, Wile wdhury S.I echnology, Morehouse rse, the str cepts of m	P &Crossley 2009. e, "Securing the udents will be icro grid.	anage, Jianzho I, 2012 for Units P, "Microgrids a ne Smart Grid N e able to	ng Wu, A III, IV & and Activ	AkihikoY V. ve Distri	okoyam	a, "Smart G	rid: Te	echnodic Edition (Hi	The Ins	stitution ovier, 201 pped Level) ding (K2)
1. 2.	JanakaEk Applicatio RENCES: Chowdhui Engineerii Tony Flick SE OUTCO mpletion of understan assess the	anayake, ns", 1st E y S, Cho ng and Te a Justin MES: the coul d the con e micro gr	Nick Jenki dition, Wile wdhury S.I echnology, Morehouse rse, the str cepts of m	P &Crossley 2009. e, "Securing the icro grid. g and energy communication	anage, Jianzho I, 2012 for Units P, "Microgrids a ne Smart Grid N e able to management	ng Wu, A	AkihikoY V. re Distri	okoyam	a, "Smart G	rid: Te	echnodition, Edition (Hi Und	The Insorting Else	stitution of vier, 2012 oped Level) ding (K2) ding (K2)
2. REFER 1. 2. COURS On cor CO1 CO2 CO3	JanakaEk Applicatio RENCES: Chowdhui Engineerii Tony Flick SE OUTCO mpletion of understan assess the analyze th	anayake, ns", 1st E Ty S, Cho ng and Te & Justin MES: the could the con e micro gr ne sensin	Nick Jenki dition, Wile wdhury S.I. echnology, Morehouse rse, the str cepts of m rid planning grid and its	P & Crossley 2009. e, "Securing the icro grid. g and energy communication ement, control	anage, Jianzho , 2012 for Units P, "Microgrids a ne Smart Grid N e able to management on technologies	ng Wu, A	re Distri	okoyam	a, "Smart G	rid: Te	echnodition, dition (Hi	The Instance In the Instance I	stitution of vier, 2017 oped Level) ding (K2) ding (K2) g (K3)
2. REFER 1. 2. COURS On cor CO1 CO2 CO3 CO4	JanakaEk Applicatio RENCES: Chowdhui Engineerii Tony Flick SE OUTCO mpletion of understan assess the analyze th	anayake, ns", 1st E Ty S, Cho ng and Te & Justin MES: the could the con e micro gr ne sensin	Nick Jenki dition, Wile wdhury S.I. echnology, Morehouse rse, the str cepts of m rid planning grid and its	ins, KithsiriLiyey & Sons Ltd P & Crossley 2009. e, "Securing the communication of the commu	anage, Jianzho Janage, Jianzho Janage, Jianzho Janage, Jianzho Janage, Jianzho Jiange, Jianzho	ng Wu, A III, IV & and Activ ext Gene an techno	AkihikoY V. re Distri eration F logies. rge.	okoyam bution N	a, "Smart G	rid: Te	echnodition, dition (Hi	The Instance of the Instance o	stitution of vier, 2017 oped Level) ding (K2) ding (K2) g (K3)
2. REFER 1. 2. COURS On cor CO1 CO2 CO3 CO4 CO5	JanakaEk Applicatio RENCES: Chowdhui Engineerii Tony Flick SE OUTCO mpletion of understan assess the analyze th interpret th examine a	anayake, ns", 1st E Ty S, Cho ng and Te & Justin MES: the could the con e micro gr ne sensin	Nick Jenki dition, Wile wdhury S.I. echnology, Morehouse rse, the str cepts of m rid planning grid and its	ins, KithsiriLiyey & Sons Ltd P & Crossley 2009. e, "Securing the communication of the commu	anage, Jianzho J. 2012 for Units P, "Microgrids and Smart Grid Notes able to management on technologies I and automation	ng Wu, A III, IV & and Activ ext Gene an techno	AkihikoY V. re Distri eration F logies. rge.	okoyam bution N	a, "Smart G	rid: Te	echnological distribution (History Under A	The Instance of the Instance o	stitution of vier, 2017 pped Level) ding (K2) ding (K3) g (K3) g (K3)
2. REFER 1. 2. COURS On cor CO1 CO2 CO3 CO4	JanakaEk Applicatio RENCES: Chowdhui Engineerii Tony Flick SE OUTCO mpletion of understan assess the analyze th interpret th examine a	anayake, ns", 1st E Ty S, Cho ng and Te & Justin MES: the coul d the con e micro gr ne sensin about the	Nick Jenki dition, Wile wdhury S.I echnology, Morehouse rse, the str cepts of m rid planning grid and its g, measure power elect	P & Crossley 2009. e, "Securing the dents will be icro grid. g and energy communication ement, control etronics in small be mapped.	anage, Jianzho Janage, Jianzho Janage, Jianzho Janage, Jianzho Janage, Jianzho Jiange, Jianzho	ng Wu, A III, IV & and Activ ext Gene n techno rgy stora	V. Ye Distri Peration I logies. Ige.	bution N Power G	a, "Smart G etworks", 1:	rid: Te	echnological distribution (History Under A	The Instance of the Instance o	stitution of vier, 2017 oped Level) ding (K2) ding (K2) g (K3)
2. REFER 1. 2. COURS On cor CO1 CO2 CO3 CO4 CO5	JanakaEk Applicatio RENCES: Chowdhui Engineerii Tony Flick SE OUTCO mpletion of understan assess the analyze th interpret th examine a	anayake, ns", 1st E Ty S, Cho ng and Te & Justin MES: the coun the micro gr ne sensin about the	Nick Jenki dition, Wile wdhury S.I echnology, Morehouse rse, the str cepts of m rid planning grid and its g, measure power elect	P & Crossley 2009. e, "Securing the udents will be icro grid. g and energy communication ement, control etronics in small post post post post post post post post	anage, Jianzho Janage, Jianzho Janage, Jianzho Janage, Jianzho Janage, Jianzho Jiange, Jianzho	ng Wu, A III, IV & and Activ ext Gene n techno rgy stora	V. Ye Distri Peration I logies. Ige.	bution N Power G	a, "Smart G etworks", 1:	rid: Te	echnological distribution (History Under A	The Instance of the Instance o	stitution ovier, 201 oped Level) ding (K2) g (K3) g (K3)

CO4	3	2		2		2		2	
CO5	3	2		3		3		2	

ASSESSMENT PATTERN - THEORY												
Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %						
40	60					100						
30	60	10				100						
20	60	20				100						
20	60	20				100						
	(K1) % 40 30 20	Remembering (K1) % Understanding (K2) % 40 60 30 60 20 60	Remembering (K1) % Understanding (K2) % Applying (K3) % 40 60 30 60 10 20 60 20	Remembering (K1) % Understanding (K2) % Applying (K3) % Analyzing (K4) % 40 60 10 30 60 10 20 60 20	Remembering (K1) % Understanding (K2) % Applying (K3) % Analyzing (K4) % Evaluating (K5) % 40 60 10 20 60 20	Remembering (K1) % Understanding (K2) % Applying (K3) % Analyzing (K4) % Evaluating (K5) % Creating (K6) % 40 60 10 40						

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

Prograi Branch		All BE	/BTech B	ranches	except EEE			Sem.	Category	L	Т	Р	Credit
Prerequ	uisites	Nil						8	OE	3	0	0	3
Preamb	ole	Biomas	ss energy	has evol	lved through cl	nemical, biolog	gical and	thermal	conversion	oroce	ss. T	he requ	uirement
					of biomass has and bio diesel				and in fact,	this s	ubjed	ct addre	esses the
Unit – I			duction										9
Biomas Advanta	s energy us ages and dis	age – Ov sadvanta	erall ener ges in use	rgy need: e of biom	s – Sources of lass as energy	biomass avai source.	lable – L	Inits and	conversions	– Pr	oblen	ns and	issues –
Unit – I			ss Conve										9
	w – Chemic ass convers			onversior	n processes –	Thermal conve	ersion pr	ocess –	Hybrid conve	rsion	proc	ess – A	Application
Unit – I	II	Biogas	Product	tion:									9
Unit – I Introduc	V ction – Vege	Bio-Die	esel Proc	duction: al fat cha	esign of biogas aracteristics – Fingine performa	atty acid com	position	– Basic	oil properties	s – Oil	l Extr	action	9 processes
Unit – \	,	Bioma	ss Comb	ustion									9
					systems – Co-	combustion o	f biomas	s and co	o-firing with	coal -	- Slad	aging a	
issues v	with agriculti	ural biom	ass – Det	termining	melting point	of biomass as	h pellets	Applic	ations of bio	mass	com	bustion	i systems
		pareda., "	Introducti	ion to Bio	omass Energy (Conversions",	1st Editi	on, CRC	press, India	, 201	3.		Total:4
1. REFER	Sergio Cap ENCES: Kothari D.F	P., Singal	K.C., Ral	kesh Rar	omass Energy (d Editio	
1.	Sergio Cap ENCES: Kothari D.F Learning P	P., Singal	K.C., Ral New Delhi	kesh Rar i, 2011.		able Energy So	ources a	nd Emer	ging Techno	ogies		d Editic	Total:4
1. REFER	Sergio Cap ENCES: Kothari D.F Learning P John Twide	P., Singal vt. Ltd., N	K.C., Ral New Delhi Weir., "Re	kesh Rar i, 2011. enewable	njan., "Renewa Energy Reso	able Energy So urces", 3rd Ed	ources ar	nd Emer	ging Techno New York, 2	ogies 015.	s", 2n		on, PHI
1. REFER 1. 2.	Sergio Cap ENCES: Kothari D.F Learning P John Twide	P., Singal vt. Ltd., Nell, Tony Narbie, "Su	K.C., Ral New Delhi Weir., "Re	kesh Rar i, 2011. enewable	njan., "Renewa	able Energy So urces", 3rd Ed	ources ar	nd Emer	ging Techno New York, 2	ogies 015.	s", 2n		on, PHI
1. REFER 1. 2. 3.	Sergio Cap ENCES: Kothari D.F Learning P John Twide	P., Singal vt. Ltd., Nell, Tony Varbie, "Su Switzerla	K.C., Ral New Delhi Weir., "Re	kesh Rar i, 2011. enewable	njan., "Renewa Energy Reso	able Energy So urces", 3rd Ed	ources ar	nd Emer	ging Techno New York, 2	ogies 015.	or Ind	lustry 4	on, PHI .0",
1. REFER 1. 2. 3. COURS	Sergio Cap ENCES: Kothari D.F Learning P John Twide Ibrahim Ga Springer., S	P., Singal vt. Ltd., Nell, Tony Varbie, "Su Switzerla	K.C., Ral New Delhi Weir., "Re stainabilit nd, 2016	kesh Rar i, 2011. enewable ty in Man	njan., "Renewa Energy Reso	uble Energy So urces", 3rd Ed erprises, Conc	ources ar	nd Emer	ging Techno New York, 2	ogies 015.	or Ind	lustry 4	on, PHI .0",
1. REFER 1. 2. 3. COURS	ENCES: Kothari D.F Learning P John Twide Ibrahim Ga Springer., S SE OUTCOM Inpletion of	P., Singal Vt. Ltd., N ell, Tony N arbie, "Su Switzerla MES: the cour	K.C., Ral New Delhi Weir., "Re stainabilit nd, 2016 se, the st	kesh Rar i, 2011. enewable ty in Man	njan., "Renewa Energy Resorufacturing Ente	uble Energy So urces", 3rd Ed erprises, Cond	ources an	nd Emer	ging Techno New York, 2	ogies 015.	or Ind	lustry 4 BT Mapighest	on, PHI .0",
1. REFER 1. 2. 3. COURS On con	ENCES: Kothari D.F Learning P John Twide Ibrahim Ga Springer., S SE OUTCOM Inpletion of	P., Singal Vt. Ltd., N ell, Tony N arbie, "Su Switzerla MES: the cour	K.C., Ral New Delhi Weir., "Re stainabilit nd, 2016 se, the si	kesh Rar i, 2011. enewable ty in Man	e Energy Resorufacturing Entermill be able to mass energy e	uble Energy So urces", 3rd Ed erprises, Cond	ources an	nd Emer	ging Techno New York, 2	ogies 015.	", 2n or Ind (Hi	lustry 4 BT Mapighest erstand	on, PHI .0", opped Level)
1. REFER 1. 2. 3. COURS On con	Sergio Cap ENCES: Kothari D.F Learning P John Twide Ibrahim Ga Springer., S SE OUTCOM Inpletion of explain the	P., Singal vt. Ltd., N ell, Tony N arbie, "Su Switzerla MES: the cour a nature a	K.C., Ral New Delhi Weir., "Re stainabilit nd, 2016 se, the st nd princip	kesh Rar i, 2011. enewable ty in Man tudents ble of bior	mjan., "Renewa e Energy Resor- ufacturing Enter will be able to mass energy e	uble Energy So urces", 3rd Ed erprises, Cond	ources an	nd Emer	ging Techno New York, 2	ogies 015.	e (Hi	lustry 4 BT Mapighest erstand	on, PHI on, PHI on, PHI ding (K2)
1.	Sergio Cap ENCES: Kothari D.F Learning P John Twide Ibrahim Ga Springer., S SE OUTCOM Inpletion of explain the illustrate va	P., Singal Vt. Ltd., N ell, Tony N arbie, "Su Switzerla MES: the cour arious bio ogas prod	K.C., Ral New Delhi Weir., "Re stainabilit nd, 2016 se, the st nd princip mass cor duction ar	kesh Rar i, 2011. enewable ty in Man tudents ble of bior	mjan., "Renewa e Energy Resor- ufacturing Enter will be able to mass energy e	urces", 3rd Ederprises, Conce	ources an	nd Emer	ging Techno New York, 2	ogies 015.	e (Hi Und	BT Mapighest erstanderstand	on, PHI on, PHI on, PHI ding (K2) ding (K2) g (K3)
1. REFER 1. 2. 3. COURS On con CO1 CO2 CO3 CO4	Sergio Cap ENCES: Kothari D.F Learning P John Twide Ibrahim Ga Springer., S SE OUTCOM Inpletion of explain the illustrate va interpret bid categorize	P., Singal Vt. Ltd., N ell, Tony N arbie, "Su Switzerla MES: the cour nature a arious bio ogas productions to	K.C., Ral New Delhi Weir., "Re stainabilit nd, 2016 se, the st nd princip mass cor duction ar echniques	kesh Rar i, 2011. enewable ty in Man tudents ble of bion nversion p	mjan., "Renewa Energy Resor- ufacturing Enter will be able to mass energy enterprocess	urces", 3rd Ederprises, Concentration systems	ources an	nd Emer	ging Techno New York, 2	ogies 015.	or Ind (Hi Und A	BT Mapighest erstanderstand	on, PHI Don, PH
1. REFER 1. 2. 3. COURS On con CO1 CO2 CO3 CO4	Sergio Cap ENCES: Kothari D.F Learning P John Twide Ibrahim Ga Springer., S SE OUTCOM Inpletion of explain the illustrate va interpret bid categorize	P., Singal Vt. Ltd., N ell, Tony N arbie, "Su Switzerla MES: the cour nature a arious bio ogas productions to	K.C., Ral New Delhi Weir., "Re stainabilit nd, 2016 se, the st nd princip mass cor duction ar echniques	kesh Rar i, 2011. enewable ty in Man tudents ble of bion nversion p nd digest s for bio-	will be able to mass energy eprocess er design	urces", 3rd Ederprises, Concentration systems	ources and ition, Rosepts, and ems	nd Emer	ging Techno New York, 2	ogies 015.	or Ind (Hi Und A	BT Mapighest erstanderstand	on, PHI on,
1. REFER 1. 2. 3. COURS	Sergio Cap ENCES: Kothari D.F Learning P John Twide Ibrahim Ga Springer., S SE OUTCOM pletion of explain the illustrate va interpret bid categorize access diffe	P., Singal Vt. Ltd., N ell, Tony N arbie, "Su Switzerla MES: the cour nature a arious bio ogas productions to	K.C., Ral New Delhi Weir., "Re stainabilit nd, 2016 se, the st nd princip mass cor duction ar echniques	kesh Rar i, 2011. enewable ty in Man tudents ble of bior nversion and digest s for bior	will be able to mass energy eprocess er design diesel refining	urces", 3rd Ederprises, Concentration systems	ems	nd Emer	ging Techno New York, 2	ogies 015.	F (Hi Und A A	BT Mapighest erstanderstand	on, PHI on,

CO2	2	3	2		1	1		1	1	
CO3	2	2	3		1	1		1	1	
CO4	2	2	3		1	1		1	1	
CO5	2	2	3		1	1		1	1	

ASSESSMENT PATTERN - THEORY												
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %					
CAT1	30	70					100					
CAT2	20	60	20				100					
CAT3	20	60	20				100					
ESE	20	60	20				100					

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 60 marks & ESE – 100 marks)

Programr Branch	me &			oranches on Engine	except Electi	ronics and		Sem.	Category	L	Т	Р	Credit
Prerequis	sites	Nil						5	OE	3	1	0	4
Preamble		specifi	c instrum	nents whic	ch is most com	an anatomy an imonly used in and learn the	hospital	s. Also u	nderstand th	e funda	ment	al con	cept of
Unit – I				ological S				7 7 7	<u> </u>				9+3
nervous s	ystem – C	Compone	ents of th	ie Bio med		rent systems of nt system – stra							
Unit – II				Electrode									9+3
						des. Biomedica	l Electric	cal signa	measureme	ent: ECC	G, EE	G, EM	IG, EOG
and ERG: Unit – III	Lead sys				and typical wa ical Signal Me								9+3
Phonocar	blood pre	/ – GSR- essure m	- Blood p nonitor. S	ressure M	/leasurement:	Sphygmomano neasurement –	meter, N Ear oxir	MEMS ba meter – F	sed catheter Pulse oximeter	r tip pres er – Lun	ssure ng vol	senso umes,	or,
Unit – IV		Biome	edical In	naging Sy									9+3
					ermography –	Ultrasonic imaç	ging sys	tems – M	lagnetic resc	nance i	magi	ng – F	PET –
SPECT – Unit – V	FIVIRI – IV			Assist De	evices:								9+3
Ventricula	ır asvnchi					Heart lung ma	chine -	Kidnev r	nachine – A	udiome	ter –	Biothe	esiometry
1.	Khandpu	r R.S," H	landbook	edicine.	edical Instrume	entation", 2 nd Ec	dition, Ta	ata McGi		•			5, Total:6
1. REFEREN	Khandpui NCES: John G. V	Vebster,	"Medica	of Biome	entation Applic	ation and Desi	gn", 4 th [Edition, J	aw-Hill , Nev	w Delhi	,2017 s, Nev	7. wYork,	2015.
1. REFEREN	Khandpui NCES: John G. V	Vebster,	"Medica	of Biome	entation Applic		gn", 4 th [Edition, J	aw-Hill , Nev	w Delhi	,2017 s, Nev	7. wYork,	2015.
REFEREN 1. 2.	Khandpul NCES: John G. V Andrew G 2018	Vebster, 6. Webb,	"Medica "Princip	of Biome	entation Applic medical Instru	ation and Desi	gn", 4 th E	Edition, J Cambridç	raw-Hill , Nev ohn Wiley ar ge University	w Delhi nd Sons Press,	,2017 s, Nev	7. wYork,	2015.
1.	Khandpur NCES: John G. V Andrew G 2018 Arumuga	Webster, G. Webb, m. M, "B	"Medica "Princip io-Medic	of Biome I Instrume les of Bio	entation Applic medical Instru	ation and Desiq mentation" 1 st E Edition, Anurad	gn", 4 th E	Edition, J Cambridç	raw-Hill , Nev ohn Wiley ar ge University	w Delhi nd Sons Press,	,2017 , Nev Unite	7. wYork, ed King	2015.
1. REFEREN 1. 2. 2 3. COURSE On comp	Khandpur NCES: John G. V Andrew C 2018 Arumuga OUTCOM letion of	Webster, G. Webb, m. M, "B MES: the cou	"Medica "Princip io-Medic	of Biome I Instrume les of Bio al Instrum students	entation Applic medical Instru nentation", 2 nd	ation and Desiq mentation" 1 st E Edition, Anurad	gn", 4 th Edition, (Edition, J Cambridç	raw-Hill , Nev ohn Wiley ar ge University	w Delhi nd Sons Press,	,2017 s, Nev Unite	vYork, ed King BT Ma	2015. gdom, apped t Level)
1. REFEREN 1. 2. 2 3. COURSE On comple	Khandpur NCES: John G. V Andrew G 2018 Arumuga OUTCOM letion of interpret t	Webster, G. Webb, m. M, "B MES: the cou	"Medica "Princip io-Medic rse, the	I Instrume les of Bion al Instrum students es and ph	entation Applic medical Instru- nentation", 2 nd will be able to enomena of B	ation and Designmentation" 1st Edition, Anurac	gn", 4 th Edition, (dha Age	Edition, J Cambrido ncies, Ku	aw-Hill , New ohn Wiley ar ge University umbakonam,	w Delhi and Sons Press, 2014.	,2017 , Nev Unite	vYork, ed King BT Ma ighes	2015. gdom, apped t Level)
1. REFEREN 1	Khandpur NCES: John G. V Andrew G 2018 Arumuga OUTCOM letion of interpret the	Webster, G. Webb, m. M, "B MES: the could he basic e bioelec	"Medica "Princip io-Medic rse, the seprinciple	I Instrume les of Bion al Instrum students es and ph ntials usin	entation Applic medical Instru nentation", 2 nd will be able to enomena of B	ation and Designmentation" 1st E Edition, Anurac o iomedical Engi	gn", 4 th Edition, (dha Age	Edition, J Cambrido ncies, Ku	aw-Hill , New ohn Wiley ar ge University umbakonam,	w Delhi and Sons Press, 2014.	,2017 , New United (H	vYork, ed King BT Ma ighes erstan	2015. gdom, upped t Level) uding (K2)
1. REFEREN 1	Khandpur NCES: John G. V Andrew G 2018 Arumuga OUTCOM letion of interpret t record the measure	Webster, G. Webb, m. M, "B MES: the could biomedical	"Medica "Princip io-Medic rse, the service principle etric potes	I Instrume les of Bion al Instrum students es and ph ntials usin	entation Applic medical Instru nentation", 2 nd will be able to enomena of B	ation and Designmentation" 1st Edition, Anuracon o iomedical Engineration in the control of the	gn", 4 th Edition, (dha Age	Edition, J Cambrido ncies, Ku	aw-Hill , New ohn Wiley ar ge University umbakonam,	w Delhi and Sons Press, 2014.	,2017 , Nev Unite (H Und	vYork, ed King BT Ma ighes erstan	2015. gdom, hpped t Level) ading (K2) ag (K3)
1. REFEREN 1	Khandpur NCES: John G. V Andrew G 2018 Arumuga OUTCOM letion of interpret t record the measure summariz	Webster, G. Webb, m. M, "B MES: the cou the basic e bioelec biomedic ze the ba	"Medica , "Princip io-Medic rse, the service potential signal	I Instrume les of Bion al Instrum students es and ph ntials usin	entation Application in Application	ation and Designmentation" 1st Edition, Anuracon o iomedical Engineration in the control of the	gn", 4 th Edition, (dha Age	Edition, J Cambrido ncies, Ku	aw-Hill , New ohn Wiley ar ge University umbakonam,	w Delhi and Sons Press, 2014.	,2017 , New United (H Und A Und	wYork, ed King BT Ma ighes erstan applyin applyin	2015. gdom, hpped t Level) ading (K2) ag (K3)
1. REFEREN 1	Khandpur NCES: John G. V Andrew G 2018 Arumuga OUTCOM letion of interpret t record the measure summariz	Webster, G. Webb, m. M, "B MES: the cou the basic e bioelec biomedic ze the ba	"Medica , "Princip io-Medic rse, the service potential signal	I Instrume les of Bior al Instrum students es and ph ntials usin I paramet	entation Application in Application	ation and Designmentation" 1st Edition, Anuracon o iomedical Engineration in the control of the	gn", 4 th Edition, (dha Age	Edition, J Cambrido ncies, Ku	aw-Hill , New ohn Wiley ar ge University umbakonam,	w Delhi and Sons Press, 2014.	,2017 , New United (H Und A Und	wYork, ed King BT Ma ighes erstan applyin applyin	2015. gdom, upped t Level) ading (K2) ag (K3) ag (K3)
1. REFEREN 1	Khandpur NCES: John G. V Andrew G 2018 Arumuga OUTCOM letion of interpret t record the measure summariz illustrate to	Webster, G. Webb, m. M, "B MES: the cou the basic e bioelec biomedic ze the ba	"Medica , "Princip io-Medic rse, the service potential signal	I Instrume les of Bion al Instrum students es and ph ntials usin I paramet iples in m assist dev	entation Application in Application	ation and Designmentation" 1st Edition, Anurace o iomedical Engineration of the control of the	gn", 4 th Edition, (dha Age	Edition, J Cambrido ncies, Ku	aw-Hill , New ohn Wiley ar ge University umbakonam,	w Delhi and Sons Press, 2014.	,2017 ;, Nev Unite (H Und	wYork, ed King BT Ma ighes erstan applyin applyin	2015. gdom, apped t Level) ading (K2) ag (K3) ag (K3) ading (K2)
1. REFEREN 1	Khandpur NCES: John G. V Andrew G 2018 Arumuga OUTCOM letion of interpret t record the measure summariz illustrate t	Webster, G. Webb, m. M, "B MES: the coul the basic e bioelec biomedic ze the ba	"Medica "Princip io-Medic rse, the service poter cal signal asic principle iological	I Instrume les of Bion al Instrum students es and ph ntials usin I paramet iples in m assist dev	entation Application in Application	ation and Designmentation" 1st Edition, Anuraco o iomedical Engin l electrode thro edical instrume g techniques COs with Pos	gn", 4th Edition, (dha Age	Edition, J Cambrido ncies, Ko signal re	ohn Wiley ar ge University umbakonam,	w Delhi and Sons Press, 2014.	,2017 ;, Nev Unite (H Und	wYork, ed King BT Ma ighes erstan applyin erstan	2015. gdom, upped t Level) ading (K2) ag (K3) ag (K3)
1. REFEREN 1	Khandpur NCES: John G. V Andrew G 2018 Arumuga OUTCOM letion of interpret t record the measure summariz illustrate t	Webster, G. Webb, m. M, "B MES: the cou the basic e bioelec biomedic ze the ba the phys	"Medica "Princip io-Medic rse, the service poter cal signal asic principle iological	I Instrume les of Bion al Instrum students es and ph ntials usin I paramet iples in m assist dev	entation Application in Application	ation and Designmentation" 1st Edition, Anuraco co iomedical Engine I electrode through techniques COs with Pos PO7 PO8	gn", 4th Edition, (dha Age	Edition, J Cambrido ncies, Ko signal re	ohn Wiley ar ge University umbakonam,	w Delhi and Sons Press, 2014.	,2017 ;, Nev Unite (H Und	wYork, wYork, ed King BT Ma ighes lerstan applyin lerstan	2015. gdom, ppped t Level) ading (K2) ag (K3) ading (K2) ag (K3)

CO	4	3	1				2	1			2	2
СО	5	3	2	1	1	1	2	1			3	3

		AUGEOUNE	INI I AI I EIX	II - IIILOKI			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	10	40	50				100
CAT3	10	40	50				100
ESE	10	40	50				100
+ 00/	(OAT 4 0 0 0 = 0		o				

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

		(0	Offered by	/ Departmer	002 - INDUSTI t of Electroni	cs and Ins	strume	ntation I	Engineerin	g)			
Program Branch	nme &			anches exce Engineerin	pt Electronic	s and		Sem.	Category	/ L	Т	Р	Credit
Prerequ	isites	Nil		g	<u>, </u>			5	OE	3	1	0	4
Preamble	۵	To prov	vide solutio	on towards h	etter control ac	tion for va	rious nr	ocess a	nlications				
Unit – I				Industrial A		tion for va	illous pi	00033 4	phications				9+3
systems	Types of - Industria	f Automa al Actuato	ition Syste or Systems	ems – The Fo s – Industrial	nformation Te Inctional Elem Control Syster Ollers (PLCs)	ents of Ind ns – The A	dustrial Architec	Automat	ion – Indus	strial S	enso	rs and	İnstrumen
Processi	ing Unit (Cl Timer Instru	PU) – Pro uctions –	ogramming Types of t	g Terminal D	lware Compor evices. Conve Delay Timer In g:	rting Relay	y Schen	natics int	o PLC Lad	der Pr	ograr	ms. Pro	gramming
Control F	Reset Instr	ters: Cou	unter Instru Subroutine	uctions – Up e Functions.	Counter – Do Data Manipul plication Instru	ation Instr	uctions:	Data C	ompare Ins				
Unit – IV				•	ystems, and								9+3
					ns – On/Off C – Human Mad							ommu	nications -
Unit – V		Interne	et of Thing	gs – An Ove	rview:			·					9+3
					on – IoT Archi rity – Identity								
	ory Limitation		9- 1-		,								
, 1	Frank D. Pe		"Programi	mable Logic	Controllers", 5	h Edition,	Tata Mo	:Graw Hi					
1. In the second	Frank D. Perfor Unit 1,2 Rajkumar E (Imprint of I	,3,4. Buyya & <i>I</i> Elsevier)	Amir Vahic , USA, 201	d Dastjerdi, "I 16 for Unit 5	nternet of Thir	gs Princip	oles and	Paradig	ll Education	n Priva	te Lir	nited, lı	ndia, 2019
1. In the second	Frank D. Perfor Unit 1,2 Rajkumar E (Imprint of I	,3,4. Buyya & <i>I</i> Elsevier)	Amir Vahic , USA, 201	d Dastjerdi, "I 16 for Unit 5		gs Princip	oles and	Paradig	ll Education	n Priva	te Lir	nited, lı	ndia, 2019
1. f 2. (REFERE	Frank D. Perfor Unit 1,2 Rajkumar Erection (Imprint of Imprint of	,3,4. Buyya & / Elsevier)	Amir Vahic , USA, 201 ontent/stora	d Dastjerdi, "I 16 for Unit 5 age2/courses	nternet of Thir	gs Princip	oles and	Paradig	ll Education ms", 1 st Ed	n Priva	te Lir	nited, lı	ndia, 2019
1. 1 1 2. 1 1 1 1 1 1 1 1 1	Frank D. Perfor Unit 1,2 Rajkumar E (Imprint of Imprint	,3,4. Buyya & A Elsevier) I.ac.in/cc I.ac.in/cc	Amir Vahic , USA, 201 ontent/stora	d Dastjerdi, "I 16 for Unit 5 age2/courses	nternet of Thir s/108105063/p s/108105063/p	gs Princip	oles and	Paradig	ll Education ms", 1 st Ed	n Priva	te Lir	mited, li	ndia, 2019 imann
1. 1 1 1 1 1 1 1 1 1	Frank D. Perfor Unit 1,2 Rajkumar E (Imprint of Imprint	,3,4. Buyya & A Elsevier) I.ac.in/co I.ac.in/co MES:	Amir Vahic , USA, 201 ontent/stora ontent/stora	d Dastjerdi, " 16 for Unit 5 age2/courses age2/courses udents will I	nternet of Thir s/108105063/p s/108105063/p	gs Princip	oles and	Paradig	ll Education ms", 1 st Ed	n Priva	te Lir ⁄lorga	mited, li an Kauf BT Ma lighest	mann
1. 1 1 1 1 1 1 1 1 1	Frank D. Perfor Unit 1,2 Rajkumar E (Imprint of Imprint	,3,4. Buyya & A Elsevier) I.ac.in/co I.ac.in/co MES: the cour	Amir Vahica, USA, 201 ontent/stora ontent/stora se, the sta	d Dastjerdi, "I 16 for Unit 5 age2/courses age2/courses udents will I sics of auton	nternet of Thir s/108105063/p s/108105063/p oe able to	gs Princip	oles and	Paradig	ll Education ms", 1 st Ed	n Priva	Morga	mited, li an Kauf BT Ma lighest	mann pped Level)
1. 1 1 2. 1 1 1 1 1 1 1 1 1	Frank D. Perfor Unit 1,2 Rajkumar E (Imprint of Imprint	,3,4. Buyya & A Elsevier) I.ac.in/co I.ac.in/co I.ac.in/co the cour concepts	Amir Vahica, USA, 201 content/stora content/stora se, the str s about back	d Dastjerdi, "I 6 for Unit 5 age2/courses age2/courses udents will I sics of auton	nternet of Thir s/108105063/p s/108105063/p oe able to	gs Princip df/L-01(Sf df/L-02(Sf	oles and	Paradig	ll Education ms", 1 st Ed	n Priva	I (H	mited, li an Kauf BT Ma lighest	pped Level) ding (K2)
1. 1 2. 1 1 1 1 1 1 1 1 1	Frank D. Perfor Unit 1,2 Rajkumar E (Imprint of Imprint	,3,4. Buyya & A Elsevier) I.ac.in/co I.ac.in/co MES: the cour concepts ogrammir	Amir Vahica, USA, 201 content/stora content/stora se, the str s about back and with PLoperation in	d Dastjerdi, "I 16 for Unit 5 age2/courses age2/courses udents will I sics of auton C advanced P	nternet of Thir s/108105063/p s/108105063/p ne able to	gs Princip df/L-01(Sf)	oles and	Paradig	ll Education ms", 1 st Ed	n Priva	I (H	BT Malighest	pped Level) ding (K2)
1. 1 2. 1 1 1 1 1 1 1 1 1	Frank D. Perfor Unit 1,2 Rajkumar E (Imprint of Imprint	Ja,4. Buyya & A Elsevier) I.ac.in/co I.ac.in/co I.ac.in/co I.ac.in/co I.ac.in/co I.ac.in/co I.ac.in/co I.ac.in/co I.ac.in/co	Amir Vahico, USA, 201 content/stora se, the stora s about bacong with PLo peration in ctural inter	d Dastjerdi, " 16 for Unit 5 age2/courses age2/courses udents will I sics of auton C advanced Pl faces and op	nternet of Thir s/108105063/p s/108105063/p ne able to nation system	gs Princip df/L-01(Sf) df/L-02(Sf)	oles and	Paradig	Il Education ms", 1 st Ed EE)NPTEL)	n Priva	I (H) Und	BT Malighest Applying	pped Level) ding (K2) g (K3)
1. 1 1 2 1 1 1 1 1 1 1	Frank D. Perfor Unit 1,2 Rajkumar E (Imprint of Imprint	Ja,4. Buyya & A Elsevier) I.ac.in/co I.ac.in/co I.ac.in/co I.ac.in/co I.ac.in/co I.ac.in/co I.ac.in/co I.ac.in/co I.ac.in/co	Amir Vahico, USA, 201 content/stora se, the stora s about bacong with PLo peration in ctural inter	d Dastjerdi, " 16 for Unit 5 age2/courses age2/courses udents will I sics of auton C advanced Pl faces and op	nternet of Thir s/108105063/p s/108105063/p be able to nation system C and SCAD/ eration about tunities, challe	gs Princip df/L-01(Sf) df/L-02(Sf)	oles and M)(IA&C	Paradig	Il Education ms", 1 st Ed EE)NPTEL)	n Priva	I (H) Und	BT Malighest Applying	pped Level) ding (K2) g (K3) g (K3)
COURSED CO2 (CO3 (CO4 (CO5))	Frank D. Perfor Unit 1,2 Rajkumar E (Imprint of Imprint	J.ac.in/co	Amir Vahica, USA, 201 ontent/stora se, the str s about back and with PLo peration in ctural inter	d Dastjerdi, "I for Unit 5 age2/courses age2/courses udents will I sics of auton C advanced P faces and op logies, oppo	nternet of Thir s/108105063/p s/108105063/p see able to nation system C and SCAD/ eration about tunities, challe	df/L-01(Sf) df/L-02(Sf) CCS Inges to br	M)(IA&C	Paradig	II Education ms", 1st Ed EE)NPTEL) EE)NPTEL) 4.0	pdf	I (H Und	BT Malighest lerstand	pped Level) ding (K2) g (K3) g (K3) ding (K2)
1. 1 1 1 1 1 1 1 1 1	Frank D. Perfor Unit 1,2 Rajkumar E (Imprint of I ENCES: https://npte https://npte E OUTCOM pletion of the explain the develop pro analyze the interpret the illustrate the	J.ac.in/co	Amir Vahica, USA, 201 ontent/stora se, the str s about back and with PLo peration in ctural inter	d Dastjerdi, " 16 for Unit 5 age2/courses age2/courses udents will I sics of auton C advanced Pl faces and op	nternet of Thir s/108105063/p s/108105063/p se able to nation system C and SCAD/ eration about tunities, challe	df/L-01(Sf) df/L-02(Sf) CCS Inges to br	oles and M)(IA&C	Paradig	Il Education ms", 1 st Ed EE)NPTEL)	n Priva	I (H Und	BT Malighest Applying Applying Applying Ilerstand	pped Level) ding (K2) g (K3) g (K3) ding (K2)
1. 1 1 1 1 1 1 1 1 1	Frank D. Perfor Unit 1,2 Rajkumar E (Imprint of Imprint	J.3,4. Buyya & A Elsevier) I.ac.in/co	Amir Vahica, USA, 201 ontent/stora se, the str s about back and with PLo peration in ctural inter	d Dastjerdi, "I for Unit 5 age2/courses age2/courses udents will I sics of auton C advanced P faces and op logies, oppo	nternet of Thir s/108105063/p s/108105063/p see able to nation system C and SCAD/ eration about tunities, challe	df/L-01(Sf) df/L-02(Sf) CCS Inges to br	M)(IA&C	Paradig	II Education ms", 1st Ed EE)NPTEL) EE)NPTEL) 4.0	pdf	I (H Und	BT Malighest lerstand	pped Level) ding (K2) g (K3) g (K3) ding (K2)

CO4	3	1						2	2
CO5	3	1						2	2

Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
20	40	40				100
10	40	50				100
30	70	-				100
10	50	40				100
	(K1) % 20 10 30	(K1) % (K2) % 20 40 10 40 30 70	(K1) % (K2) % (K3) % 20 40 40 10 40 50 30 70 -	(K1) % (K2) % (K3) % (K4) % 20 40 40 10 40 50 30 70 -	(K1) % (K2) % (K3) % (K4) % (K5) % 20 40 40 10 40 50 30 70 -	(K1) % (K2) % (K3) % (K4) % (K5) % (K6) % 20 40 40 10 40 50 30 70 -

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

					_		MING AND nics and Ins	-	_		g)			
Progra Branci	nmme &		E/BTech I		-	t Electroni	ics and		Sem.	Category	L	Т	Р	Credit
Prerec	uisites	Nil							6	OE	3	1	0	4
		<u> </u>												
Pream Unit - I			<u> </u>	•			ble controlle An Overvi		d Industr	al Automat	on			9+3
Introdu Compo	oction - Ponents: Th	arts of a ne I/O Sec	PLC - Prii	nciple of rete I/O	operation	on - PLCs - Analog I/0	versus Co O modules d Retrieving	mputers - Specia	al I/O mo	dules - I/O				Hardwar
Addres	sor Mem	ory Orga anch Insti	nization – uctions – I	Prograi nternal f	m Scan Relay Ins	- PLC Postructions -	amming Tin Programming - Examine I Ladder Pro	g Langi F CLOS	SED and	IF OPEN -	Mode	es of	Operat	ions. Seal
Instruc	tion – Off	Delay Tin	er Instruct	ion – Re	etentive 1	Γimer – Cas	scading Tim	ners.						
Unit -							ontrol Instr							9+3
Com	bining Co	unter and	Timer Fu	nctions.	Program		 Cascading nstructions: 							
Unit - I	V	Adva	nced PLC	Progra	mming:									9+3
Introdu	ction – Ad	ldition Ins		ubtraction			insfer Oper tiplication Ir							
Unit - '			ications:											9+3
TEXT	воок:									Lectu	ıre:45	, Tut	orial:1	5, Total:6
_														
1.	Delhi, 2		a, "Progra	mmable	Logic Co	ontrollers",	5 th Edition,	Tata Mo	cGraw H	ill Education	n Priva	ate Li	imited,	New
	Delhi, 2		a, "Progra	mmable	Logic Co	ontrollers",	5 th Edition,	Tata Mo	cGraw H	ill Education	n Priva	ate Li	imited,	New
REFE	RENCES: John W	019. . Webb 8		. Reis,			5 th Edition,							
1. REFEF 1. 2.	John W Educati	019. . Webb & on India, I	Ronald <i>F</i>	A. Reis,	"Prograr	mmable Lo		llers: Pr						
REFEF 1. 2. COUR	John W Educati http://in:	. Webb & on India, I strumenta	Ronald <i>F</i>	a. Reis, om/learr	"Prograr n-prograr	mmable Lo mmable-log	ogic Control	llers: Pr				, 5 th		Pearson
REFER 1. 2. COUR On co	John W Educati http://in:	. Webb & on India, I strumenta	Ronald Andia, 2015 ion tools.c	A. Reis, om/learr	"Progran	mmable Lo mmable-log able to	ogic Control	llers: Pr r-plc/				, 5 th	Edition, BT Map	Pearson
REFEF 1. 2. COUR	John W Educati http://ins SE OUTC mpletion gain kno	. Webb & on India, I strumenta COMES: of the co	Ronald Andia, 2015 ion tools.c	a. Reis, om/learr	"Progran n-progran s will be	mmable Lo mmable-log able to	ogic Controllegic-controlle	llers: Pr r-plc/				, 5 th (H	Edition, BT Map	Pearson pped Level)
REFER 1. 2. COUR On con CO1 CO2	John W Educati http://in: SE OUTO mpletion gain knowninterpre	. Webb & on India, I strumenta COMES: of the co	Ronald Andia, 2015 ion tools.c	a. Reis, om/learr students compor	"Progrand-progrands will be nents of pand lange	mmable Lo mmable-log able to programma	ogic Controllegic-controlle	llers: Pr r-plc/				, 5 th (H Und	Edition	Pearson pped Level) ling (K2)
REFEF 1. 2. COUR On col	John W Educati http://in: SE OUTO mpletion gain know interpre	. Webb & on India, I strumenta comes: of the co wledge of the co a various p	Ronald Andia, 2015 ion tools.c urse, the sent the basic rogrammir wiring and	a. Reis, om/learr students compor	"Progrand n-progrand s will be nents of pand langumming w	mmable Lo mmable-log able to programma guages of F	ogic Controllegic-controlle	r-plc/				(HU)	Edition, BT Maplighest lerstand	Pearson pped Level) ling (K2) g (K3)
REFER 1. 2. COUR On col CO1 CO2 CO3	John W Educati http://ins SE OUTO mpletion gain know interpre develop impleme	. Webb & on India, I strumenta comes: of the co whedge of the co hardware	Ronald Andia, 2015 ion tools.c urse, the sent the basic rogrammir wiring and	a. Reis, com/learr students compor ng logics d prograr mer and	"Program n-program s will be nents of p and lang mming w counter	mmable Lo mmable-log able to programma guages of F	ogic Controlle gic-controlle able automa PLC	r-plc/				(HU)	Edition, BT Maplighest lerstand Applying	Pearson pped Level) ding (K2) g (K3) g (K3)
COUR On col CO1 CO2 CO3 CO4	John W Educati http://ins SE OUTO mpletion gain know interpre develop impleme	. Webb & on India, I strumenta comes: of the co whedge of the co hardware	Ronald Andia, 2015 ion tools.c urse, the sent the basic rogrammir wiring and	a. Reis, com/learr students compor ng logics d prograr mer and	"Program n-program s will be nents of p and lang mming w counter d in indus	mmable Lo mmable-log able to programma guages of F ith PLCs based sequents	ogic Controlle gic-controlle able automa PLC	r-plc/ tion	rinciples			(HU)	Edition, BT Maplighest lerstand Applying Applying	Pearson pped Level) ding (K2) g (K3) g (K3)
COUR On col CO1 CO2 CO3 CO4	John W Educati http://in: SE OUTO mpletion gain knot interpre develop impleme apply pr	. Webb & on India, I strumenta COMES: of the co ewledge of the correct warious properties the correct the correct the correct or the correct thand the correct the correct the correct the correct the correct t	Ronald Andia, 2015 ion tools.c urse, the sent the basic rogrammir wiring and	a. Reis, com/learr students compor ng logics d prograr mer and	"Program n-program s will be nents of p and lang mming w counter d in indus	mmable Lo mmable-log able to programma guages of F ith PLCs based sequential applications	ogic Controlle gic-controlle able automa PLC uence controlle	r-plc/ tion	rinciples			(HU)	Edition, BT Maplighest lerstand Applying Applying	Pearson pped Level) ding (K2) g (K3) g (K3)
COUR On col CO1 CO2 CO3 CO4 CO5	John W Educati http://in: SE OUTO mpletion gain knot interpre develop implement apply processors POS PO	. Webb & on India, I strumenta comes: of the co owledge of the various properties that the core ogramma	Ronald Andia, 2015 ion tools.c urse, the sent the basic rogrammir wiring and acepts of ti	a. Reis, om/learr students compor ng logics I prograr mer and er basec	"Progrand and languaring was countered in indus	mmable Lo mmable-log able to programma guages of F ith PLCs based sequential applications	egic Controller gic-controller able automa PLC uence controller cations	r-plc/ tion	rinciples	and Applic	ation"	(HU)	Edition	Pearson pped Level) ding (K2) g (K3) g (K3) g (K3)

3

CO3

CO4	3	2	1	1	1				3	3
CO5	3	2	1	1	1				3	3

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	60	30				100
CAT2	10	30	60				100
CAT3	10	30	60				100
ESE	10	30	60				100

^{*} $\pm 3\%$ may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

22EIO04 - VIRTUAL INSTRUMENTATION (Offered by Department of Electronics and Instrumentation Engineering) All BE/BTech branches except Electronics and Programme & Sem. Category P Credit L т **Branch Instrumentation Engineering Prerequisites** Nil 6 OE 3 1 0 4 Preamble Virtual instrumentation is a powerful concept for control, measuring, testing and analysis of real time problems. This course aims at giving an adequate exposure and practice in LabVIEW programming and DAQ system to overcome the limitations of classical methods. Unit - I **Introduction to Virtual Instrumentation:** Virtual Instrumentation- Programming Requirements- Drawbacks of Recent Approaches- Virtual Instruments Versus Traditional

Virtual Instrumentation- Programming Requirements- Drawbacks of Recent Approaches- Virtual Instruments Versus Traditional Instruments- Advantages of VI- Creating Virtual Instruments Using LabVIEW- Virtual Instrumentation in the Engineering Process-Graphical Programming and Textual Programming- Advantages of LabVIEW- LabVIEW Environment- Dataflow Programming- G Programming.

Unit – II Basic Tools, Loops and Graphs:

9+3

Front Panel-Block Diagram Tools and Palettes- Repetition and Loops: FOR Loop, While Loop, Shift Registers, Tunnels, Feedback Nodes, Local and Global Variables – Arrays-Clusters-Waveform Charts-Waveform Graphs-XY Graphs-Intensity Graphs and Charts-Digital Waveform Graph-3D Graphs.

Unit – III Programming with Structures:

9+3

Structures: Case Structure, Sequence Structures, Customizing Structures, Timed Structures, Formula Nodes, Event Structure, MathScript-Strings-File I/O-State Machine.

Unit – IV Data Acquisition:

9+3

Interface Buses: RS 232, RS422, RS485, GPIB and USB. Hardware Aspects: Signal Grounding-Signal Conditioning-Digital I/O Techniques-Data Acquisition in LabVIEW-Hardware Installation and Configuration-Components of DAQ-DAQ Signal Accessory-DAQ Assistant-DAQ Hardware- DAQ Software.

Unit – V Tools and Applications:

9+3

Signal processing and Analysis Tools-Control System Design and Simulation Tools-Signal, Voltage and Current measurement using general purpose DAQ Card-Bio-Medical Signal Acquisition using NI-ELVIS –Temperature Measurement.

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. S.Sumathi , P.Surekha, "LabVIEW based Advanced Instrumentation Systems", 1st Edition, Springer Berlin, Heidelberg, 2007.

REFERENCES:

1. Jovitha Jerome, "Virtual Instrumentation Using LabVIEW", 3rd Edition, PHI Learning Pvt. Ltd., New Delhi, 2012.

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	explain the Virtual Instrumentation concepts	Applying (K2)
CO2	apply structured programming concepts in developing LabVIEW programs	Applying (K3)
CO3	build LabVIEW programs using structures, nodes and state machine concepts	Applying (K3)
CO4	utilize DAQ System to solve real time problems	Applying (K3)
CO5	apply knowledge on various tools in practical works	Applying (K3)

Mapping of COs with Pos and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2											2	2
CO2	3	2	1	1	1								3	3
CO3	3	2	1	1	1								3	3
CO4	3	2	1	1	1								3	3
CO5	3	2	1	1	1								3	3

	ASSESSMENT PATTERN – THEORY														
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %								
CAT1	20	50	30				100								
CAT2	15	40	45				100								
CAT3	15	60	30				100								
ESE	20	40	40				100								

		(0	Offered b							RIAL IoT ntation I	Engineerin	g)			
Programme Branch	e &		/BTech b			t Electr	onics a	and		Sem.	Category	L	Т	Р	Credit
Prerequisit	es	Nil								7	OE	3	0	0	3
Preamble		To tran	eform the	inducti	ial proc	occoc th	rough t	ho intoc	ration o	of moder	n technolog	ioc cu	ch o	c conco	rc
reamble			inication,						nauon	n moden	ii teciiilolog	ies su	UII a	5 561150	5,
Jnit – I			uction to												9
ntroduction - Intelligent Characterist	devices	s – Key d	opportuni	ties and											
Jnit – II			chitectu												9
IoT Referer - Connectiv - Overview	ity: Key	system	character	istics, C	Connecti										
Unit – III		lloT W	AN Tech	nologie	s and P	rotoco	ls:								9
Need of Pro Standard Et RPMA, Low	thernet.	Legacy	Industria	al protoc	cols – M WAN op	odern C otimized	Commur I techno	logies	protoco for M2N	ols: Indu: //: SigFo	strial Etheri x, LoRaW <i>I</i>	net, Er N, nV	ncap Vave	sulated e, Dash7	Field Bus 7, Ingenu
Unit – IV			rial loT S												9
ntroduction solutions – patterns – fo	Strategi	c princip	les of cyl	oer seci	urity - c	yber se	curity m	easure							
Jnit – V	Jui Hei		rial loT A					•							9
Software D	efined I							– Clou	d and	Foa - B	ig Data an	d Ana	lvtic	s in Ilo	_
Technologic	cal com	ponents													
operation ar	nd traini	ng.													
															Total:4
TEXT BOO	K:														
1. Ala	sdair Gi	lchrist, "l	ndustry 4	.0: The	Industria	al Intern	et of Th	ings", 1	st Edition	n, Apres	s Media, N	ewYor	k, 20	016.	
REFERENC	CES:		<u> </u>												
Alp		dag and	EmreCev	vikcan.	"Industr	v 4.0: I	Managir	na the	Digital	Transfor	mation", S	pringe	r se	ries in	Advance
i. Mar	nufactur	ring, Swit	zerland, 2	2018.		-									
							ngs (IoT) Systei	ns, Arc	hitecture	s, Algorithn	ns, Me	thod	ologies"	, Springe
Inte	ernation	ai Publisi	ning AG,	Switzeri	and, 20	18.									
COURSE O	UTCON	/FS·												BT Map	ned
On comple			se, the s	tudents	will be	able to)							lighest	
CO1 exp	lore the	basics o	of industria	al intern	et of thir	ngs							Und	derstand	ling (K2)
			ts of vario				ompone	ents							ling (K2)
002 1110	nprot tin	0 001100p	no or vario		ootaro		ompone						0110	201010110	g (112)
CO3 des	ign and	impleme	ent protoc	ols and	sensors	for IIoT	-						/	Applying	(K3)
CO4 imp	art the I	knowledg	ge of IIoT	security	/ layers								Und	derstand	ling (K2)
CO5 app	oly IIoT i	n real tim	ne Industr	ial appli	cations								,	Applying	(K3)
1								D C							
00 /50	D C :	D 6 5	D .C.C.	n c :		ng of C	1		ı	ı	D			DOC :	
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1	2	PSO1	PSO2
CO1	3	1						1			[1	1

CO2

CO3

CO4	3	1					1			2	2
CO5	3	2	1	1	1		1			3	3

	ASSESSMENT PATTERN - THEORY													
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %							
CAT1	15	85					100							
CAT2	10	50	40				100							
CAT3	5	35	60				100							
ESE	10	50	40				100							

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

						IDUSTRIAL								
		((Offere	d by De _l	partment (of Electron	ics and	Instrur	nentatio	n Engineer	ring)			
Programm Branch	ne &				es except ineering	Electronic	s and		Sem.	Category	L	Т	Р	Credit
Prerequisi	ites	Nil							7	OE	3	0	0	3
Preamble		wireles	s comm	nunicatio	n.	s of data co	mmunica	ation, d	ifferent ir	ndustrial cor	nmunica	tion pr	otocol	
Unit – I				ınicatio		osala DO	2000		DC 000) :tf		(00)	TT \/ C	9
	- Half-dup	olex ope	ration of	f the RS		ocols – RS ace – Limita								
Unit – II				•	ber Optics	s Cable Cor	nmunica	ation:						9
	Fibre opt	acteristic	s – Cab	le selec	tion – Coax	xial cables - able compor	- Twisted	l-pair ca						
Unit – III			US, PR	OFIBUS	PA/DP/F	MS and TC	P/IP:							9
(Packet Transwork lay Unit – IV HART: HA	ansport) - yer proble RT Introd	– Host-tems – Tre HART luction –	o-host I ansport and Fo - HART	ayer: en layer pr undatio and sma	nd to end roblems. In Field Buart instrum	ation objects reliability. To us: nentation – I er and Wirir	CP/IP tro	layer,	ooting: I	ntroduction	- Comn	non pr er – H	oblems	s – Typical 9 Commands.
Error detec							.g .ta.co,	1110 2	ata iii iit i	ayor, 111071	ppiioaiio	iayo	, , , , ,	oooi layoi,
Unit – V		Indust	rial Eth	ernet ar	nd Wireles	SS Commur 100 Mbps E								9
TEXT BOO	OK:													Total:45
_			0:		- 1 · 14/			15		. ,.	" 4ct F I			
1.		eynders	, Steve	Mackay,	, Edwin Wr	right, "Practi		strial Da	ata Com	munications	", 1 st Ed	ition, E	Elsevie	
	Deon Re	eynders	, Steve	Mackay,	, Edwin Wr	right, "Practi		strial Da	ata Com	munications	", 1 st Ed	ition, E	Elsevie	
1. REFEREN 1.	Deon Ro					right, "Practi ion and Net	ical Indus							r, 2005.
REFEREN	Deon Ro	an, Behro	ouz A., '	"Data co	mmunicati		ical Indus	, 5 th Ed	ition, Ta	ta McGraw-I				r, 2005.
REFEREN 1.	Deon Ro CES: Forouza William Steve M	an, Behro L.Schwe	ouz A., ' eber, "D Edwin	"Data co ata Com Wright,	ommunication	ion and Net ns", 1 st Edit ynders," Pr	ical Indus working" ion, Tata	, 5 th Ed	ition, Tar	ta McGraw-l 2009.	Hill, New	Delhi	, 2013.	r, 2005.
REFEREN 1. 2.	Deon Ro CES: Forouza William Steve No Troubles	L.Schwe	ouz A., ' eber, "D Edwin	"Data co ata Com Wright,	ommunication Deon Re	ion and Net ns", 1 st Edit ynders," Pr	ical Indus working" ion, Tata	, 5 th Ed	ition, Tar	ta McGraw-l 2009.	Hill, New	Delhi Install	, 2013. ation a	r, 2005. and
1. 2. 3.	Deon Ro CES: Forouza William Steve N Troubles	an, Behro L.Schwe Mackay, shooting IES: he cour	ouz A., 'Deber, "DEdwin J", 1st Eco	"Data co ata Com Wright, dition, E	ommunication Deon Relsevier, 20	ion and Net ns", 1 st Edit ynders," Pr 005. able to	working" ion, Tata	, 5 th Ed i McGra	ition, Tar aw-Hall, : al Data	ta McGraw-I 2009. Networks:	Hill, New Design,	Delhi Install	, 2013. ation a	r, 2005.
REFEREN 1. 2. 3.	Deon Ro CES: Forouza William Steve N Troubles	L.Schwe Mackay, shooting IES: he cour	ouz A., 'Deber, "DEdwin J", 1st Eco	"Data co ata Com Wright, dition, E	ommunication Deon Relsevier, 20	ion and Net ns", 1 st Edit ynders," Pr 005.	working" ion, Tata	, 5 th Ed i McGra	ition, Tar aw-Hall, : al Data	ta McGraw-I 2009. Networks:	Hill, New Design,	Delhi Install	ation a	r, 2005. and
1. 2. 3. COURSE (On complete)	Deon Ro CES: Forouza William Steve N Troubles OUTCOMetion of t Make us interface	L.Schweing Mackay, shooting IES: he course of the e	ouz A., 'Deber, "D Edwin J", 1 st Ed	"Data contata Com Wright, dition, El studentials of th	ommunication Deon Relatevier, 20	ion and Net ns", 1 st Edit ynders," Pr 005. able to	working" ion, Tata ractical I	, 5 th Ed McGra ndustria	ition, Tar aw-Hall, a al Data ne serial (ta McGraw-I 2009. Networks:	Hill, New Design,	Delhi Install	ation a	and apped st Level)
REFEREN 1. 2. 3. COURSE (On completed) CO1 CO2	Deon Ro CES: Forouza William Steve M Troubles OUTCOMetion of t Make us interface Interpres	L.Schwe Mackay, shooting IES: he cour se of the	ouz A., 'Deber, "D Edwin ", 1st Ed	"Data contata Com Wright, dition, E studentials of the	ommunication Deon Results will be a see communication and the comm	ion and Net ns", 1 st Edit synders," Pr 2005. able to nication syst	working" ion, Tata actical I	, 5 th Ed McGra ndustria	ition, Tar aw-Hall, a al Data ne serial (ta McGraw-I 2009. Networks:	Hill, New Design,	Delhi Install (Ur	ation a BT M Higher adersta	and apped st Level)
1. 2. 3. COURSE (On comple	Deon Ro CES: Forouza William Steve M Troubles OUTCOMetion of to Make us interface Interpret Examine	L.Schwe Mackay, shooting IES: he cour se of the e t knowle	ouz A., 'Deber, "D Edwin g", 1st Ed ese, the essention	"Data contata Com Wright, dition, E student ials of the	ommunication Deon Re Isevier, 20 ts will be a ne communication	ion and Net ns", 1 st Edit synders," Pr 2005. able to nication syst	working" ion, Tata ractical I	, 5 th Ed McGra ndustria	ition, Tar aw-Hall, a al Data ne serial (ta McGraw-I 2009. Networks:	Hill, New Design,	Delhi Install (Ur Ur	BT M Highest anderstanderstanderstandersta	and apped st Level) anding(K2)
REFEREN 1. 2. 3. COURSE (On completed) CO1 CO2 CO3	Deon Ro CES: Forouza William Steve M Troubles OUTCOM etion of the Make us interface Interpretation of the Int	L.Schwe Mackay, shooting IES: he cour se of the e t knowle e the sui	eber, "D Edwin g", 1st Ec	"Data conata Com Wright, dition, E student ials of th out Copp of variou	Deon Re Isevier, 20 ts will be a per cable a las communications of the communications o	ion and Net ns", 1 st Edit eynders," Pr 2005. able to nication system and fiber opt	working" ion, Tata ractical li em and l ic cable o	, 5 th Ed McGra ndustria learn th commu	ition, Taraw-Hall, and Data	ta McGraw-I 2009. Networks:	Hill, New Design,	Delhi Install (Ur Ur	BT M Highest anderstanderstanderstandersta	and apped st Level) anding(K2) anding(K2)
REFEREN 1. 2. 3. COURSE (On complete CO1 CO2 CO3 CO4	Deon Ro CES: Forouza William Steve M Troubles OUTCOM etion of the Make us interface Interpretation of the Int	L.Schwe Mackay, shooting IES: he cour se of the e t knowle e the sui	eber, "D Edwin g", 1st Ec	"Data conata Com Wright, dition, E student ials of th out Copp of variou	Deon Re Isevier, 20 ts will be a see communum cation and communum communication commun	ion and Net ns", 1st Edit lynders," Pr 2005. able to ication systematication protection protection of the systematication of the systematication protection of the systematication of the systematication protection of the systematication of the systematica	working" ion, Tata ractical li ic cable o ocols d Field bu	, 5 th Ed McGra ndustria learn th commu	ition, Taraw-Hall, and Data ne serial controls	ta McGraw-I 2009. Networks:	Hill, New Design,	Delhi Install (Ur Ur	BT M Highest anderstanderstanderstandersta	apped st Level) anding(K2) anding(K2) anding(K2)
REFEREN 1. 2. 3. COURSE (On complete CO1 CO2 CO3 CO4	Deon Ro CES: Forouza William Steve M Troubles OUTCOM etion of the Make us interface Interpretation of the Int	L.Schwe Mackay, shooting IES: he cour se of the e t knowle e the sui	eber, "D Edwin g", 1st Ec	"Data conata Com Wright, dition, E student ials of th out Copp of variou	mmunication Deon Re Isevier, 20 ts will be and the communication Decr cable and the communications of the communication of	ion and Net ons", 1st Edit cynders," Pr 2005. able to nication syst nication prote of HART and et and wirel	working" ion, Tata ractical li ic cable o ocols d Field bu	, 5 th Ed McGra ndustria learn th commu	ition, Taraw-Hall, and Data ne serial controls	ta McGraw-I 2009. Networks:	Hill, New Design,	Delhi Install (Ur Ur Ur	BT M Highest anderstanderstanderstandersta	and apped st Level) anding(K2) anding(K2) anding(K2)

CO2	3	1		1				2	2
CO3	3	1		1				2	2
CO4	3	2		1				3	3
CO5	3	1		1				3	3

 $1-Slight,\, 2-Moderate,\, 3-Substantial,\, BT-\, Bloom's\, Taxonomy$

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	20	80					100
CAT3	20	60	20				100
ESE	20	60	20				100

^{* ±3%} may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

_		A!! ===	-											
Programn Branch	ne &		BTech b nentatio			Electronics	and		Sem.	Category	L	T	Р	Credit
Prerequis	ites	Nil							7	OE	3	0	0	3
Preamble						technology formation on								
Jnit – I		Wireles	s Instru	mentatio	n Tech	nology:								9
ommunic	ation prot	ocols – R	F interfa	ces and	example	asurement s s – Networks systems – Se	s of wirel	ess inst	ruments					
Jnit – II		Powerii	ng Auto	nomous	sensor	s:								9
nstrument Thermal e values.	ts – Enei	rgy harve rvesting –	esting: So - Energy	olar and manage	wind ei ment te	d transduce nergy harves chniques – (sting, RF Calculatio	energy	y harves	ting, Energy	/ harv	estir/	ng from	n vibration SI and LQ
Jnit – III	IADT D					or Automatic					10.4	00.4	4 1 1	9
	Working (group of	ISA 100	Featu	ires – S	s – Addressi Sensor class ol stacks.								
Jnit – IV			of Wire											9
		d instrume networks a			n – Wire	eless integra	ted netw	ork sen	sors – P	ug-and-play	sens	ors a	nd net	works –
					rence b	etween LoRa	a and Lol	RaWAN	I – LoRa	WAN archite	ecture	– Lo	RaWA	N classes
Jnit – V		Wireles	s Senso	r and In	strume	nt Application	ons:							9
	ment net	works - V	Vireless	human h	nealth m	- Commerci	nd enviro	nmenta	l applica	tions – Rad				
							portation	unu ng						
						ons in Transp	portation	4.749						Total:4
EXT BO	OK:				r 1	5115 III TTAITS	portation							Total:4
Jo	ohn G. We		alit Eren,	"Measur	ement,	Instrumentati					ition,	CRC	Press	
· Jo	ohn G. We rancis Gro	ebster, Ha	alit Eren,	"Measur	ement,	Instrumentati					ition,	CRC	Press	
Fr REFEREN Su Bu	ohn G. We rancis Gro ICES: ubhas Chusiness M	ebster, Ha bup, LLC, andra Mu ledia, Hei	alit Eren, Boca Ra Ikhopadh idelberg,	"Measur iton, Floi yay, "Sm German	ement, ida, 201 nart Sen y, 2013	Instrumentati 7 sors, Measu	ion, and	Sensors	s Handb	ook", 2 nd Ed	tion , :	Sprin	ger Sc	- Taylor &
St. St.	ohn G. We rancis Gro ICES: ubhas Chusiness M	ebster, Ha bup, LLC, andra Mu ledia, Hei	alit Eren, Boca Ra Ikhopadh idelberg,	"Measur iton, Floi yay, "Sm German	ement, ida, 201 nart Sen y, 2013	Instrumentati 7	ion, and	Sensors	s Handb	ook", 2 nd Ed	tion , :	Sprin	ger Sc	- Taylor &
REFEREN Su Bu Su 2. Su 2. 20	ohn G. We rancis Gro ICES: ubhas Chusiness Munit Kuma	ebster, Ha bup, LLC, andra Mu ledia, Hei ar Sen, "F	alit Eren, Boca Ra ikhopadh idelberg, Fieldbus	"Measur iton, Floi yay, "Sm German and Netv	ement, ida, 201 aart Sen y, 2013 vorking	Instrumentati 7 sors, Measu	ion, and rement a	Sensors and Instr	s Handbourness	ook", 2 nd Ed ion", 2 nd Edi Taylor & Fra	tion , s	Sprin	ger Sc	- Taylor & ience & , London,
Jo Fr REFEREN Su Bu 20 3. Ha	ohn G. Worancis Gro ICES: ubhas Chusiness Munit Kuma 017 alit Eren,	ebster, Habup, LLC, andra Mu ledia, Hei ar Sen, "F "Wireless	alit Eren, Boca Ra ikhopadh idelberg, ieldbus	"Measur iton, Floi yay, "Sm German and Netv	ement, ida, 201 aart Sen y, 2013 vorking	Instrumentati 7 sors, Measu in Process A	ion, and rement a	Sensors and Instr	s Handbourness	ook", 2 nd Ed ion", 2 nd Edi Taylor & Fra	tion , s	Sprin Grou C Pre	ger Sc	- Taylor & ience & , London,
Jo Fr REFEREN Su Bu Su 20 Bu Ha	ohn G. Worancis Gro ICES: ubhas Ch usiness M unit Kuma 017 alit Eren, OUTCOM etion of the	ebster, Habup, LLC, andra Mu Media, Hei ar Sen, "F "Wireless MES: the cours	alit Eren, Boca Rankhopadh idelberg, Fieldbus Sensors	"Measur yay, "Sm German and Netv	ement, ida, 201 nart Sen y, 2013 vorking ruments	Instrumentati 7 sors, Measu in Process A	rement a	Sensors and Instr on", 1st and App	s Handbournerstate	ook", 2 nd Ed ion", 2 nd Edi Taylor & Fra	ancis (Sprin Grou C Pre B1 (Hig	ger Sc p, LLC ess, 20 Mapp hest L	- Taylor & ience & , London,
Su S	ohn G. We rancis Gro ICES: ubhas Chusiness Munit Kuma 017 alit Eren, OUTCOM letion of the	ebster, Habup, LLC, andra Mu ledia, Hei ar Sen, "F "Wireless MES: the course	alit Eren, Boca Ra ikhopadh idelberg, ieldbus Sensors se, the s	"Measur yay, "Sm German and Netv	ement, ida, 201 art Sen y, 2013 vorking ruments will be a	Instrumentation of the second	rement a Automatic Design, a	Sensors and Instr on", 1 st and App	umentat Edition, Dlications	ook", 2 nd Ediion", 2 nd Edi Taylor & Fra	n, CRG	Sprin Grou C Pre B1 (Hig	ger Sc p, LLC ess, 20 Mapp hest Lo	- Taylor & ience & , London, 06
Substitution of the control of the c	ohn G. We rancis Gro ICES: ubhas Chusiness Munit Kuma 017 alit Eren, OUTCOM letion of the control of the con	ebster, Habup, LLC, andra Mu fledia, Hei ar Sen, "F "Wireless fleS: the cours e power so	alit Eren, Boca Ra akhopadh idelberg, Fieldbus Sensors se, the serumentat	"Measur yay, "Sm German and Netv and Inst	ement, ida, 201 art Sen y, 2013 vorking ruments will be a ms and	Instrumentation 7 sors, Measurin Process Are: Networks, able to fundamental	ion, and rement a Automatic Design, a	Sensors and Instr on", 1 st and App	s Handbourners Han	ook", 2 nd Ediion", 2 nd Edi Taylor & Fra	tion , ancis (Sprin Grou C Pre B1 (Hig	ger Sc p, LLC ess, 20 Mapp hest Lo standir	- Taylor 8 ience & , London, 06 ed evel)
GOURSE COOL incomple COOL incom	ohn G. Worancis Gro ICES: ubhas Ch usiness M unit Kuma 017 alit Eren, OUTCOM letion of the entify difference of the cognize the	ebster, Habup, LLC, andra Mu ledia, Hei ar Sen, "F "Wireless MES: the cours e power so he differen	alit Eren, Boca Ra khopadh idelberg, Fieldbus Sensors se, the serumentate burces ar	"Measur yay, "Sm German and Netv and Inst udents on syste	ement, ida, 201 art Sen y, 2013 vorking ruments ms and y storag ols and	Instrumentation 17 sors, Measur in Process Ars: Networks, able to fundamental e units used	ion, and rement a Automatic Design, a Is of wire for autor	Sensors and Instr on", 1st and App less tec	s Handbourners Han	ook", 2 nd Ediion", 2 nd Edi Taylor & Fra	tion , sancis (Sprin Grou C Pre B1 (Hig nder	ger Sc p, LLC ess, 20 Mapp hest L standir standir	- Taylor & ience & , London, 06 ed evel) ng (K2)
REFEREN Su Bu 2. 20 3. Ha COURSE COO ind C	ohn G. Worancis Gro ICES: ubhas Ch usiness M unit Kuma 017 alit Eren, OUTCOM entify differ dicate the ecognize to	ebster, Habup, LLC, andra Mu fedia, Hei ar Sen, "F "Wireless MES: the cours erent instr e power so he different	alit Eren, Boca Ra ukhopadh idelberg, Fieldbus Sensors se, the serumentat ources and nt wirele	"Measur yay, "Sm German; and Netv and Inst udents on syste	ement, ida, 201 nart Sen y, 2013 vorking ruments ms and y storag ols and ure for w	Instrumentati 7 sors, Measu in Process A s: Networks, able to fundamental e units used network star	ion, and rement a Automatic Design, a Is of wire for autor ndards fo	Sensors and Instr on", 1st and App less tec nomous or wirele	s Handbourners Han	ook", 2 nd Ediion", 2 nd Edi Taylor & Fra	tion , sancis (Sprin Grou C Pre B1 (Hig nder	ger Sc p, LLC ess, 200 Mapp hest Lo standir standir standir	- Taylor & ience & , London, 06 ed evel) ng (K2) ng (K2)
REFERENCE SUBJECT SUBJ	ohn G. Worancis Gro ICES: ubhas Ch usiness M unit Kuma 017 alit Eren, OUTCOM entify differ dicate the ecognize to	ebster, Habup, LLC, andra Mu fedia, Hei ar Sen, "F "Wireless MES: the cours erent instr e power so he different	alit Eren, Boca Ra ukhopadh idelberg, Fieldbus Sensors se, the serumentat ources and nt wirele	"Measur yay, "Sm German; and Netv and Inst and Inst cudents on syste and energy	ement, ida, 201 nart Sen y, 2013 vorking ruments ms and y storag ols and ure for w eless se	Instrumentati 7 sors, Measu in Process A s: Networks, able to fundamental e units used network star	ion, and rement a Automatic Design, a Is of wire for autor ndards fo ces and L	Sensors and Instr on", 1st and App less tec nomous or wirele oRA systems	s Handbourners Han	ook", 2 nd Ediion", 2 nd Edi Taylor & Fra	tion , sancis (Sprin Grou C Pre B1 (Hig nder	ger Sc p, LLC ess, 200 Mapp hest Lo standir standir standir	- Taylor 8 ience & , London, 06 eed evel) ng (K2) ng (K2) ng (K2)

CO1	3	2	2							
CO2	3	2	2						3	
CO3	3	3	2	2	3				3	2
CO4	3	3	3	2	3				3	3
CO5	3	3	3	3	3				3	3

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
15	85					100
15	85					100
15	85					100
10	90					100
	(K1) % 15 15 15	(K1) % (K2) % 15 85 15 85 15 85 15 85	(K1) % (K2) % (K3) % 15 85 15 85 15 85	(K1) % (K2) % (K3) % (K4) % 15 85 15 85 15 85	(K1) % (K2) % (K3) % (K4) % (K5) % 15 85 15 85 15 85	(K1) % (K2) % (K3) % (K4) % (K5) % Creating (K6) % 15 85 15 85 15 85

^{* ±3%} may be varied (CAT 1, 2 & 3 – 60 marks & ESE – 100 marks)

		(Offered by	, ,									
Programi Branch	me &			anches excep Engineering	ot Electronics	and		Sem.	Category	L	т	Р	Credit
Prerequis	sites	Transo	ducers Enç	gineering				7	OE	3	0	0	3
Preamble Unit – I	9			nsing and aut	omation techno	logy assoc	ciated	with agri	culture.				9
	v of instruc				and food proce	essina reau	iireme	ent World	d Agriculture	Scen	ario	Indian A	-
sector – A		Review-	Areas of C		nation, Interpret								
Unit – II	iucers – C		ransducer	'S									9
	gy Trend -				lucers, Capaciti	ve gauges,	, Silico	on Displa	acement trans	sduce	r, Sili	con Tei	-
ransduce	er, Silicon	Pressu	re Transd	lucer. Grain	Moisture trans								
				ent Sensors.									•
Unit – III Microproc			ation in A		nt- Introduction,	Sensing N	Mecha	aniem I/I	O requireme	nt ans	alveie	Micro	9 processor
					rients and thei								
mechanis	sm. Prepa	ration of	soil extract	for estimation	of N,P,K and S	S, I/O requi	iremer	nt Analys	sis. SĆADA E	Based	syste	em for A	Ágriculture
	monitoring		ari cancar	s with Microco	ontroller								
Jnit – IV				nd Precision									9
		rs, Hardv	vare block	Schematic, sy	stem operation								
					Subsystem and	d compone	ents- G	SPS, Agr	i sensors, DA	S, Co	mmu	ınicatior	n System.
Jnit – V	agricuitur		– working House cu l	Philosophy.									9
			i ioacc cai										•
Designs a	and classi	ification of	of greenho	use- Orientat	ion of Greenho	use / Poly	/ hous	se- Com	ponents of g	reen	hous	e- Plan	t growing
structures	s/containe	rs in gree	en house p	production- Er	ion of Greenhonvironmental fa	ctors influe	encing	greenh	ouse cultivati	ion- N	1edia	prepar	ation and
structures	s/containe	rs in gree	en house p	production- Er		ctors influe	encing	greenh	ouse cultivati	ion- N	1edia	prepar	ation and
structures	s/containe	rs in gree	en house p	production- Er	nvironmental fa	ctors influe	encing	greenh	ouse cultivati	ion- N	1edia	prepar	ation and
structures fumigation	s/containe n- Drip irri	rs in gree	en house p	production- Er	nvironmental fa	ctors influe	encing	greenh	ouse cultivati	ion- N	1edia	prepar	ation and
structures umigation	s/containe n- Drip irri	rs in gree gation ar	en house pand fertigation	production- Er on systems gro	nvironmental fa	ctors influe ration- Prob	encing blem r	g greenh manager	ouse cultivati nent in green	ion- M house	fedia e cult	prepar ivation.	ation and
structures fumigation	s/containe n- Drip irri DOK: Krishna K	rs in gree gation ar	en house pand fertigation	production- Er on systems gro	nvironmental fa eenhouse cultiv	ctors influe ration- Prob	encing blem r	g greenh manager	ouse cultivati nent in green	ion- M house	fedia e cult	prepar ivation.	ation and
structures fumigation TEXT BO 1. I	s/containe n- Drip irri DOK: Krishna K NCES:	rs in gree gation ar	en house pad fertigation	oroduction- Er on systems gro or Based Agri	nvironmental fa eenhouse cultiv	ctors influe ration- Prob n", 1 st Edition	encing blem r	g greenh manager HI Privat	ouse cultivati nent in green	ion- M house	fedia e cult	prepar ivation. 010.	Total:45
FEXT BO I. REFEREI	s/containe n- Drip irri DOK: Krishna K NCES: Suchismit IoT and A	rs in gree gation ar ant , "Mic a Satapa I", Spring	en house pad fertigation croprocesses they, Debes per nature,	or Based Agri sh Mishra, Art Switzerland, 2	nvironmental fa eenhouse cultive Instrumentation uro Realyvasqu 2021.	ctors influe ration- Prob n", 1 st Edition	encing blem r ion, Pl	g greenh manager HI Privat rvásquez	e Limited, Ne	ion- M house ew De	ledia e cult lhi, 2	prepar ivation. 010.	Total:45
TEXT BO 1. I	s/containe n- Drip irri DOK: Krishna K NCES: Suchismit IoT and A	rs in gree gation ar ant , "Mic a Satapa I", Spring	en house pad fertigation croprocesses they, Debes per nature,	or Based Agri sh Mishra, Art Switzerland, 2	nvironmental fa eenhouse cultive Instrumentation	ctors influe ration- Prob n", 1 st Edition	encing blem r ion, Pl	g greenh manager HI Privat rvásquez	e Limited, Ne	ion- M house ew De	ledia e cult lhi, 2	prepar ivation. 010.	ation and
TEXT BO 1. I REFEREI 1. S	s/containe n- Drip irri OOK: Krishna K NCES: Suchismit IoT and A Sidney Wa	rs in gree gation ar ant , "Mic a Satapa I", Spring alter Regi	en house pad fertigation croprocesses they, Debes per nature,	or Based Agri sh Mishra, Art Switzerland, 2	nvironmental fa eenhouse cultive Instrumentation uro Realyvasqu 2021.	ctors influe ration- Prob n", 1 st Edition	encing blem r ion, Pl	g greenh manager HI Privat rvásquez	e Limited, Ne	ion- M house ew De	Media e cult lhi, 2 on in	prepar ivation. 010. Agricul	Total:45
TEXT BO 1. I REFEREI 1. S COURSE	OOK: Krishna K NCES: Suchismit IoT and A Sidney Wa	rs in gree gation ar ant , "Mic a Satapa I", Spring alter Regi	en house pand fertigation croprocesses the parties of the parties	or Based Agri sh Mishra, Arti Switzerland, 2 Filby D E , "Ir	nvironmental fa eenhouse cultive Instrumentation uro Realyvasqu 2021.	ctors influe ration- Prob n", 1 st Edition	encing blem r ion, Pl	g greenh manager HI Privat rvásquez	e Limited, Ne	ion- M house ew De	Media e cult lhi, 2 on in	prepar ivation. 010. Agricul	Total:45
FEXT BO 1. 1 REFEREI 1. 2 COURSE On comp	S/containe n- Drip irri DOK: Krishna K NCES: Suchismit IoT and A Sidney Wa E OUTCOR Dietion of	rs in gree gation ar ant , "Mic a Satapa I.", Spring alter Regi	en house pand fertigation of fertiga	or Based Agri or Based Agri sh Mishra, Art Switzerland, 2 Filby D E, "Ir	Instrumental facenhouse cultive Instrumentation uro Realyvasque 2021.	ctors influe ration- Prob n", 1 st Edition	encing blem r ion, Pl	g greenh manager HI Privat rvásquez	e Limited, Ne	ion- M house ew De	Media e cult lhi, 2 on in 2011.	prepar ivation. 010. Agricul BT Map ghest I	Total:45 ture with ped _evel)
FEXT BO 1. 1 REFEREI 1. 5 COURSE On comp	S/containe n- Drip irri DOK: Krishna K NCES: Suchismit IoT and A Sidney Wa E OUTCOR Dietion of	rs in gree gation ar ant , "Mic a Satapa I.", Spring alter Regi	en house pand fertigation of fertiga	or Based Agri sh Mishra, Arti Switzerland, 2 Filby D E , "Ir	Instrumental facenhouse cultive Instrumentation uro Realyvasque 2021.	ctors influe ration- Prob n", 1 st Edition	encing blem r ion, Pl	g greenh manager HI Privat rvásquez	e Limited, Ne	ion- M house ew De	Media e cult lhi, 2 on in 2011.	prepar ivation. 010. Agricul BT Map ghest I	Total:45
TEXT BO 1. I REFEREI 1. S COURSE On comp	COUTCOI COU	rs in gree gation ar ant , "Mic a Satapa I", Spring alter Regi MES: the cour e necess	croprocessor they, Debes ger nature, inald Cox,	or Based Agri or Based Agri sh Mishra, Arta Switzerland, 2 Filby D E , "Ir	Instrumental facenhouse cultive Instrumentation uro Realyvasque 2021.	ctors influeration- Prob	ion, Pl	g greenh manager HI Privat vvásquez ockwood	e Limited, Ne	ion- M house ew De	Media e cult Ihi, 2 Don in Conn. English Und	prepar ivation. 010. Agricul BT Map ghest I erstand	Total:4! ture with ped _evel)
TEXT BO 1. 1 REFEREI 1. 5 COURSE On comp	OOK: Krishna K NCES: Suchismit IoT and A Sidney Wa COUTCOR Detion of explain the	rs in gree gation ar ant, "Mic a Satapa I", Spring alter Regi MES: the cour e necess	en house pand fertigation of fertiga	or Based Agri or Based Agri sh Mishra, Arti Switzerland, 2 Filby D E , "Ir udents will be umentation for neters and tra	Instrumentation Unro Realyvasque 2021. Instrumentation in the able to agriculture Inducers in agriculture	ctors influeration- Prob	encing blem r ion, Pl Realy ure", Lu	g greenh manager HI Privat vvásquez ockwood	e Limited, Ne	ion- M house ew De	Media e cult Ihi, 2 on in Control (Hi Und	prepar ivation. 010. Agricul BT Map ghest I erstanderst	Total:45 ture with ped _evel) ling (K2)
TEXT BO 1. I REFEREI 1. S COURSE On comp	OOK: Krishna K NCES: Suchismit IoT and A Sidney Wa COUTCOR Detion of explain the	rs in gree gation ar ant, "Mic a Satapa I", Spring alter Regi MES: the cour e necess	en house pand fertigation of fertiga	or Based Agri or Based Agri sh Mishra, Arti Switzerland, 2 Filby D E , "Ir udents will be umentation for neters and tra	Instrumental facenhouse cultive Instrumentation uro Realyvasque 2021. Instrumentation in the able to agriculture	ctors influeration- Prob	encing blem r ion, Pl Realy ure", Lu	g greenh manager HI Privat vvásquez ockwood	e Limited, Ne	ion- M house ew De	Media e cult Ihi, 2 on in Control (Hi Und	prepar ivation. 010. Agricul BT Map ghest I erstand	Total:4: ture with ped _evel) ling (K2)
TEXT BO I. I REFEREI I. S COURSE On comp CO1 (CO2 I	s/containe n- Drip irri DOK: Krishna K NCES: Suchismit IoT and A Sidney Wa E OUTCOI oletion of explain th familiarize	ant, "Mic a Satapa I", Spring alter Regi MES: the cour e necess with the	croprocessor they, Debes per nature, inald Cox, itse, the studity of instruction Soil paramages of against the state of th	or Based Agri or Based Agri sh Mishra, Arti Switzerland, 2 Filby D E, "Ir udents will be umentation for neters and tra	Instrumental facenhouse cultive la	ctors influeration- Prob	ion, Pl Realy ure", Lu	g greenh manager HI Privat vvásquez ockwood	e Limited, Ne	ion- M house ew De	Media e cult Ilhi, 2 Don in O11. E (Hi Und	prepar ivation. 010. Agricul BT Map ghest I erstand erstand	Total:4! ture with ped _evel) ling (K2) ling (K2)
TEXT BO 1. I REFEREI 1. S COURSE On comp CO1 C CO2 1 CO3 C CO4 C CO4 C	S/containe n- Drip irri DOK: Krishna K NCES: Suchismit IoT and A Sidney Wa E OUTCOI oletion of explain th familiarize Illustrate t Outline th	ant, "Mic a Satapa I", Spring alter Regi MES: the cour e necess with the	croprocessor the study of instruction of agreementals of agreemental or ag	or Based Agri or Based Agri sh Mishra, Artr Switzerland, 2 Filby D E, "Ir udents will be umentation for neters and tra griculture using	Instrumental facenhouse cultive Instrumentation uro Realyvasque 2021. Instrumentation in agriculture agriculture anducers in agriculture and Precision Agriculture and Precisi	ctors influeration- Prob	ion, Pl Realy ure", Lu	g greenh manager HI Privat vvásquez ockwood	e Limited, Ne	ion- M house ew De	Media e cult Ilhi, 2 Don in O11. E (Hi Und A Und	prepar ivation. 010. Agricul BT Map ghest I erstand erstand Applying erstand	Total:45 ture with ped _evel) ling (K2) ling (K2)
TEXT BO 1. I REFEREI 1. S COURSE On comp CO1 C CO2 1 CO3 I CO4 C	S/containe n- Drip irri DOK: Krishna K NCES: Suchismit IoT and A Sidney Wa E OUTCOI oletion of explain th familiarize Illustrate t Outline th	ant, "Mic a Satapa I", Spring alter Regi MES: the cour e necess with the	croprocessor the study of instruction of agreementals of agreemental or ag	or Based Agri or Based Agri sh Mishra, Artr Switzerland, 2 Filby D E, "Ir udents will be umentation for neters and tra griculture using	Instrumental facenhouse cultive la	ctors influeration- Prob	ion, Pl Realy ure", Lu	g greenh manager HI Privat vvásquez ockwood	e Limited, Ne	ion- M house ew De	Media e cult Ilhi, 2 Don in O11. E (Hi Und A Und	prepar ivation. 010. Agricul BT Map ghest I erstand erstand Applying erstand	Total:45 Total:45 ture with ped _evel) ling (K2) ling (K2)
REFEREI COURSE COURSE COO COO COO COO COO COO COO COO COO CO	S/containe n- Drip irri DOK: Krishna K NCES: Suchismit IoT and A Sidney Wa E OUTCOI oletion of explain th familiarize Illustrate t Outline th	ant, "Mic a Satapa I", Spring alter Regi MES: the cour e necess with the	croprocessor the study of instruction of agreementals of agreemental or ag	or Based Agri or Based Agri or Based Agri sh Mishra, Artr Switzerland, 2 Filby D E, "Ir udents will be umentation for neters and tra griculture using Drip Irrigation ments in Gree	Instrumental fa eenhouse cultival Instrumentation uro Realyvasque 2021. Instrumentation in eable to agriculture agriculture agriculture and Precision Annouse cultival en house cultival	ctors influeration- Probation Probat	ion, Pl Realy ure", Lu	g greenhomanager HI Private vásquez ockwood ntation	e Limited, Ne	ion- M house ew De	Media e cult Ilhi, 2 Don in O11. E (Hi Und A Und	prepar ivation. 010. Agricul BT Map ghest I erstand erstand Applying erstand	Total:4! ture with ped _evel) ling (K2) ling (K2)
TEXT BO 1. 1 REFEREI 1. 5 COURSE On comp CO1 6 CO2 1 CO3 1 CO5 1	S/containe n- Drip irri DOK: Krishna K NCES: Suchismit IoT and A Sidney Wa E OUTCOP Detion of explain the familiarize Illustrate t Outline the	ant, "Mic a Satapa I", Spring alter Regi MES: the cour e necess with the	croprocessorthy, Debester nature, inald Cox, instructions of agreementals of I is of instructions of instructi	or Based Agri or Based Agri or Based Agri sh Mishra, Artr Switzerland, 2 Filby D E, "Ir udents will be umentation for neters and tra griculture using Drip Irrigation ments in Gree	Instrumental facenhouse cultive Instrumentation uro Realyvasque 2021. Instrumentation in agriculture agriculture anducers in agriculture and Precision Agriculture and Precisi	ctors influeration- Probation, 1st Edition ez, Arturo fin Agricultural instructural	ion, Pl Realy ure", Lu	g greenhomanager HI Private vásquez ockwood ntation	e Limited, Ne	ion- M house ew De	Media e cult Ilhi, 2 Ilhi, 2 In	prepar ivation. 010. Agricul BT Map ghest I erstand erstand Applying erstand	Total:45 ture with ped _evel) ling (K2) ling (K2)
TEXT BO 1. I REFEREI 1. S COURSE On comp CO1 CO2 1 CO2 CO3 CO4 CO5 C	S/containe n- Drip irri DOK: Krishna K NCES: Suchismit IoT and A Sidney Wa E OUTCOI Dietion of explain the familiarize Illustrate t Outline the	rs in gree gation ar ant, "Mic a Satapa I", Spring alter Regi MES: the cour e necess with the he techni-	croprocessorthy, Debester nature, inald Cox, instructions of agreementals of I is of instructions of instructi	or Based Agri or Based Agri or Based Agri sh Mishra, Arte Switzerland, 2 Filby D E , "Ir udents will be umentation for neters and tra griculture using Drip Irrigation ments in Gree	Instrumentation Unro Realyvasque 2021. Instrumentation agriculture Inducers in	ctors influeration- Probation, 1st Edition ez, Arturo fin Agricultural instructural	ion, Pl Realy ure", Le	g greenhomanager HI Privat vásquez ockwood ntation	e Limited, Ne Vargas, "Inr	ew De	Media e cult Ilhi, 2 Ilhi, 2 In	prepar ivation. 010. Agricul BT Map ghest I erstand erstand erstand erstand erstand erstand	Total:45 ture with ped _evel) ling (K2) ling (K2)
TEXT BO 1. 1 REFEREI 1. 5 COURSE On comp CO1 6 CO2 1 CO2 1 CO3 1 CO5 1 CO5 1	S/containe n- Drip irri DOK: Krishna K NCES: Suchismit IoT and A Sidney Wa E OUTCOI Detion of explain th familiarize Illustrate t Outline th Utilize the	ant, "Michael Satapa I", Spring alter Regional Street Regional Spring alter Regional Spring the courte necess with the he technology with the technology of the courter of the courter of the concepts of the	croprocessorthy, Debester nature, inald Cox, instructions of agreementals of I is of instructions of instructi	or Based Agri or Based Agri or Based Agri sh Mishra, Arte Switzerland, 2 Filby D E , "Ir udents will be umentation for neters and tra griculture using Drip Irrigation ments in Gree	Instrumentation Unro Realyvasque 2021. Instrumentation agriculture Inducers in	ctors influeration- Probation, 1st Edition ez, Arturo fin Agricultural instructural	ion, Pl Realy ure", Le	g greenhomanager HI Privat vásquez ockwood ntation	e Limited, Ne Vargas, "Inr	ew De	Media e cult Ilhi, 2 Ilhi, 2 In	prepar ivation. 010. Agricul BT Map ghest I erstand	ture with ped evel) ling (K2) ling (K2) ling (K2) ling (K2)
TEXT BO 1. I REFEREI 1. S COURSE On comp CO1 C CO2 1 CO3 C CO4 C CO5 C	S/containe n- Drip irri DOK: Krishna K NCES: Suchismit IoT and A Sidney Wa E OUTCOI Oletion of explain th familiarize Illustrate t Outline th Utilize the	ant, "Mica Satapa I", Spring alter Region MES: the cour e necesse with the he technic e fundame concepts	croprocessorthy, Debester nature, inald Cox, instructions of agreementals of I is of instructions of instructi	or Based Agri or Based Agri or Based Agri sh Mishra, Arte Switzerland, 2 Filby D E , "Ir udents will be umentation for neters and tra griculture using Drip Irrigation ments in Gree	Instrumentation Unro Realyvasque 2021. Instrumentation agriculture Inducers in	ctors influeration- Probation, 1st Edition ez, Arturo fin Agricultural instructural	ion, Pl Realy ure", Le	g greenhomanager HI Privat vásquez ockwood ntation	e Limited, Ne Vargas, "Inr	ew De	Media e cult Ilhi, 2 Ilhi, 2 In	prepar ivation. 010. Agricul BT Map ghest I erstand erstand erstand erstand erstand	Total:4: ture with ped_evel) ling (K2) ling (K2) ling (K2) ling (K2)

CO4	3	1						2	2
CO5	3	1						2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70	(220) 70	() //	() //	(223) 70	100
CAT2	20	60	20				100
CAT3	40	60					100
ESE	20	60	20				100

^{* ±3%} may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

		(Offered b		O09 - ENVIRONI ent of Electronic				Engineerin	g)			
Programi	ıma &	All RE	/RTach h	ranches ev	cept Electronics	and							
Branch	iiie α			n Engineeri		anu		Sem.	Category	L	Т	Р	Credit
Prerequis	sites	Nil						8	OE	3	0	0	3
Preamble	9	Funda	mental co	urse on sen	sors, instruments	and rea	ıl- time s	svstems	to monitor e	nviror	nmer	ntal syst	ems.
Unit – I		Fibre (Optic Ser	nsors:									9
Raman se	ensors-Eva	anescen	t field sen	sors - fibre o	echnology-principoptic sensors for each of the contamination.								
Unit – II				c Sensors:									9
					egrated optic dev nance, Light scat								
					ated optic gas ser		тррпсан	0113 01 111	tegrated op	lic dev	/1003	IOI CIIVI	TOTTITIETILA
Unit – III					Gas Analysers:								9
sensor co	oatings op i IR spectro	erating i	n liquids. Differentia	Gas analys	analysis, Piezoe ers: Principles of LIDAR, Laser-in on:	operation	n, Diffe	rential c	ptical abso	ption	spe	ctroscop	
Common	contamina	ant types	and env	ironmental b	ehavior: Contami								
subsurfac		ons, Disc			ng equipment an ect determination								
Unit – V		Monito			ion and Air Poll I variables: Temp								9
Biochemic	ical oxyger	deman	d- Total o	rganic carbo	: Dissolved oxyge n, Chemical oxyg - Monitoring mod	en dema	nd. Air f	Pollution	: Air quality	standa	ards	- Chara	cterisation
													Total:4
_	_												
1 N	_	cevedo,	"Real-Tir	me Environn	nental Monitoring	Sensors	and Sy	/stems",	1 st Edition,	CRC	Pres	ss, Unite	
1. N	Miguel F. A 2015.	cevedo,	"Real-Tir	me Environn	nental Monitoring	Sensors	and Sy	/stems",	1 st Edition,	CRC	Pres	ss, Unite	
1. 2 REFEREI	Miguel F. A 2015. NCES:				nental Monitoring usseau, "Environ								ed States,
1. M 2 2 2 1. 2 2 3 A	Miguel F. A 2015. NCES: Janick Artic 2004	ola, Ian I	Pepper	, Mark L. Br		mental N	Monitorii	ng and (Characteriza	ation",	1 st E	Edition,	ed States,
1. M 2 2 1. 2 2. A p COURSE	Miguel F. A 2015. NCES: Janick Artic 2004 Acevedo M Dress, 2013	ola, lan l .F., "Dat B	Pepper a Analysi	, Mark L. Br	usseau, "Environ tics for Geograph	mental N	Monitorii	ng and (Characteriza	ation",	1 st [Edition,	ed States, Elsevier, on, CRC
1. M 2 2 REFEREI 1. 2 2 A p COURSE On comp	Miguel F. A 2015. NCES: Idanick Artic 2004 Acevedo M press, 2013 E OUTCOM Diletion of the	ola, lan l .F., "Dat } IES: the cour	Pepper a Analysi	, Mark L. Br is and Statis tudents wil	usseau, "Environ tics for Geograph	mental N y, Enviro	Monitorii	ng and (Characteriza	ation",	1 st E	Edition, 1 st Editi BT Map lighest	ed States, Elsevier, on, CRC
1. M 2 REFEREI 1. 2 2. A p COURSE On comp	Miguel F. A 2015. NCES: Janick Artic 2004 Acevedo M Dress, 2013 E OUTCOM Deletion of the	ola, Ian I .F., "Dat B IES: the cour	Pepper a Analysi se, the s	tudents will	usseau, "Environ tics for Geograph	mental M y, Enviro	Monitorii	ng and (Characteriza	ation",	1 st Eng",	Edition, 1 st Editi BT Map lighest	Elsevier, on, CRC opped Level)
1. M 2 REFEREI J. 1. 2 2. A P COURSE On comp CO1 ic CO2 a	Miguel F. A 2015. NCES: Janick Artice 2004 Acevedo Moress, 2013 E OUTCOM Deletion of the completion of the complet	DIa, Ian I I.F., "Dat IES: the cour role of fi	Pepper a Analysi se, the s bre optic	tudents will sensors for environments.	usseau, "Environ tics for Geograph I be able to	mental M y, Environ nitoring	Monitorin	ng and (Characteriza	ation",	1 st Eng", (F	Edition, 1st Editi BT Maphighest derstand Applying	Elsevier, on, CRC pped Level) ding (K2) g (K3)
1. M 2 REFEREI	Miguel F. A 2015. NCES: Janick Article 2004 Acevedo Moress, 2013 E OUTCOM Deletion of the Apply the in Apply the pi	I.F., "Data I.F., "Data IES: the cour role of fi	Pepper a Analysi se, the s bre optic optic seric senso	tudents will sensors for environments.	usseau, "Environ tics for Geograph I be able to environmental mo ironmental sension	mental M y, Environ nitoring	Monitorin	ng and (Characteriza	ation",	1st [ng", (F Und	Edition, 1st Editi BT Map Highest derstand Applying Applying	Elsevier, on, CRC oped Level) ding (K2) g (K3) g (K3)
1. M 2 REFEREI	Miguel F. A 2015. NCES: Janick Article 2004 Acevedo Moress, 2013 E OUTCOM Deletion of the dentify the property the pro-	JES: the cour role of fi tegrated cases a	a Analysi se, the s bre optic optic ser tric senso	tudents will sensors for enverse and gas a pot of land po	usseau, "Environ tics for Geograph I be able to environmental mo ironmental sension	mental M y, Environ nitoring	Monitorin	ng and (Characteriza	ation",	1st [ng", (F Und	Edition, 1st Editi BT Map Highest derstand Applying Applying	Elsevier, on, CRC opped Level) ding (K2) g (K3)
1. M 2 REFEREI	Miguel F. A 2015. NCES: Janick Article 2004 Acevedo Moress, 2013 E OUTCOM Deletion of the dentify the property the pro-	JES: the cour role of fi tegrated cases a	a Analysi se, the s bre optic optic ser tric senso	tudents will sensors for enverse and gas a pot of land population and	usseau, "Environ tics for Geograph be able to environmental mo ironmental sensionallyzers for Envi	mental M y, Environ nitoring	Monitorir onmenta	ng and (al Science)	Characteriza	ation",	1st [ng", (F Und	Edition, 1st Editi BT Map Highest derstand Applying Applying	Elsevier, on, CRC oped Level) ding (K2) g (K3) g (K3)
1. M 2 REFEREI	Miguel F. A 2015. NCES: Janick Artic 2004 Acevedo M bress, 2013 E OUTCON Detion of the dentify the mapply the indeptify the paper of	JES: the cour role of fi tegrated cases a	a Analysi se, the s bre optic optic ser tric senso	tudents will sensors for enverse and gas a pot of land population and	usseau, "Environ tics for Geograph be able to environmental mo ironmental sension analyzers for Envi llution d Air pollution pping of COs wi	mental M y, Environ nitoring	Monitorir onmenta	ng and (al Science)	Characteriza	ation",	1st [ng", (F Und	Edition, 1st Editi BT Map Highest derstand Applying Applying	Elsevier, on, CRC oped Level) ding (K2) g (K3) g (K3)
1. M 2 2 REFEREI	Miguel F. A 2015. NCES: Janick Artic 2004 Acevedo M bress, 2013 E OUTCON Detion of the dentify the mapply the indeptify the paper of	ola, Ian I I.F., "Dat IES: the cour role of fi tegrated cases al	Pepper a Analysi se, the s bre optic optic ser tric senso nd concep of Water	tudents will sensors for enverse and gas a pot of land popullution and	usseau, "Environ tics for Geograph be able to environmental mo ironmental sension analyzers for Envi llution d Air pollution pping of COs wi	mental M y, Environ nitoring	Monitoria	oring	Characteriza	ation",	1st [ng", (F Und	Edition, 1st Editi BT Map Highest derstand Applying derstand derstand	Elsevier, on, CRC oped Level) ding (K2) g (K3) g (K3) ding (K2)

CO3

CO4	3	3		3			3	2
CO5		3		3			2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	50	20				100
CAT2	30	50	20				100
CAT3	40	60					100
ESE	30	50	20				100

^{*} $\pm 3\%$ may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

		(0	Offered b	y Depart	tment of Ele	ectronics	and Ins	strume	ntation E	Engineerin	g)			
Programm Branch	ne &			ranches n Engine	except Elec	ctronics a	and		Sem.	Category	, L	Т	Р	Credit
Prerequisi	tes	Nil							8	OE	3	0	0	3
Preamble		regulat	ory frame	works, a	arious aspe nd manager es, and the in	nent strate	egies. S	Students	s will gair	n an unders	standin	g of		
Jnit – I					n Control M									9
Overview: \ Jnit – II	Water Routants Ar	esource f Water and Their S	Managem Pollutior Sources -	nent Systenent : · Water P	t - Profession em - Wastew Follution In R	vater Disp	osal Su	ıbsyster	n - Air R	esource Ma	anager	nent	Systen	n. 9
Jnit – III	er i onut		water Tre											9
					eatment Sta				ewater T	reatment S	ystems	- La	nd Trea	atment Fo
Unit – IV		Air Pol					•							9
					ants - Origin						o Air F	ollut	ion - A	ir Pollution
Meteorolog Unit – V	gy - Air P				ry Sources -	Air Pollut	ion Con	itroi ot N	nodile Sc	ources.			1	
	stics of S			anageme d waste m	nt: nanagement	decision	alternat	ives - Ir	ntegrated	Solid Was	ste Ma	nade	ment -	9 Collectio
					Landfill - Wa					. Cona ma	, , , , , , , , , , , , , , , , , , ,	lugo		Conconc
		L. Davis	& David	A. Cornwe	ell, "Introduc	tion To Er	nvironm	ental E	ngineerir	ng", 5 th Editi	on, Th	е Мс	Graw -	Hill Series
REFEREN Gil Lir	13. CES: bert M. M nited, 20 Jeffrey P	Masters V 14. eirce, P./	Vendell P Aarne Ve	. Ela , "Int	ell, "Introduc troduction to uth F.Weiner	Environm	ental E	ngineer	ing and §	Science" 3 rd	^I Editio	n, Pe	earson	Educatio
1. 20 REFEREN 1. Gil Lir 2. J. Te	13. CES: bert M. M. nited, 20 effrey P. chnology	Masters V 14. eirce, P./ / Books,	Vendell P Aarne Ve 1997.	. Ela , "Int	troduction to	Environm	ental E	ngineer	ing and §	Science" 3 rd	^I Editio	n, Pe	earson sevier S	Educatior Science &
REFEREN 1. Gil Lir 2. Te COURSE (On comple	13. CES: bert M. M. nited, 20 leffrey P. chnology DUTCOM etion of	Masters V 14. eirce, P., y Books, MES: the cour	Vendell P Aarne Ve 1997. se, the s	. Ela , "Int silind, Ru tudents v	troduction to	Environm , "Environ	nental Ei	ngineer	ing and §	Science" 3 rd	^I Editio	n, Pe	earson sevier S BT Ma ighest	Educatior Science &
REFEREN 1. Gil Lir 2. J. Te COURSE (On comple	13. CES: bert M. Mited, 20 leffrey Pichnology DUTCOMetion of the the	Masters V 14. eirce, P./ y Books, MES: the cour fundame	Vendell P Aarne Ve 1997. se, the s ntals of p	. Ela , "Int silind, Ru tudents v	troduction to uth F.Weiner will be able	Environm , "Environ to anageme	nental Ei	ngineer	ing and §	Science" 3 rd	^I Editio	n, Pe n, Els I (H Und	earson sevier S BT Ma ighest	Education Science & pped Level)
REFEREN 1. Gil Lir 2. J. Te COURSE (On comple CO1 ou CO2 int	13. CES: bert M. M. nited, 20 Jeffrey Prohnology DUTCOM etion of the street the	Masters V 14. eirce, P./ y Books, MES: the cour fundame e concep	Vendell P Aarne Ve 1997. se, the s ntals of p	. Ela , "Int silind, Ru tudents v ollution c	troduction to uth F.Weiner will be able control and m	Environm , "Environ to anageme	nental Enmental	ngineer Pollutio	ing and §	Science" 3 rd	^I Editio	n, Pe n, Els (H Und	earson sevier \$ BT Map ighest lerstand	Education Science & pped Level) ding (K2)
1. 20 REFEREN 1. Gil Lir 2. J Te COURSE (On comple CO1 ou CO2 int CO3 su	13. CES: Ibert M. Mited, 20 Jeffrey Pichnology DUTCOMetion of the three	Masters V 14. eirce, P./ y Books, MES: the cour fundame e concep	Vendell P Aarne Ve 1997. se, the s ntals of p ats of water	. Ela , "Int silind, Ru tudents v collution co er pollution astewate	troduction to uth F.Weiner will be able control and meaning and control	Environm , "Environ to anageme of methods	ental Enmental	ngineer Pollutio	ing and §	Science" 3 rd	^I Editio	n, Pe	earson sevier \$ BT Map ighest lerstand	Education Science & pped Level) ding (K2) ding (K2)
REFEREN 1. Gil Lir 2. J. Te COURSE (On comple CO1 ou CO2 int CO3 su CO4 ap	13. CES: bert M. Mited, 20 leffrey Pichnology DUTCOMetion of the company of	Masters V 14. eirce, P. y Books, MES: the cour fundame e concep the methological	Vendell P Aarne Ve 1997. se, the s ntals of p ats of wate	Ela , "Int silind, Rutudents vollution coer pollution astewate	troduction to uth F.Weiner will be able control and mean and control	Environm , "Environ to anageme of methods and waste	nental Entental Entental Entent	ngineer Pollutio	ing and §	Science" 3 rd	^I Editio	n, Pe n, Els (H Und Und	earson sevier S BT Malighest lerstand	Education Science 8 Pped Level) ding (K2) ding (K2) ding (K2)
REFEREN 1. Gil Lir 2. J. Te COURSE (On comple CO1 ou CO2 int CO3 su CO4 ap	13. CES: bert M. Mited, 20 leffrey Pichnology DUTCOMetion of the company of	Masters V 14. eirce, P. y Books, MES: the cour fundame e concep the methological	Vendell P Aarne Ve 1997. se, the s ntals of p ats of wate	Ela , "Int silind, Ruttudents vollution context pollution astewate pollution blid waste	troduction to uth F.Weiner will be able control and m on and control r treatment a managemer e manageme	Environm , "Environ to lanageme of methods and waste ant techniquent techniquent	ental Enmental ent s disposa	ngineer Pollutio	ing and S	Science" 3 rd	^I Editio	n, Pe n, Els (H Und Und	BT Malighest erstanderstand	Education Science & pped Level) ding (K2) ding (K2) ding (K2)
REFEREN 1. Gil Lir 2. J. Te COURSE (On comple CO1 ou CO2 int CO3 su CO4 ap	13. CES: bert M. Mited, 20 leffrey Pichnology DUTCOMetion of the company of	Masters V 14. eirce, P. y Books, MES: the cour fundame e concep the methological	Vendell P Aarne Ve 1997. se, the s ntals of p ats of wate	Ela , "Int silind, Ru tudents v collution c er pollution astewate pollution	troduction to uth F.Weiner will be able control and me on and control tr treatment a	Environm to anageme and waste at technique ant technique ant technique	ental Enmental ent s disposa	ngineer Pollutio	ing and S	Science" 3 rd	^I Editio	n, Pe	BT Malighest erstanderstand	Education Science 8 pped Level) ding (K2) ding (K2) g (K3) g (K3)
REFEREN 1. Gil Lir 2. Te COURSE (CO) COO1 ou COO2 int COO3 su COO4 ap COO5 ide	13. CES: bert M. M. nited, 20 leffrey P. chnology DUTCOM etion of the three three mmarize ply suital	Masters V 14. eirce, P./ y Books, MES: the cour fundame e concep the metholious metholious metholious	Vendell P Aarne Ve 1997. se, the se entals of periods of weet anods of weet anods of weet anod for air anod for so	Ela , "Int silind, Ru tudents v collution c er pollution astewate pollution	troduction to uth F.Weiner will be able control and m on and control r treatment a managemer e managemer managemer	Environm , "Environ to lanageme of methods and waste at technique nt technic COs with	ental Enmental ent s disposa ues ques	ngineer Pollutio	ing and S	Science" 3 rd	Edition	n, Pe	earson Sevier S BT Maj ighest lerstand lerstand lerstand	Education Science & pped Level) ding (K2) ding (K2) g (K3)
20 REFEREN	13. CES: Bert M. Mited, 20 Deffrey Pechnology DUTCOMetion of the three three three ply suital entify var	Masters V 14. eirce, P./ y Books, MES: the cour fundame e concep the methole methole ious methole	Vendell P Aarne Ve 1997. se, the se entals of periods of weet anods of weet anods of weet anod for air anod for so	Ela , "Int silind, Ru tudents v collution c er pollution astewate pollution	will be able control and managemer e manageme Mapping of POS PO6	Environm to anageme of methods and waste at technique ant technique of COs with by PO7	ental	ngineer Pollutio	ing and S	Science" 3 rd	Edition	n, Pe	BT Malighest erstanderstand	Education Science 8 Pped Level) ding (K2) ding (K2) ding (K3) g (K3)
1. 20 REFEREN 1. Gil Lir 2. J. Te COURSE (On comple CO1 ou CO2 int CO3 su CO4 ap CO5 ide CO5/POs CO1	13. CES: bert M. M. nited, 20 deffrey Prochnology DUTCOM etion of the thing the erpret	Masters V 14. eirce, P./ y Books, MES: the cour fundame e concep the metholious metholious metholious	Vendell P Aarne Ve 1997. se, the se entals of periods of weet anods of weet anods of weet anod for air anod for so	Ela , "Int silind, Ru tudents v collution c er pollution astewate pollution	will be able control and mon and control are treatment a management e management Mapping of PO5 PO6 2	Environm to anageme of methods and waste at technique of technique	ental	ngineer Pollutio	ing and S	Science" 3 rd	Edition	n, Pe	earson Sevier S BT Maj ighest lerstand lerstand Applying Applying PSO1 2	Education Science 8 Pped Level) ding (K2) ding (K2) g (K3) g (K3) PSO2 2
1. 20 REFEREN 1. Gil Lir 2. J. Te COURSE (On comple CO1 ou CO2 int CO3 su CO4 ap CO5 ide CO5/POs CO1 CO2	13. CES: Bert M. M. Inited, 20 Deffrey P. Inchnology DUTCOM etion of the serpret the servet the serpret the serpret the serpret the serpret the servet the serv	Masters V 14. eirce, P./ y Books, MES: the cour fundame e concep the metholic metho	Vendell P Aarne Ve 1997. se, the se entals of periods of weet anods of weet anods of weet anod for air anod for so	Ela , "Int silind, Ru tudents v collution c er pollution astewate pollution	will be able control and managemer managemer PO5 PO6 2 2	Environm to anageme of methods and waste at technique ant technique of COs with by PO7	ental Enmental ent sent sent pont sent pont pont pont pont pont pont pont po	ngineer Pollutio	ing and S	Science" 3 rd	Edition	n, Pe	BT Malighest erstand erstand Applying Applying PSO1 2 2	Education Science 8 Pped Level) ding (K2) ding (K2) g (K3) g (K3) PSO2 2 2

1 – Slight, 2 – Moderate,	3 –	Substantial,	BT-	· Bloom's	Taxonomy
---------------------------	-----	--------------	-----	-----------	----------

		ASSESSMEN	T PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	20	80					100
CAT3	20	40	40				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

	22CSX01- FUNDAMENTALS (
Dragramma 9	(Offered by Departmen	it of CSE)					T
Programme & Branch	All BE/BTech Branches except	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	5	OE	3	0	2	4
Preamble	This course provides the learners to know the fund	damentals of data	nase and SOI	lan	ดเเลต	e to (reate and
Troumbio	manipulate the database	damontalo or data	Jaco ana OQI		guug	0 10 1	ordato aria
Unit – I	Introduction to Database Management:						9
DBMS Users -	atabase System – Example – Characteristics – Importa Data abstraction – Levels of abstraction – Data Inde Phoosing a DBMS – Enterprise Database: Advantages, C	pendence – Datal	base System				
Unit – II	Data Models:						9
and Aggregation	nefits of Data Modelling – Types Modelling – Phases of D – Database Design Process – Strength and Weakne – Data Structure – Mapping the ER Model to Relational del.	ss of ER Model -	Case study	of B	uildin	g an	ER Model.
Unit – III	SQL:						9
	nition: CREATE, ALTER and DROP commands– Keys a riews from single and multiple relations – DML operation						Retrieval-
Unit – IV	Functional Dependency and Normalization:		<u> </u>				9
	perties and Schema refinement – Decomposition using fur composition – Multi valued Dependencies.	nctional dependen	cies: 1NF, 2NI	F, 3N	IF, BO	CNF -	- Desirable
	:						
	Indexing and Hashing: es – Secondary Storage – Buffer Management. File Struction file. But the State hashing. External hashing. D		Sequential fil	e. In	dex -	- Туре	9 es of Index
Types of Memori – Indexed seque			Sequential fil	e. In	dex -	- Туре	
Types of Memori – Indexed seque	es – Secondary Storage – Buffer Management. File Stru ntial file – B+ tree. Static hashing – External hashing – D		Sequential fil	e. In	dex -	- Туре	
Types of Memori – Indexed seque LIST OF EXPER 1. Write the	es – Secondary Storage – Buffer Management. File Struntial file – B+ tree. Static hashing – External hashing – D		Sequential fil	e. In	dex -	- Турє	
Types of Memori – Indexed seque LIST OF EXPER 1. Write the 2. Impleme	es – Secondary Storage – Buffer Management. File Struntial file – B+ tree. Static hashing – External hashing – D IMENTS / EXERCISES: e queries using Data definition language.		Sequential fil	e. In	dex –	- Туре	
Types of Memori – Indexed seque LIST OF EXPER 1. Write the 2. Impleme 3. Write the	es – Secondary Storage – Buffer Management. File Struntial file – B+ tree. Static hashing – External hashing – D IMENTS / EXERCISES: e queries using Data definition language. Int the Integrity Constraints on Database.		Sequential fil	e. In	dex –	- Туре	
Types of Memori – Indexed seque LIST OF EXPER 1. Write the 2. Impleme 3. Write the 4. Impleme	es – Secondary Storage – Buffer Management. File Struntial file – B+ tree. Static hashing – External hashing – D IMENTS / EXERCISES: e queries using Data definition language. Int the Integrity Constraints on Database. e queries using Data manipulation language.		Sequential fil	e. In	dex -	- Туре	
Types of Memori – Indexed seque LIST OF EXPER 1. Write the 2. Impleme 3. Write the 4. Impleme 5. Write qu	es – Secondary Storage – Buffer Management. File Struntial file – B+ tree. Static hashing – External hashing – D IMENTS / EXERCISES: e queries using Data definition language. Int the Integrity Constraints on Database. e queries using Data manipulation language. Int various Aggregate functions on Database		Sequential fil	e. In	dex -	- Туре	
Types of Memori – Indexed seque LIST OF EXPER 1. Write the 2. Impleme 3. Write the 4. Impleme 5. Write qu 6. Write ne	es – Secondary Storage – Buffer Management. File Struntial file – B+ tree. Static hashing – External hashing – D IMENTS / EXERCISES: e queries using Data definition language. Int the Integrity Constraints on Database. e queries using Data manipulation language. Int various Aggregate functions on Database eries using Set operations on various Relations.		Sequential fil	e. In	dex –	- Туре	
Types of Memori – Indexed seque LIST OF EXPER 1. Write the 2. Impleme 3. Write the 4. Impleme 5. Write qu 6. Write ne 7. Impleme	es – Secondary Storage – Buffer Management. File Struntial file – B+ tree. Static hashing – External hashing – D IMENTS / EXERCISES: e queries using Data definition language. Int the Integrity Constraints on Database. e queries using Data manipulation language. Int various Aggregate functions on Database eries using Set operations on various Relations. Integrity Constraints on Database		Sequential fil	e. In	dex -	- Турє	
Types of Memori – Indexed seque LIST OF EXPER 1. Write the 2. Impleme 3. Write the 4. Impleme 5. Write qu 6. Write ne 7. Impleme 8. Write the	es – Secondary Storage – Buffer Management. File Structure of the structur		Sequential fil	e. In	dex -	- Туре	
Types of Memori – Indexed seque LIST OF EXPER 1. Write the 2. Impleme 3. Write the 4. Impleme 5. Write qu 6. Write ne 7. Impleme 8. Write the 9. Create V	es – Secondary Storage – Buffer Management. File Struntial file – B+ tree. Static hashing – External hashing – D IMENTS / EXERCISES: e queries using Data definition language. Int the Integrity Constraints on Database. e queries using Data manipulation language. Int various Aggregate functions on Database eries using Set operations on various Relations. Interest and sub queries on Database Int the various Join operations using SQL e queries using DCL and TCL commands		Sequential fil	e. In	dex -	- Турє	
Types of Memori – Indexed seque LIST OF EXPER 1. Write the 2. Impleme 3. Write the 4. Impleme 5. Write qu 6. Write ne 7. Impleme 8. Write the 9. Create V	es – Secondary Storage – Buffer Management. File Structure of the structur						es of Index
Types of Memori – Indexed seque LIST OF EXPER 1. Write the 2. Impleme 3. Write the 4. Impleme 5. Write qu 6. Write ne 7. Impleme 8. Write the 9. Create V 10. Perform	es – Secondary Storage – Buffer Management. File Structure of the structur						es of Index
Types of Memori – Indexed seque LIST OF EXPER 1. Write the 2. Impleme 3. Write the 4. Impleme 5. Write qu 6. Write ne 7. Impleme 8. Write the 9. Create \(\) 10. Perform	es – Secondary Storage – Buffer Management. File Structure of the structur	lynamic Hashing.	Lecture:				es of Index
Types of Memori – Indexed seque LIST OF EXPER 1. Write the 2. Impleme 3. Write the 4. Impleme 5. Write qu 6. Write ne 7. Impleme 8. Write the 9. Create \(\) 10. Perform TEXT BOOK: 1. G K Gup	es – Secondary Storage – Buffer Management. File Structural file – B+ tree. Static hashing – External hashing – D IMENTS / EXERCISES: e queries using Data definition language. Int the Integrity Constraints on Database. e queries using Data manipulation language. Int various Aggregate functions on Database eries using Set operations on various Relations. Interest and sub queries on Database Int the various Join operations using SQL e queries using DCL and TCL commands I equeries usin	lynamic Hashing.	Lecture:	45, F	Practi	cal:3	es of Index
Types of Memori – Indexed seque LIST OF EXPER 1. Write the 2. Impleme 3. Write the 4. Impleme 5. Write qu 6. Write ne 7. Impleme 8. Write the 9. Create \(\) 10. Perform TEXT BOOK: 1. G K Gup	es – Secondary Storage – Buffer Management. File Structural file – B+ tree. Static hashing – External hashing – D IMENTS / EXERCISES: e queries using Data definition language. Int the Integrity Constraints on Database. e queries using Data manipulation language. Int various Aggregate functions on Database eries using Set operations on various Relations. Int the various Join operations using SQL e queries using DCL and TCL commands If ews and perform SQL operations in it If SQL operations using index Ita, "Database Management Systems", Tata Mc Graw Hill IMANUAL / SOFTWARE: Intal Abraham, Korth, Henry F. and Sudarshan S., "Da	lynamic Hashing.	Lecture:	45, F	Practi	cal:3	es of Index

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	outline the features, architecture and applications of database system and choose an appropriate database	Applying (K3) Precision (S3)
CO2	design a relational database using ER model	Applying (K3) Precision (S3)
СОЗ	manipulate the relational database with SQL statements	Applying (K3) Precision (S3)
CO4	design relational database using normalization methods	Applying (K3) Precision (S3)
CO5	apply indexing and hashing techniques in the design of relational database	Applying (K3) Precision (S3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1									
CO2	3	2	1	1	1									
CO3	3	2	1	1	1									
CO4	3	2	1	1	1									
CO5	3	2	1	1	1									

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category* Remembering (K1) % Understanding (K2) % Applying (K3) % Analyzing (K4) % Evaluating (K5) % Creating (K6) % Total % CAT1 10 50 40 - - - 100 CAT2 10 35 55 - - - 100 CAT3 10 30 60 - - - 100 ESE 5 35 60 - - - 100								
CAT2 10 35 55 100 CAT3 10 30 60 100							•	Total %
CAT3 10 30 60 100	CAT1	10	50	40	-	-	-	100
	CAT2	10	35	55	-	-	-	100
ESE 5 35 60 100	CAT3	10	30	60	-	-	-	100
	ESE	5	35	60	-	-	-	100

 $^{^{\}star}$ ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

		22CSX02 - DATA SCIENCE FO						
Progra	amme &	<u> </u>	<u> </u>	0-1	Τ.	-		0
Branc		All BE/BTech Branches except CSE & IT	Sem.	Category	L	Т	Р	Credit
Prerec	quisites	Nil	5	OE	3	0	2	4
Pream	ble	This course introduces data science and the essent science and its applications.	ials of applied stati	stics required	in th	e cor	ntext c	of data
Unit –	1	Introduction						9
		efits and uses – facets of data - Data Science Proces Exploratory Data analysis – Building the model– prese					etriev	ring data
Unit –	II	Descriptive Statistics						9
		pes of Variables -Describing Data with Tables and Grapons and Standard (z) Scores.	hs –Describing Da	ta with Averag	jes -	Desc	ribing	Variabilit
Jnit –	III	Predictive Analytics						9
-regre egres: Jnit -	ssion line —lesion towards	Python Libraries for Data Wrangling	ate – interpretation	of r2 –multip	le re	gress	sion e	quations -
arrays	- Data man	errays –aggregations –computations on arrays –compa ipulation with Pandas – data indexing and selection – s – aggregation and grouping.						
Unit –	٧	Data Visualization						9
		MENTS / EXERCISES:	utor Statemedale a	and Dandaa ne	ماده	~~~		
1.		, install and explore the features of NumPy, SciPy, Jup	yter, Statsmodels a	ind Pandas pa	аска	ges.		
2. 3.	_	vith Numpy arrays vith Pandas data frames						
4.	-	ata from text files, Excel and the web and exploring va	rious commands fo	r doing descri	ntive	anal	vtics	
5.	Perform th a. Univaria b. Bivariat c. Multiple	ne following Predictive Analytics ate analysis: Frequency, Mean, Median, Mode, Variance analysis: Linear and logistic regression modeling Regression analysis mpare the results of the above analysis for the two data	e, Standard Deviat		-		-	
6.	Implement a. Ir between v score, GP. b. A	t the following using Regression model mport a data from web storage. Name the dataset and ariables that are affecting the admission of a student in A obtained and rank of the student. Apply multiple regressions, if data have a continuous Inche above dataset. Apply regression Model techniques	now do Logistic Re	on his or her	GRE			on
	a. Normal	explore various plotting functions on the given data se curves and contour plots tion and scatter plots	ts.					
7.	c. Correlat							
	c. Correlat d. Histogra e. Three-d	ams						
3.	c. Correlat d. Histogra e. Three-d Visualizing	ams limensional plotting	ommendation syste	em that recom	men	ds m	ovies	to users.
7. 3. 9.	c. Correlat d. Histogra e. Three-d Visualizing Develop a Develop a	ams limensional plotting g Geographic Data with Basemap						to users.

- Davy Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (Unit I)
 Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017. (Units II and III)
 Jake VanderPlas, "Python Data Science Handbook Essential Tool for Working with Data", O'Reilly, 2016. (Units IV and V)
- **REFERENCES/ MANUAL / SOFTWARE:**

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green TeaPress, 2014.

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	utilize the skills of data science processes such as data inspecting and cleansing	Applying (K3)
CO2	perform the different types of descriptive analytics for the data science process	Applying (K3)
CO3	perform the correlation and regression analytics on standard data sets for the data science	Applying (K3)
CO4	use the Python Libraries for Data Wrangling in data science	Applying (K3)
CO5	apply visualization techniques to interpret and explore data	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	1									
CO2	3	2	1	1	1									
CO3	3	2	1	1	1									
CO4	3	2	1	1	1									
CO5	3	2	1	1	1									

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

Prog. & Branch	ALL BE/BTech Branches	s of CSE) Sem.	Category	L	Т	Р	Credi
Pre requisite	Java Programming	5	OE	3	0	2	4
Preamble	This course offers good knowledge on how to develop technologies and hosting with application server.	an enterprise orier	l nted application	ns us	ing ja	ava	
UNIT – I	Network Programming and RMI						9
Inet6Address - TC	ming - Basics - Classes and Interfaces - InetAddress - Fa P/IP Client Sockets - URL - URLConnection - HttpURLC architecture - Developing Simple RMI applications.	actory methods - Ir onnection -URI Cl	stance Metho ass - Cookies	ds - I - TCF	net4/ P/IP S	Addres Server	ss and sockets
UNIT – II	Servlets and JSP						9
Reloading - init an Caching - Retrievi	P Servlet Basics: Servlet API - Page Generation - Web Add destroy - Single Thread Model - Background Processing information - Sending HTML information - Java Servewards - Custom Tag libraries - Simple JSP program.	ng - Load on Startu	p - Client-Sid	e Cad	hing	- Serv	ver-Side
UNIT – III	J2EE, Application Server and Software Architectur	es					9
Application server architectures - SO	- EJB - Session, Entity and Message driven beans - Moc - <u>Apache Tomcat</u> - Introduction - Installation - services - A and Monolith Architecture - Micro Services - Micro Ser Infra Layer - REST API - Advantages with Micro Service	Hosting Java Apportice Architecture -	s with server.	Types	of s	oftwar	e .
UNIT – IV	Configuration of Spring Framework						9
	amework - Annotation - Built annotations - Dependency application development : Run JAR - Application Proper						
UNIT – V	SpringBoot Framework and Database connectivity						9
Spring Boot: Introd	duction to Spring vs. Spring Boot vs. Spring MVC - Archit	tecture - Initializr M	lodules – Inte	rface	- Dat	abase) -
methods - Data JF	- POJO classes - MYSQL - Working with Hibernate - Date PA with custom queries tical: 15 Total: 60	ta JPA with CRUD	Repositories	- Data	a JPA	with	custom
methods - Data JF Lecture:45, Prac	PA with custom queries tical: 15 Total: 60	a JPA with CRUD	Repositories	- Data		with	custom
methods - Data JF Lecture:45, Prac List of Exercises	PA with custom queries tical: 15 Total: 60	a JPA with CRUD	Repositories	- Data		with	custom
methods - Data JF Lecture:45, Prac List of Exercises 1. Develop of Develop o	PA with custom queries tical: 15 Total: 60 : chat application using TCP and UDP a RMI application	a JPA with CRUD	Repositories	- Data		with	custom
methods - Data JF Lecture:45, Prac List of Exercises 1. Develop of the Develop	PA with custom queries tical: 15 Total: 60 : chat application using TCP and UDP a RMI application servlet based Login application for session tracking	a JPA with CRUD	Repositories	- Data		with	custom
methods - Data JF Lecture:45, Prac List of Exercises 1. Develop a 2. Develop a 3. Develop a 4. Develop a	PA with custom queries tical: 15 Total: 60 : chat application using TCP and UDP a RMI application servlet based Login application for session tracking a simple application using JSP	a JPA with CRUD	Repositories	- Data		with	custom
methods - Data JF Lecture:45, Prac List of Exercises 1. Develop of the Develop	PA with custom queries tical: 15 Total: 60 : chat application using TCP and UDP a RMI application servlet based Login application for session tracking a simple application using JSP eb application using Servlets, JDBC and JSP	a JPA with CRUD	Repositories	- Data		with	custom
methods - Data JF Lecture:45, Prac List of Exercises 1. Develop of the Develop	PA with custom queries tical: 15 Total: 60 : chat application using TCP and UDP a RMI application servlet based Login application for session tracking a simple application using JSP eb application using Servlets, JDBC and JSP an EJB application that demonstrates Entity Bean	a JPA with CRUD	Repositories	- Data		with	custom
methods - Data JF Lecture:45, Prac List of Exercises 1. Develop of the develop	PA with custom queries tical: 15 Total: 60 : chat application using TCP and UDP a RMI application servlet based Login application for session tracking a simple application using JSP eb application using Servlets, JDBC and JSP	a JPA with CRUD	Repositories	- Data		with	custom
methods - Data JF Lecture:45, Prac List of Exercises 1. Develop a 2. Develop a 3. Develop a 4. Develop a 5. Create w 6. Develop a 7. Implemer 8. Develop a	chat application using TCP and UDP a RMI application servlet based Login application for session tracking a simple application using JSP eb application using Servlets, JDBC and JSP an EJB application that demonstrates Entity Bean at an EJB application that demonstrates Session Bean		Repositories	- Data		with	custom
methods - Data JF Lecture:45, Prac List of Exercises 1. Develop a 2. Develop a 3. Develop a 4. Develop a 5. Create w 6. Develop a 7. Implemen 8. Develop a 9. Develop a	eA with custom queries tical: 15 Total: 60 : chat application using TCP and UDP a RMI application servlet based Login application for session tracking a simple application using JSP eb application using Servlets, JDBC and JSP an EJB application that demonstrates Entity Bean at an EJB application that demonstrates Session Bean an application and hosting with tomcat server		Repositories	- Data		with	custom
methods - Data JF Lecture:45, Prac List of Exercises 1. Develop a 2. Develop a 3. Develop a 4. Develop a 5. Create w 6. Develop a 7. Implement 8. Develop a 9. Develop a 10. Deploy sin	eA with custom queries tical: 15 Total: 60 : chat application using TCP and UDP a RMI application servlet based Login application for session tracking a simple application using JSP eb application using Servlets, JDBC and JSP an EJB application that demonstrates Entity Bean an application and hosting with tomcat server a simple application using Spring with database connecti		Repositories	- Data		with	custom
methods - Data JF Lecture:45, Prac List of Exercises 1. Develop 9 2. Develop 9 3. Develop 9 5. Create w 6. Develop 9 7. Implement 8. Develop 9 9. Develop 9 10. Deploy sin	eA with custom queries tical: 15 Total: 60 : chat application using TCP and UDP a RMI application servlet based Login application for session tracking a simple application using JSP eb application using Servlets, JDBC and JSP an EJB application that demonstrates Entity Bean an application and hosting with tomcat server a simple application using Spring with database connecti	vity		- Data		with	custom
methods - Data JF Lecture:45, Prac List of Exercises: 1. Develop : 2. Develop : 3. Develop : 4. Develop : 5. Create w: 6. Develop : 7. Implemer 8. Develop : 9. Develop : 10. Deploy sir TEXT BOOKS: 1. Schildt, Her 2. Mark Heckle	chat application using TCP and UDP a RMI application servlet based Login application for session tracking a simple application using JSP eb application using Servlets, JDBC and JSP an EJB application that demonstrates Entity Bean at an EJB application that demonstrates Session Bean an application and hosting with tomcat server a simple application using Spring with database connection mple database application using SpringBoot bert, "Java: The Complete Reference", 9th Edition, Tata Ner, "Spring Boot: Up and Running: Building Cloud Native	vity McGraw-Hill, New	Delhi, 2014.				
methods - Data JF Lecture:45, Prac List of Exercises: 1. Develop : 2. Develop : 3. Develop : 4. Develop : 5. Create w: 6. Develop : 7. Implemer 8. Develop : 9. Develop : 10. Deploy sir TEXT BOOKS: 1. Schildt, Her 2. Mark Heckle Inc., USA, 2 REFERENCES:	chat application using TCP and UDP a RMI application servlet based Login application for session tracking a simple application using JSP eb application using Servlets, JDBC and JSP an EJB application that demonstrates Entity Bean at an EJB application that demonstrates Session Bean an application and hosting with tomcat server a simple application using Spring with database connection mple database application using SpringBoot bert, "Java: The Complete Reference", 9th Edition, Tata Ner, "Spring Boot: Up and Running: Building Cloud Native 2021.	vity McGraw-Hill, New Java and Kotlin A	Delhi, 2014. pplications", 1	st Edit	ion, (D'Reil	ly Media
methods - Data JF Lecture:45, Prac List of Exercises: 1. Develop: 2. Develop: 3. Develop: 4. Develop: 5. Create w: 6. Develop: 7. Implemer 8. Develop: 9. Develop: 10. Deploy sir TEXT BOOKS: 1. Schildt, Her 2. Mark Heckleinc., USA, 2 REFERENCES: 1. Asbury, Ste	chat application using TCP and UDP a RMI application servlet based Login application for session tracking a simple application using JSP eb application using Servlets, JDBC and JSP an EJB application that demonstrates Entity Bean at an EJB application that demonstrates Session Bean an application and hosting with tomcat server a simple application using Spring with database connection mple database application using SpringBoot bert, "Java: The Complete Reference", 9th Edition, Tata Mer, "Spring Boot: Up and Running: Building Cloud Native 2021.	vity McGraw-Hill, New Java and Kotlin A Applications", 2 nd 6	Delhi, 2014. pplications", 1	st Edit	ion, (D'Reil	ly Media
methods - Data JF Lecture:45, Prac List of Exercises: 1. Develop of the develop	chat application using TCP and UDP a RMI application servlet based Login application for session tracking a simple application using JSP eb application using Servlets, JDBC and JSP an EJB application that demonstrates Entity Bean at an EJB application that demonstrates Session Bean an application and hosting with tomcat server a simple application using Spring with database connection mple database application using SpringBoot bert, "Java: The Complete Reference", 9th Edition, Tata Ner, "Spring Boot: Up and Running: Building Cloud Native 2021. phen and Weiner, Scott R., "Developing Java Enterprise Jardo de Oliveira, Greg L. Turnquist, Alex Antonov, "Developing, Mumbai, 2018	vity McGraw-Hill, New Java and Kotlin A Applications", 2 nd Eeloping Java Appli	Delhi, 2014. pplications", 1 Edition, Wiley cations with S	st Edit	ion, (D'Reil	ly Media
methods - Data JF Lecture:45, Prac List of Exercises 1. Develop of the Develop	chat application using TCP and UDP a RMI application servlet based Login application for session tracking a simple application using JSP eb application using Servlets, JDBC and JSP an EJB application that demonstrates Entity Bean at an EJB application that demonstrates Session Bean an application and hosting with tomcat server a simple application using Spring with database connection mple database application using SpringBoot bert, "Java: The Complete Reference", 9th Edition, Tata Mer, "Spring Boot: Up and Running: Building Cloud Native 2021.	vity McGraw-Hill, New Java and Kotlin A Applications", 2 nd Eeloping Java Appli	Delhi, 2014. pplications", 1 Edition, Wiley cations with S	st Edit	ion, (D'Reil	ly Media

COURSE OUTCOMES:	BT Mapped
On completion of the course, the students will be able to	(Highest Level)

CO1:	construct network with socket programming concepts and RMI architecture	Applying (K3)
CO2:	interpret server side programming using JSP and Servlets	Applying (K3) Precision (S3)
CO3:	make use of EJB, application server and microservice architecture and its concepts	Applying (K3)
CO4:	experiment with annotations, dev tools in Spring framework	Applying (K3) Precision (S3)
CO5:	utilize JPA/Hibernate for Spring Boot database connectivity	Applying (K3) Precision (S3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO1 1	PO12	PSO 1	PSO 2
CO1	3	2	1	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

^{1 –} Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

ASSESSMENT PATTERN

Test/Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT 1	40	40	20				100
CAT 2	40	30	30				100
CAT 3	40	30	30				100
ESE	30	40	30				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	(Offered by Department of	f CSE)														
Programme & Branch	All BE/BTech Branches except CSE & IT	Sem.	Category	L	Т	Р	Credit									
Prerequisites	Nil	5	OE	3	1	0 4										
Preamble	This course focuses on applications of computer simular problems.	ulation and mod	eling to real v	vorld	simp	ole an	d comple									
Unit – I	Modeling Process						9+3									
Differential Equati – Reports – Cons	ons – Steps of the Modeling Process – System Dynamics: on – Difference Equation – Simulation Program – Analytical trained Growth: Carrying Capacity – Revised Model – Equose and Repeated Doses – Mathematics of Repeated Doses	l Solution – Furt ilibrium and Sta	her Refineme bility – Drug I	nt – i Dosa	Unco ge: C	nstraii Inecoi	ned Deca mpartmer									
Unit – II	Force and Motion						9+3									
 Assessment of second control of sec	and Skydiving: Acceleration, Velocity and Position – Physics the Skydive Model – Bungee Jumping: Physics Backgroun Simple Pendulum – Linear Damping – Pendulum Clock – R	nd – Vertical Sp	rings – Model	ing a	a Bun	igee J	ump – Tr									
Unit – III	System Dynamics Models						9+3									
	eling the spread of SARS: SIR Model - SARS Model -	Reproductive I	Number – En	zyme	e Kin	etics:										
Reactions – Differ Unit – IV Functions: Linear Linear Empirical N	eling the spread of SARS: SIR Model – SARS Model – rential Equations – Model – Moles vs. Molar – Results – Mic Data Driven Models Quadratic – Polynomial – Square Root – Exponential – Lo Model – Predictions – Linear Regression – Non-Linear One-	Reproductive I chaelis-Menten garithmic – Log term Model – M	Number – En Equation – Mo istic – Trigono ulti-term Mod	zyme odelii metr els –	e Kin ng In ric – E Adva	etics: hibitio Empirio anced	Enzymat n. 9+3 cal Model Fitting wi									
Reactions – Differ Unit – IV Functions: Linear Linear Empirical N Computational To – Measure of Qual	eling the spread of SARS: SIR Model – SARS Model – rential Equations – Model – Moles vs. Molar – Results – Mice Data Driven Models — Quadratic – Polynomial – Square Root – Exponential – Lo Model – Predictions – Linear Regression – Non-Linear Oneols – Simulating with Randomness: Simulations: Disadvantality – Simulation Development – Different Range of Random	Reproductive I chaelis-Menten garithmic – Log term Model – Mages of Computa	Number – En Equation – Mo istic – Trigono ulti-term Mod ational Simula	zyme odelii metr els – tions	ic – E	etics: hibitio Empirio anced ement	Enzymat n. 9+3 cal Model Fitting wi									
Reactions – Differ Unit – IV Functions: Linear Linear Empirical N Computational To – Measure of Qual	eling the spread of SARS: SIR Model – SARS Model – rential Equations – Model – Moles vs. Molar – Results – Mice Data Driven Models — Quadratic – Polynomial – Square Root – Exponential – Lo Model – Predictions – Linear Regression – Non-Linear Oneols – Simulating with Randomness: Simulations: Disadvanta	Reproductive I chaelis-Menten garithmic – Log term Model – Mages of Computa	Number – En Equation – Mo istic – Trigono ulti-term Mod ational Simula	zyme odelii metr els – tions	ic – E	etics: hibitio Empirio anced ement	Enzymat n. 9+3 cal Model: Fitting wit									
Reactions – Differ Unit – IV Functions: Linear Linear Empirical M Computational To – Measure of Qual – Rejection Method Unit – V Matrices for Populous Scalar – Dot P Systems of Equal Projected –popula	eling the spread of SARS: SIR Model – SARS Model – rential Equations – Model – Moles vs. Molar – Results – Mice Data Driven Models — Quadratic – Polynomial – Square Root – Exponential – Lo Model – Predictions – Linear Regression – Non-Linear Oneols – Simulating with Randomness: Simulations: Disadvanta lity – Simulation Development – Different Range of Randomod – Random Walk.	Reproductive I chaelis-Menten garithmic – Log term Model – Mages of Computa Numbers – Rar Computing – V – Matrix Multiplic Model – Leslie I Sensitivity Analy	Number – En Equation – Modistic – Trigono ulti-term Modiational Simulandom numbers ectors – Vectoation – Squa Matrices – Ag vsis for Age ar	metrels – tions from	e Kinng Inline I	etics: hibitio Empirio anced ement ous di n – M es – M tion o Structu	Enzymat n. 9+3 cal Models Fitting wit of Chancistribution 9+3 ultiplication atrices an ver Time ured Model									
Reactions – Differ Unit – IV Functions: Linear Linear Empirical N Computational To – Measure of Qual – Rejection Metho Unit – V Matrices for Popu by Scalar – Dot P Systems of Equal Projected –popula – Applicability of L	eling the spread of SARS: SIR Model – SARS Model – rential Equations – Model – Moles vs. Molar – Results – Mice Data Driven Models — Quadratic – Polynomial – Square Root – Exponential – Lo Model – Predictions – Linear Regression – Non-Linear Oneols – Simulating with Randomness: Simulations: Disadvantality – Simulation Development – Different Range of Randomod – Random Walk. Matrix Models Ilation Studies: Population Matrices and High-Performance roduct – Matrices – Scalar Multiplication and Matrix Sums – tions – Time after Time: The Problem – Age-structured Matrion Growth Rate – Stage-structured Model – Algorithms – Station Growth Rate – Stage-structured Model – Algorithms – Stage-structured Model – Algor	Reproductive I chaelis-Menten garithmic – Log term Model – Mages of Computa Numbers – Rar Computing – V – Matrix Multiplic Model – Leslie I Sensitivity Analy	Number – En Equation – Mod istic – Trigono ulti-term Mod ational Simula adom numbers fectors – Vect cation – Squa Matrices – Ag vsis for Age ar Modeling with	zymedodelii metr metrells – tions fron or Ad or or Ad or or Ad or or Ad or or o	e Kinng Ining In	etics: hibitio Empirio anced ement ous di n – M ss – M tion o Structu	Enzymatin. 9+3 cal Model Fitting wir of Chanci istribution 9+3 ultiplicatio atrices ar ver Time ured Mode									
Reactions – Differ Unit – IV Functions: Linear Linear Empirical Normal Computational To – Measure of Qual – Rejection Method Unit – V Matrices for Popular Systems of Equal Projected – popular – Applicability of LFIu Pandemic.	eling the spread of SARS: SIR Model – SARS Model – rential Equations – Model – Moles vs. Molar – Results – Mice Data Driven Models — Quadratic – Polynomial – Square Root – Exponential – Lo Model – Predictions – Linear Regression – Non-Linear Oneols – Simulating with Randomness: Simulations: Disadvantality – Simulation Development – Different Range of Randomod – Random Walk. Matrix Models Ilation Studies: Population Matrices and High-Performance roduct – Matrices – Scalar Multiplication and Matrix Sums – tions – Time after Time: The Problem – Age-structured Matrion Growth Rate – Stage-structured Model – Algorithms – Station Growth Rate – Stage-structured Model – Algorithms – Stage-structured Model – Algor	Reproductive I chaelis-Menten garithmic – Log term Model – Mages of Computa Numbers – Rar Computing – V – Matrix Multiplic Model – Leslie I Sensitivity Analy	Number – En Equation – Mod istic – Trigono ulti-term Mod ational Simula adom numbers fectors – Vect cation – Squa Matrices – Ag vsis for Age ar Modeling with	zymedodelii metr metrells – tions fron or Ad or or Ad or or Ad or or Ad or or o	e Kinng Ining In	etics: hibitio Empirio anced ement ous di n – M ss – M tion o Structu	Enzymat n. 9+3 cal Model Fitting wi of Chance istribution 9+3 ultiplicatic atrices ar ver Time ured Mode – The ne									
Reactions – Differ Unit – IV Functions: Linear Linear Empirical Name Computational To – Measure of Qual – Rejection Method Unit – V Matrices for Populby Scalar – Dot P Systems of Equal Projected – popula – Applicability of LFlu Pandemic. TEXT BOOK: Angela B.	eling the spread of SARS: SIR Model – SARS Model – rential Equations – Model – Moles vs. Molar – Results – Mice Data Driven Models — Quadratic – Polynomial – Square Root – Exponential – Lo Model – Predictions – Linear Regression – Non-Linear Oneols – Simulating with Randomness: Simulations: Disadvantality – Simulation Development – Different Range of Randomod – Random Walk. Matrix Models Ilation Studies: Population Matrices and High-Performance roduct – Matrices – Scalar Multiplication and Matrix Sums – tions – Time after Time: The Problem – Age-structured Matrion Growth Rate – Stage-structured Model – Algorithms – Station Growth Rate – Stage-structured Model – Algorithms – Stage-structured Model – Algor	Reproductive I chaelis-Menten garithmic – Log term Model – Mages of Computa Numbers – Rar Computing – V – Matrix Multiplic Model – Leslie I Sensitivity Analy e Computing – I	Number – En Equation – Mo istic – Trigono ulti-term Mod ational Simula ndom numbers fectors – Vect cation – Squa Matrices – Ag vsis for Age ar Modeling with Lecture	zymeodelii metrels – tions fron or Ad or Ad e Dis e Dis e Dis e Stand Stand Mark	E Kinng Ini	etics: hibitio Empirio anced ement ous di n – M es – M tion o Structu	Enzymaten. 9+3 cal Model Fitting with of Chance istribution 9+3 ultiplication attrices are ver Time ured Model — The ne 5, Total:6									
Reactions – Differ Unit – IV Functions: Linear Linear Empirical Name Computational To – Measure of Qual – Rejection Method Unit – V Matrices for Popul by Scalar – Dot P Systems of Equal Projected – popula – Applicability of LFlu Pandemic. TEXT BOOK: Angela B.	eling the spread of SARS: SIR Model – SARS Model – rential Equations – Model – Moles vs. Molar – Results – Mice Data Driven Models — Quadratic – Polynomial – Square Root – Exponential – Lo Model – Predictions – Linear Regression – Non-Linear Oneols – Simulating with Randomness: Simulations: Disadvantality – Simulation Development – Different Range of Randomod – Random Walk. Matrix Models Ilation Studies: Population Matrices and High-Performance roduct – Matrices – Scalar Multiplication and Matrix Sums – tions – Time after Time: The Problem – Age-structured Matrion Growth Rate – Stage-structured Model – Algorithms – Stales and Lefkovitch Matrices – Need for High-Performance	Reproductive I chaelis-Menten garithmic – Log term Model – Mages of Computa Numbers – Rar Computing – V – Matrix Multiplic Model – Leslie I Sensitivity Analy e Computing – I	Number – En Equation – Mo istic – Trigono ulti-term Mod ational Simula ndom numbers fectors – Vect cation – Squa Matrices – Ag vsis for Age ar Modeling with Lecture	zymeodelii metrels – tions fron or Ad or Ad e Dis e Dis e Dis e Stand Stand Mark	E Kinng Ini	etics: hibitio Empirio anced ement ous di n – M es – M tion o Structu	9+3 cal Mode Fitting wi of Chance istribution 9+3 ultiplicatic atrices an ver Time ured Mode The ne									

R. Panneerselvam, P. Senthilkumar, System Simulation, Modelling and Languages, PHI learning Pvt.Ltd. 2013.

2.

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	model system dynamics with and without constraints	Applying (K3)
CO2	determine system dynamics involved in force and motion	Applying (K3)
CO3	construct models for systems with interactions	Applying (K3)
CO4	make use of randomness and data for modeling	Applying (K3)
CO5	apply matrix theory in problem solving	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1											
CO2	3	3	1											
CO3	3	2	1											
CO4	3	2	1											
CO5	3	3	1											

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Remembering Category* (K1) %		Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	50	20				100
CAT2	10	45	45				100
CAT3	25	45	30				100
ESE	20	40	40				100

	(Offered by Depart	tment of CSF)					
Programme & Branch	All BE/BTech Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	NIL	5	OE	3	1	0	4
Preamble	The course helps the learners to know the mo- formal languages and their recognizers and computer science. This can be applied in design	to familiarize students v	with the foun	datic	ns a	nd pri	
Unit – I	Formal proof and Automata						9+3
	rmal proof – Finite Automata (FA) – Deterministic Fir etween NFA and DFA – Finite Automata with Epsilo automata.						
Unit – II	Regular Expressions and Languages						9+3
	ion – Equivalence of finite automata and regular or reproperties of regular languages.	expressions – Proving la	anguages no	t to	be re	gular	(Pumping
Unit – III	Context Free Grammar and Languages						9+3
 Languages of Pushdown Autor 		automata and CFG-CFG					terministic
Unit – IV	Context Free Languages and Turing Machin	nes					9+3
Context Free Lai	r CFG – Chomsky Normal Form and Greibach Nonguages – Turing machines: Basic model – definition of Turing Machine – TM as Computations).	on and representation –	Instantaneou	s De	scrip	tion –	Language
Unit – V	Undecidability						9+3
	not Recursively Enumerable (RE) – An undecida s correspondence problem – The classes P and NP						
			Lecture	:45,	Tuto	rial:15	, Total:6
TEXT BOOK:							
	t J.E., Motwani R. & Ullman J.D., "Introduction to Au Education, New Delhi, 2008.	itomata Theory, Languag	jes and Comp	outat	ions"	, 3rd E	dition,
REFERENCES:							
1. Martin J.	., "Introduction to Languages and the Theory of Con	nputation", 4th Edition, T	ata McGraw-l	Hill, I	New I	Delhi,	2010.

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	apply induction and contradiction methods for theorem proving.	Applying (K3)
CO2	design finite automata and regular expression for regular languages.	Applying (K3)
CO3	develop and normalize context free grammar for context free languages and demonstrate the recognition of context free languages using push down automata.	Applying (K3)
CO4	construct Turing Machine to accomplish specific task and argue formally about its correctness.	Applying (K3)
CO5	make use of Turing machines to distinguish decidable / undecidable problems and compare different classes of problems.	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	2	1											
CO3	3	2	1											
CO4	3	2	1											
CO5	3	2	1											

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	30	50				100
CAT2	20	30	50				100
CAT3	20	30	50				100
ESE	20	30	50				100

					(Offere	d by Dep	artment of	f CSE)						
Programm Branch	e &	All BE/	Tech E	Brancl	hes ex	xcept (CSE & IT		Se	m.	Category	L	Т	Р	Credit
Prerequisi	tes	Nil							(i	OE	3	0	2	4
Preamble							dology of		nslate a da	a dı	iven busines	s pro	blem	into a	an effective
Unit – I		Introdu	tion												9
											Problems. M ential Calcul				
Jnit – II							nd Tool B								9
											ata – Infrastru I kit in MATL		e - Al	gorithr	ns.
Jnit – III		Data Sc	rubbin	g and	Settir	ng up y	our Data	1							9
Means – Se Relative Sq Jnit – V	ression – etting K. E juared Eri eent Learr	Basics Multi line Bias and For (RSE Advance	of Regreration Regression Americans	ression ression re. Erro tive Ab rning	on, Clu on - Log or calc bsolute s – Bu	gistic R culation e Error iilding a	Regression: Mean A (RAE) - (Specificient of the Network – E	rt Vector Ma ror (MAE) - of Determin Ensemble M	Roo	e - Clustering t Mean Squa n (R2 or R-so ling- Decision	red E uare	rror d).	(RMSI	Ē) - 9
					300tii 19	g - Kan	dom Fore	ests – Deep	Learning.						
1. Imp	plementa	ion of Py	thon ba	SES: asic Lit	braries	s such a	as Math,	Numpy and		olotl	ib.				
1. Imp	plementa	ion of Py	thon ba	SES: asic Lib	braries s for M	s such a	as Math, ication su	Numpy and	d Scipy.		ib. Deviation usi	ng Da	atase	ts.	
1. Imp 2. Imp 3. Wr	plementa	ion of Py ion of Py on progr	thon ba	SES: asic Lib braries ompute	braries s for M	s such a	as Math, ication su lian, Mode	Numpy and ich as Pand e, Variance	d Scipy.			ng Da	atase	ts.	
2. Imp 3. Wr 4. Imp 5. Wr	plementar plementar ite a pyth plement Note a progedictions	ion of Py ion of Py on progr laïve Ba ram to ir	thon bathon Like am to cover the control of the con	SES: asic Like braries brante brem to nt k-Ne	braries s for M te Mea to class earest	s such a flL applian, Med sify the	as Math, ication su lian, Mode English to	Numpy and ich as Pande, Variance text.	d Scipy. das and Mate and Stand assify the iris	ard I	Deviation usi	oth c	orrec	t and v	•
I. Imp 2. Imp 3. Wr 4. Imp 5. Wr 5. Vr	plementar plementar ite a pyth plement Note a progedictions	ion of Py ion of Py on progr laïve Ba ram to ir	thon bathon Like am to cover the control of the con	SES: asic Like braries brante brem to nt k-Ne	braries s for M te Mea to class earest	s such a flL applian, Med sify the	as Math, ication su lian, Mode English to	Numpy and ich as Pande, Variance text.	d Scipy. das and Mate and Stand assify the iris	ard I	Deviation usi	oth c	orrec	t and v	· ·
I. Imp 2. Imp 3. Wr 4. Imp 5. Wr 6. Wr 6. Wr 6. Wr 7. Wr	plementar plementar ite a pyth plement N ite a prog edictions ite a prog ta sets.	ion of Py ion of Py on progr laïve Ba ram to ir ram to c	thon batthon Like am to conves the complement of	SES: asic Like braries brantes brem to brem to rem to reshal	braries s for M se Mea to class earest uping th	s such a such a sify the data sification	as Math, ication sullian, Mode English to bour algoon, filtering	Numpy and as Pande, Variance text. rithm to cla	d Scipy. das and Mate and Stand assify the iris	dat data	Deviation usi a set. Print b and handling	oth co	orrec	t and v	lues in
1. Imp 2. Imp 3. Wr 4. Imp 5. Wr 6. dat 7. Wr bui	plementar plementar ite a pyth plement N ite a prog edictions ite a prog ta sets. ite a prog ite a prog	ion of Py ion of Py on progr laïve Ba ram to ir ram to c ram to d decision	thon batthon Like am to cover the complement of	praries prompute prem te preshal	braries s for M te Mea to class earest uping th M class ne worl	s such a flL applian, Med sify the Neight he data sification king of knowle	as Math, ication su lian, Mode English to bour algo on, filtering on.	Numpy and ich as Pande, Variance text. rithm to clathed the data, massion tree bassify a new	d Scipy. das and Mai e and Stand assify the iris nerging the ased ID3 alg w sample.	dat data	Deviation usi a set. Print b and handling m. Use an a	oth co	orrec missi oriate	ng va	lues in
1. Imp 2. Imp 3. Wr 4. Imp 5. Wr 6. dat 7. Wr bui	plementar plementar ite a pyth plement N ite a prog edictions ite a prog ta sets. ite a prog ite a prog	ion of Py ion of Py on progr laïve Ba ram to ir ram to c ram to ir ram to d decision ram to c	thon batthon Like am to cover the complement of	praries prem to prem to reshal preshal	braries s for M te Mea to class earest uping th M class ne worl ly this l yesian	s such a flL applian, Med sify the Neight he data sification king of knowled netwo	as Math, ication su lian, Mode English to bour algo on. the decisedge to clark consider.	Numpy and as Pande, Variance text. rithm to clathe data, make the	d Scipy. das and Mai e and Stand assify the iris nerging the ased ID3 alg w sample.	dat data	Deviation usi a set. Print b and handling	oth co	orrec missi oriate	ng va	lues in
. Imp 2. Imp 3. Wr 4. Imp 5. Wr 6. Wr 6. Wr 7. Wr 8. Wr 9. Wr	plementar plementar plement N plementar plemen	ion of Py ion of Py on progr laïve Ba ram to ir ram to c ram to ir ram to d decision ram to c	thon batthon Like am to cover the complement of	praries prem to prem to reshal preshal	braries s for M te Mea to class earest uping th M class ne worl ly this l yesian	s such a flL applian, Med sify the Neight he data sification king of knowled netwo	as Math, ication su lian, Mode English to bour algo on. the decisedge to clark consider.	Numpy and as Pande, Variance text. rithm to clathe data, make the	d Scipy. das and Mai e and Stand assify the iris nerging the ased ID3 alg w sample.	dat data	Deviation usi a set. Print b and handling m. Use an a s model to do	oth control	orrec missi oriate strate	ng va	lues in set for diagnosis
. Imp	plementar plementar plement N plemen	ion of Py ion of Py on progr laïve Ba ram to ir ram to c ram to ir ram to d decision ram to c	thon batthon Like am to cover the complement of	praries prem to prem to reshal preshal	braries s for M te Mea to class earest uping th M class ne worl ly this l yesian	s such a flL applian, Med sify the Neight he data sification king of knowled netwo	as Math, ication su lian, Mode English to bour algo on. the decisedge to clark consider.	Numpy and as Pande, Variance text. rithm to clathe data, make the data, make the data assify a new ering medical control of the data.	d Scipy. das and Mai e and Stand assify the iris nerging the ased ID3 alg w sample.	dat data	Deviation usi a set. Print b and handling m. Use an a s model to do	oth control	orrec missi oriate strate	ng va	lues in set for diagnosis
Imp Imp Imp Imp Imp Imp Imp Imp	plementar plementar plement N plemen	ion of Py ion of Py on progr laïve Ba ram to ir ram to c ram to d decision ram to c ents usir	thon batthon Literated the control of the control o	praries prem to prem to reshal reshal rate th d appl a Baylard He	braries s for M te Mea to class earest uping th M class ne worl ly this l yesian eart Di	s such a flL applian, Med sify the Neight he data sification king of knowled netwo isease	as Math, ication sulfian, Mode English to bour algo on. the decised by the consideration of the decised by the consideration of the decised by the decise of	Numpy and ach as Pandetext. rithm to clathe data, make assify a newering medical.	d Scipy. das and Mate and Stand assify the iris nerging the ased ID3 alg w sample. cal data. Us	data	Deviation usi a set. Print b and handling m. Use an a s model to de	the pprop	orrec missi oriate strate	ng va	lues in
Imp Imp Imp Imp Imp Imp Imp Imp	plementar plementar plement N plemen	ion of Py ion progr laïve Ba ram to ir ram to c ram to d decision ram to c ents usir	thon batthon Literated the complement of the com	bes: asic Like braries braries brampute brem te brem te reshal at SVM rate th d apply a Bay lard He	braries s for M te Mea to class earest uping th M class ne worl ly this lyyesian eart Di	s such a flL applian, Med sify the Neight he data sification king of knowled netwo isease	as Math, ication sulfian, Mode English to bour algo on. the decised by the consideration of the decised by the consideration of the decised by the decise of	Numpy and ach as Pandetext. rithm to clathe data, make assify a newering medical.	d Scipy. das and Mate and Stand assify the iris nerging the ased ID3 alg w sample. cal data. Us	data	Deviation usi a set. Print b and handling m. Use an a s model to de	the pprop	orrec missi oriate strate	ng va	lues in set for diagnosis
I. Imp 2. Imp 3. Wr 4. Imp 5. pre 6. dat 7. Wr 8. Wr 9. of I REFERENCE I. Ra	plementar plementar plement N ite a pyth plement N ite a prog edictions ite a prog ta sets. rite a prog iding the ite a prog heart pati	ion of Py ion of Py on progr laïve Ba ram to ir ram to c ram to ir ram to d decision ram to c ents usir	thon batthon Literated the control of the control o	prem to the searnin and to the searnin are the searning	braries s for M te Mea to class earest uping th M class ne worl ly this l yesian eart Di	s such a IL appli In, Med sify the Neight he data sification king of knowle netwo isease Absolut al Intell	as Math, ication sulfian, Mode English to bour algo on, filtering on. the decise dge to clark consider Data Set on Set o	Numpy and ich as Pande, Variance text. rithm to clathe data, musion tree bassify a newering medical. ers", Scatte	d Scipy. das and Mai e and Stand assify the iris nerging the ased ID3 alg w sample. cal data. Us	data orith thi eco	Deviation usi a set. Print b and handling m. Use an a s model to de Lecture rd Edition, 20	the pppropremon 1:45,	missi missi priate strate	datasethe c	lues in set for diagnosis 60, Total:75
I. Imp 2. Imp 3. Wr 4. Imp 5. pre 6. Wr 6. Wr 7. Wr 8. Wr 9. Oliv REFERENCE I. Ra 6. Go	plementar plementar plement N ite a pyth plement N ite a prog edictions ite a prog ta sets. rite a prog iding the ite a prog heart pati	ion of Py ion of Py on progr laïve Ba ram to ir ram to c ram to ir ram to d decision ram to c ents usir	thon batthon Literated the control of the control o	prem to the searnin and to the searnin are the searning	braries s for M te Mea to class earest uping th M class ne worl ly this l yesian eart Di	s such a IL appli In, Med sify the Neight he data sification king of knowle netwo isease Absolut al Intell	as Math, ication sulfian, Mode English to bour algo on, filtering on. the decise dge to clark consider Data Set on Set o	Numpy and ich as Pande, Variance text. rithm to clathe data, musion tree bassify a newering medical. ers", Scatte	d Scipy. das and Mai e and Stand assify the iris nerging the ased ID3 alg w sample. cal data. Us	data orith thi eco	Deviation using a set. Print be and handling m. Use an a smodel to do Lecture rd Edition, 20	the pppropremon 1:45,	missi missi priate strate	datasethe c	lues in set for diagnosis 60, Total:7

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	relate machine learning basics and the importance of mathematics towards machine learning technologies.	Applying (K3) Precision (S3)
CO2	use toolbox for basic methods for different applications with the basic concepts of Python through examples	Applying (K3) Precision (S3)
CO3	perform pre-processing on data to be used in machine learning models and algorithms	Applying (K3) Precision (S3)
CO4	formulate own learning model for a specified application.	Applying (K3) Precision (S3)
CO5	apply decision tree and neural networks for solving a given problem.	Applying (K3) Precision (S3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	2	1											
CO3	3	2	1											
CO4	3	2	1											
CO5	3	2	1											

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	30	50				100
CAT3	20	30	50				100
ESE	10	40	50				100

-				/055	rad by Danan	tmant of CCE						
Program	ma&			•		rtment of CSE)						
Branch	iiiea	All BE/BT	ech Branch	hes excep	t CSE & IT		Sem.	Category	L	T	Р	Credit
Prerequi	isites	Nil					6	OE	3	0	2	4
Preamble	е	This cours	e aims to ed	quip the stu	udents with the	e necessary skil	lls to des	sign and deve	lop v	veb a	pplica	tions.
Unit – I		UI Design	:									9
Conflictin	ng Styles –	- Linking Exte	ernal Style S	Sheets – P		ascading Style S ments – Backgr						
Unit – II		Client Sid	e Scripting	j – Part 1:								9
Number -	Displayir	ng Random I	mages – Sc	cope Rules	- Global Fund	n – Random Nu ctions – Recurs orting and Searc	ion – Re	cursion vs Ite				
Unit – III		Client Sid	e Scripting	– Part 2:								9
Docum	ent Object	t Model: DON	l Nodes and	d Trees – D	OM Collection	ate Object – Bons – Dynamic Stand Mouseout	tyle – Dy	namic Styles	to Cr	eate		
Unit – IV	1	Web Serv	er and Data	abase with	n MySQL:							9
Account Client-Sid	Creating	g Databases ng versus Se	n MySQL -	- Web Serv	ers – Introduc	- UPDATA – DE ction – HTTP Tra	ansactio	ns – Multitier	Appl	icatio	n Årcl	nitecture –
, ipaono i		ver	ver-side so	cripting Acc	cessing Web S	Servers – AAM	ı mota	iation – Ruini	9 .		•	ŭ
Unit - V Introduct	ion – Data	Server Side Type Conve	le Scripting	g using Ph erators – A	HP: Arrays – String	s Comparisons	– String	Processing:	Sear	ching	g for E	9 xpressions
Unit – V Introduct – Repres Form Pro	ion – Data senting Pat ocessing –	Server Side Type Conve	le Scripting ersion – Ope ng Matches onnectivity	g using Ph erators – A s – Charac	HP: Arrays – String Ster Classes –		– String	Processing:	Sear	ching	g for E	9 xpressions
Unit – V Introduct – Repres Form Pro	ion – Data senting Pat ocessing –	Server Side Type Converterns – Find - Database C	le Scripting ersion – Ope ing Matches onnectivity	g using Ph erators – A s – Charac – Session	HP: Arrays – String Ster Classes – Tracking.	s Comparisons	– String	Processing:	Sear	ching	g for E	9 xpressions
Unit – V Introduct – Repres Form Pro	ion – Data senting Pat ocessing – EXPERIM Create a G	Server Side a Type Conventerns – Find – Database Conventerns / EXE	le Scripting ersion – Ope ing Matches onnectivity RCISES: tory and exp	g using Pherators – As – Charace – Session	HP: Arrays – String Ster Classes – Tracking.	s Comparisons	– String e Instand	Processing:	Sear	ching	g for E	9 xpressions
Unit – V Introduct – Repres Form Pro LIST OF 1. (ion – Data senting Pat ocessing – EXPERIM Create a G Design a s	Server Side a Type Conventerns – Find – Database Conventerns / EXECUTE SitHub repositions of the part	le Scripting ersion – Ope ing Matches onnectivity RCISES: tory and exp ge using HT	g using Pherators – As – Charace – Session – Session – Phore the its	HP: Arrays – String Ster Classes – Tracking. s features and host it in git	s Comparisons Finding Multiple	– String e Instand	Processing: ce of a Patter	Sear	ching	g for E	9 xpressions
Unit – V Introduct – Repres Form Pro LIST OF 1. (2) 2. 1 3. /	ion – Data senting Pat occssing – EXPERIM Create a G Design a s	Server Side a Type Converterns – Find – Database Converterns / Database Converterns / Extended from the converter of the conv	le Scripting ersion – Ope ing Matches connectivity RCISES: tory and exp ge using HT ground, and	g using Pherators – As – Charace – Session plore the its ML tags as described by the session of the session o	HP: Arrays – String Ster Classes – Tracking. s features and host it in git	s Comparisons Finding Multiple	- String e Instand	Processing: ce of a Patter	Sear	ching	g for E	9 xpressions
Unit – V Introduct – Repres Form Pro LIST OF 1. (1) 2. 1 3. / 4. 1	ion – Data senting Pat occessing – EXPERIM Create a G Design a s Apply CSS	Server Side a Type Converterns – Find – Database Converterns / Executive SitHub repositatic web paces a Text, Backweb page with	le Scripting ersion – Ope ing Matches connectivity RCISES: tory and exp ge using HT ground, and	g using Pherators – As – Charace – Session plore the its ML tags as d Border per particular using	HP: Arrays – String Ster Classes – Tracking. s features and host it in git roperties to de appropriate C	s Comparisons Finding Multiple thub repository.	– String e Instand	Processing: ce of a Patter	Sear	ching	g for E	9 xpressions
Unit – V Introduct – Represe Form Pro LIST OF 1. (2. 1 3.	ion – Data senting Par occessing – EXPERIM Create a G Design a s Apply CSS Design a w Design an	Server Side a Type Convetterns – Find - Database Convetterns / EXEGITHUB reposition of the convetter of the	le Scripting resion – Opeing Matches connectivity : RCISES: tory and experience using HT ground, and navigation tration Form	g using Pherators – As – Charace – Session plore the its ML tags as d Border per bar using mand performand performance performan	HP: Arrays – String Ster Classes – Tracking. s features and host it in git roperties to de appropriate C	s Comparisons Finding Multiple thub repository. esign an attractives:	- String e Instand ve web p	Processing: ce of a Patter	Sean – F	ching	g for E	9 xpressions pressions -
Unit – V Introduct – Repres Form Pro LIST OF 1. (1) 3. (4) 5. [1] 6. [1]	ion – Data senting Pat pocessing – EXPERIM Create a G Design a s Apply CSS Design a w Design an Develop a page using	Server Side a Type Converterns – Find - Database Converterns / EXEMPLE SitHub reposition of the service of the	le Scripting ersion – Ope ing Matches connectivity : RCISES: tory and exp ge using HT ground, and in navigation tration Form	g using Pherators – As – Charace – Session – S	HP: Arrays – String Ster Classes – Tracking. It is features Ind host it in git It is roperties to de It is appropriate Corm form validate It is retrieve the unit in the corm form validate It is retrieve the unit in the corm form validate It is appropriate Corm form validate retrieve the unit in the corm form validate retrieve	thub repository. esign an attractives:	- String e Instand ve web p	Processing: be of a Patter page	Searn – F	ching	g for E	9 xpressions pressions -
Unit – V Introduct – Repres Form Pro LIST OF 1. (1) 3. (4) 5. (1) 6. (1) 7. (1)	ion – Data senting Pat pocessing – EXPERIM Create a G Design a s Apply CSS Design a w Design an Develop a page using Create a d	Server Side a Type Converterns – Find – Database with example database converters – Find –	le Scripting rision – Opering Matches connectivity and expression and expression and expression and expression formation formatic web approaches and the control of the con	g using Pherators – As – Charace – Session – S	HP: Arrays – String Ster Classes – Tracking. It is features Ind host it in git It is roperties to de It is appropriate Corm form validate It is retrieve the unit in the corm form validate It is retrieve the unit in the corm form validate It is appropriate Corm form validate retrieve the unit in the corm form validate retrieve	thub repository. esign an attractives ation using Javaser details from queries using p	- String e Instand ve web p	Processing: be of a Patter page	Searn – F	ching	g for E	9 xpressions pressions -
Unit – V Introduct – Repres Form Pro LIST OF 1. (1) 3. (4) 5. (1) 6. (1) 7. (6) 8. (1)	ion – Data senting Pat becausing – EXPERIM Create a G Design a s Apply CSS Design an Develop a page using Create a d Develop ar	Server Side a Type Converted a Type Conv	le Scripting ersion – Opeing Matches connectivity erson experience of the second experience of t	g using Pherators – As – Charace – Session – S	HP: Arrays – String Ster Classes – Tracking. It is features Ind host it in git If it is features The component of the com	thub repository. esign an attractives ation using Javaser details from queries using p	- String e Instand ve web p	Processing: be of a Patter page	Searn – F	ching	g for E	9 xpressions pressions -
Unit – V Introduct – Repres Form Pro LIST OF 1. (1) 3. (4) 5. (1) 6. (1) 7. (6) 8. (1)	ion – Data senting Pat becausing – EXPERIM Create a G Design a s Apply CSS Design an Develop a page using Create a d Develop ar	Server Side a Type Converted a Type Conv	le Scripting ersion – Opeing Matches connectivity erson experience of the second experience of t	g using Pherators – As – Charace – Session – S	HP: Arrays – String ster Classes – Tracking. Is features Ind host it in git Arrays – String Iter Classes – Tracking. Is features Ind host it in git Array form validate Array form validate Iterieve the und Iterieve SQL	thub repository. esign an attractives ation using Javaser details from queries using p	- String e Instand ve web p	Processing: be of a Patter page	Searn – F	Regul	g for E ar Exp	9 xpressions pressions -
Unit – V Introduct – Represe Form Pro LIST OF 1. (1) 3. (4) 4. (1) 5. (1) 6. (1) 7. (1) 8. (1) 9. (7)	ion – Data senting Paracessing – EXPERIM Create a G Design a s Apply CSS Design a w Design an Develop a page using Create a d Develop ar Apply Sess	Server Side a Type Converted a Type Conv	le Scripting ersion – Opeing Matches connectivity erson experience of the second experience of t	g using Pherators – As – Charace – Session – S	HP: Arrays – String ster Classes – Tracking. Is features Ind host it in git Arrays – String Iter Classes – Tracking. Is features Ind host it in git Array form validate Array form validate Iterieve the und Iterieve SQL	thub repository. esign an attractives ation using Javaser details from queries using p	- String e Instand ve web p	Processing: be of a Patter page	Searn – F	Regul	g for E ar Exp	9 xpressions pressions -
Unit – V Introduct – Represe Form Pro LIST OF 1. (1) 3. (4) 4. (1) 5. (1) 6. (1) 7. (6) 8. (1) 9. (7)	ion – Data senting Paracessing – EXPERIM Create a G Design a s Apply CSS Design a w Design an a page using Create a d Develop ar Apply Sess DOK: Paul Deitel	Server Side a Type Convetterns – Find - Database Comments / EXEMINATE / EXEMIN	le Scripting ersion – Opeing Matches onnectivity : RCISES: tory and experience with the control of the control	g using Pherators – As – Charace – Session plore the its ML tags and Border per plore the using pharms and performance plication to tables and attion using manage using manage using properties.	HP: Arrays – String Ster Classes – Tracking. In the string of the strin	thub repository. esign an attractives ation using Javaser details from queries using p	ve web pascript	Processing: the of a Patter page Form and disp dmin and MyS Lecture	Sean n – F	Regul	g for E ar Exp	9 xpressions pressions -
Unit – V Introduct – Represe Form Pro LIST OF 1. (1) 3. (4) 4. (1) 5. (1) 6. (1) 7. (1) 8. (1) 9. (7) TEXT BC 1. (1)	ion – Data Senting Paracessing – EXPERIM Create a G Design a s Apply CSS Design an w Design an Develop a page using Create a d Develop ar Apply Sess DOK: Paul Deitel Hall, 2012.	Server Side a Type Convetterns – Find - Database Comments / EXEMINATE / EXEMIN	de Scripting Prision – Opeing Matches connectivity of the Prision	g using Pherators – As – Charace – Session plore the its ML tags and Border per plore the using pharms and performance plication to tables and attion using manage using manage using properties.	HP: Arrays – String Ster Classes – Tracking. In the string of the strin	thub repository. esign an attractives sation using Java ser details from queries using particular to the properties attractive series at the properties at t	ve web pascript	Processing: the of a Patter page Form and disp dmin and MyS Lecture	Sean n – F	Regul	g for E ar Exp	9 xpressions pressions -

2	Luke Welling and Laura Thomson, PHP and MySQL Web Development", 5th Edition, Pearson Educati	on 2016
۷.	Luke Welling and Ladia Thomson, i in and Myode Web Development, o Lullion, i carson Ludcali	JII, ZUIU.

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	Design static web pages using HTML5 and CSS3	Applying (K3), Precision (S3)
CO2	Design interactive web pages using the basic programming constructs of JavaScript	Applying (K3), Precision (S3)
CO3	Make use of DOM and Event handling in JavaScript to validate an online registration form	Applying (K3), Precision (S3)
CO4	Create and manipulate relational databases using MySQL	Applying (K3), Precision (S3)
CO5	Develop a real-time dynamic web application using PHP and MySQL	Applying (K3), Precision (S3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	2	1											
CO3	3	2	1											
CO4	3	2	1											
CO5	3	2	1											

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	30	55				100
CAT2	15	40	45				100
CAT3	15	40	45				100
ESE	10	30	60				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22CSO03- NATURE INSPIRED OPTIM	IZATION TECH	NIQUES				
	(Offered by Departm	nent of CSE)					
Programme & Branch	All BE/BTech Branches except CSE & IT	Sem.	Category	L	Т	Р	Credit
Prerequisites	NIL	7	OE	3	0	0	3
Preamble	This course provides an introduction to nature ins	pired techniques	s and application	ıs.			
Introduction							9
Unit – II	Computing Inspired By Nature						9
Standard Evolut	puting-Hill Climbing and Simulated Annealing-Evolu ionary Algorithm-Genetic Algorithms-Selection-C ning approaches-Hebbian learning-Single layer perce	rossover-Mutati	on-Neurocompu	ting-Art	ificial	neur	ons-networl
Unit – III	Swarm Intelligence						9
Algorithm (ACA)-	Colonies- Ant Foraging Behavior- Ant Colony Optimiza Swarm Robotics- Foraging for food- Social Adaptations to particle swarm.						
Unit – IV	Immuno Computing						9
self discrimination-	ne System-Physiology and main components-Pattern - Immune Network Theory-Danger Theory-artificial im- egative selection algorithms-Clonal selection and affini	mune systems-E	Evaluating Intera	ction- I	mmune		
Unit – V	Computing With New Natura Materials						9
•			meriment - Test	t tube			
DNA Computing - Formalmodels-Uni	 Basic concepts - DNA Molecule - Filtering models versalDNAComputers-ScopeofDNAComputing-From m quantum theory-principles from quantum mechanic 	ClassicaltoDNAC			nputing	j-intro	duction-
DNA Computing - Formalmodels-Uni	versalDNAComputers-ScopeofDNAComputing-From(ClassicaltoDNAC			nputing	j-intro	Total:45
DNA Computing - Formalmodels-Uni	versalDNAComputers-ScopeofDNAComputing-From(ClassicaltoDNAC			nputing	g-intro	
DNA Computing - Formalmodels-Uni basic concepts fro TEXT BOOK:	versalDNAComputers-ScopeofDNAComputing-From(ClassicaltoDNAC s.	Computing-Quan	tumcor			To

FloreanoD. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MITPress, Cambridge, 1stEdition, 2008.

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	Apply fundamental concepts in Nature Inspired Systems to solve computational problems.	Applying(K3)
CO2	Manipulate the evolutionary and neuro Computing techniques inspired by nature.	Applying(K3)
CO3	Implement collective intelligence of biological systems to computing.	Applying(K3)
CO4	Develop immune systems behavior to computing and optimization.	Applying(K3)
CO5	Make use of the characteristics of DNA computing and Quantum Computing.	Applying(K3)

COs/P Os	PO1	PO2	PO3	PO4	P 05	PO6	P07	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	2	1											
CO3	3	2	1											
CO4	3	2	1											
CO5	3	2	1											

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembe ring (K1) %	Understanding (K2) %	Applyin g (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	45	35				100
CAT2	20	30	50				100
CAT3	20	30	50				100
ESE	10	40	50				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

		22CSO04 - MACHINE TRA	ANSLATION					
		(Offered by Departmen	nt of CSE)					
Program Branch	me &	All BE/BTech Branches	Sem.	Category	L	Т	Р	Credit
Prerequi	sites	Nil	8	OE	3	0	0	3
Preamble	-	The course helps the learners to know the basic con models with the core aspects of training and decomachine translation.						
Unit – I		Introduction						9
Access -	Aiding Hu	oblem: Goals of Translation – Ambiguity – Linguistic v uman Values – Communication – NLP Pipelines - M tion: Task based Evaluation – Human Assessments -	ultimodal Translatio	n. History: Ne	ural	Netw		
Unit – II		Neural Network Based Machine Translation mo	dels					9
Processir Feed-For	ng. Compu ward Lang	Linear models – Multiple Layers – Nonlinearity – Infutation Graphics: Neural Network as Computation Grauge Models – Word Embeddings – Noise Contrastivurrent Units.	raphs - Gradient Co	omputations. I	Neur	al La	nguag	je Models
Unit – III		Encoding and Decoding of Translation Model						9
		er-Decoder Approach – Adding an Alignment Model - mizing Decoding – Directing Decoding	- Training. Decoding	g: Beam Sear	ch –	Ense	emble	Decoding
Unit – IV		Refining Machine Translation Model						9
Vanishing	g and Expl ional Macl	Tricks: Failures – Ensuring Randomness – Adjustir oding Gradients – Sentence Level Optimization. Alter hine Translation and Neural Networks with Attentio	rnate Architecture: (Components of	f NN	l – At	tentio	n Models-
Embeddii Unit – V Adaptatio	n: Domain	pe Vocabularies-Character Based Models. Adaptation and Linguistic Structure as – Mixture Models – Sub Sampling – Fine-Tuning -Us	sing Monolingual Da	ıta – Multiple L	angı	ıage	Pairs	9
Embeddii Unit – V Adaptatio	n: Domain	e Vocabularies-Character Based Models. Adaptation and Linguistic Structure	sing Monolingual Da	ıta – Multiple L	angı	ıage	Pairs	9 – Training
Embeddii Unit – V Adaptatio on Relate	n: Domain ed Tasks. I	pe Vocabularies-Character Based Models. Adaptation and Linguistic Structure as – Mixture Models – Sub Sampling – Fine-Tuning -Us	sing Monolingual Da	ıta – Multiple L	angı	ıage	Pairs	9 – Training
Embeddii Unit – V Adaptatio on Relate	on: Domain ed Tasks. I	pe Vocabularies-Character Based Models. Adaptation and Linguistic Structure as – Mixture Models – Sub Sampling – Fine-Tuning -Us Linguistic Structure: Guided Alignment Training – Mod	sing Monolingual Da deling Coverage- Ad	ıta – Multiple L	angı	ıage	Pairs	9 – Training
Embeddii Unit – V Adaptatio on Relate	on: Domain ed Tasks. I	pe Vocabularies-Character Based Models. Adaptation and Linguistic Structure as – Mixture Models – Sub Sampling – Fine-Tuning -Us	sing Monolingual Da deling Coverage- Ad	ıta – Multiple L	angı	ıage	Pairs	9 – Training
Embeddii Unit - V Adaptatio on Relate TEXT BC 1. F	on: Domain ed Tasks. I DOK:	pe Vocabularies-Character Based Models. Adaptation and Linguistic Structure as – Mixture Models – Sub Sampling – Fine-Tuning -Us Linguistic Structure: Guided Alignment Training – Mod	sing Monolingual Da deling Coverage- Ad	ıta – Multiple L	angı	ıage	Pairs	9
Embeddii Unit – V Adaptatio on Relate TEXT BC 1. F REFERE 1. C 1	on: Domain ed Tasks. I DOK: Philipp Koe NCES: Gloria Cor Franslation	pe Vocabularies-Character Based Models. Adaptation and Linguistic Structure as – Mixture Models – Sub Sampling – Fine-Tuning -Us Linguistic Structure: Guided Alignment Training – Mod	sing Monolingual Dadeling Coverage- Addeling Coverage- Addeling Press, 2020 a Seretan, "Multiwo	nta – Multiple L dding Linguisti ord Units in N	angı c An	uage notat	Pairs ion	9 - Training Total:45

	SE OUTCOMES: mpletion of the course, the students will be able to,	BT Mapped (Highest Level)		
CO1	summarize the basic concepts and techniques of Machine Translator.	Understand (K2)		
CO2	apply Neural Network concepts to build Machine Translation models	Applying (K3)		
СОЗ	make use of encoding and decoding approaches for building Machine Translation models	Applying (K3)		
CO4	apply optimization techniques to refine the Machine Translation models	Applying (K3)		
CO5	utilize adaptation techniques and linguistic approaches to finetune the machine translation model	Applying (K3)		

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	2	1											
CO3	3	2	1											
CO4	3	2	1											
CO5	3	2	1											

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	50	20				100
CAT2	30	50	20				100
CAT3	25	50	25				100
ESE	35	45	20				100

	(Offered by Department	F BLOCKCHAIN					
Dragramma 9	(Offered by Department	of CSE)					
Programme & Branch	All BE/BTech Branches except CSE & IT	Sem.	Category	L	Т	Р	Credi
Prerequisites	Nil	8	OE	3	0	0	3
Preamble	This course provides technical fundamentals of Block aspects of blockchain applications.	chain, practical in	nplications, an	ıd ha	nds c	n dev	/elopmer
Unit – I	Introduction:						9
Asymmetric Key Unit – II Game Theory: P – Merkle Trees -	Working of Blockchain: risoner's Dilemma – Byzantine Generals' Problem – Compo - Properties of Blockchain Solutions – Blockchain Transact	onents of Compute	r Science Eng	ginee	ring:	The B	9 Blockchai
Applications – S	. B						
							۵
Unit – III	Bitcoin:	Pitcoin Plackchai	n: Plack struc	turo	The	Gon	9
Unit – III The History of M – The Bitcoin Ne							esis Bloc
Unit – III The History of M – The Bitcoin Ne – Bitcoin Scripts Unit – IV	Bitcoin: oney – Introduction to Bitcoin - Working with Bitcoins – The twork: Network Discovery for a New Node – Bitcoin Transac – Full Nodes vs. SPVs – Bitcoin Wallets. Ethereum and Introduction to Hyperledger:	tions – Consensus	s and Block M	ining	– Blo	ock Pr	esis Bloc opagatio
Unit – III The History of M – The Bitcoin Ne – Bitcoin Scripts Unit – IV Bitcoin to Ethere Ethereum Ecosy	Bitcoin: oney – Introduction to Bitcoin - Working with Bitcoins – The twork: Network Discovery for a New Node – Bitcoin Transac – Full Nodes vs. SPVs – Bitcoin Wallets.	tions – Consensus - Ethereum Virtual nents – Hyperledg	s and Block Mi	ining I Cod	– Blo	ock Pr	esis Blocopagatio
Unit – III The History of M – The Bitcoin Ne – Bitcoin Scripts Unit – IV Bitcoin to Ethere Ethereum Ecosy	Bitcoin: oney – Introduction to Bitcoin - Working with Bitcoins – The twork: Network Discovery for a New Node – Bitcoin Transac – Full Nodes vs. SPVs – Bitcoin Wallets. Ethereum and Introduction to Hyperledger: eum – Ethereum Blockchain – Ethereum Smart Contracts – stem – Swarm – Whisper – DApp – Development Compor Iroha – Blockchain Explorer – Fabric Chaintool – Fabric S	tions – Consensus - Ethereum Virtual nents – Hyperledg	s and Block Mi	ining I Cod	– Blo	ock Pr	esis Bloc opagatio 9
Unit – III The History of M – The Bitcoin Ne – Bitcoin Scripts Unit – IV Bitcoin to Ethere Ethereum Ecosy Sawtooth lake – Unit – V Decentralized A Creating a Smar	Bitcoin: oney – Introduction to Bitcoin - Working with Bitcoins – The twork: Network Discovery for a New Node – Bitcoin Transac – Full Nodes vs. SPVs – Bitcoin Wallets. Ethereum and Introduction to Hyperledger: eum – Ethereum Blockchain – Ethereum Smart Contracts – extem – Swarm – Whisper – DApp – Development Compor	- Ethereum Virtual nents – Hyperledg DK Py – Corda.	Machine and er - Introducti	I Cocon –	– Blo	ecuticects: F	esis Blocopagatio 9 on – Fabric – 9 ctions –
Unit - III The History of M - The Bitcoin Ne - Bitcoin Scripts Unit - IV Bitcoin to Ethere Ethereum Ecosy Sawtooth lake - Unit - V Decentralized A Creating a Smar	Bitcoin: oney – Introduction to Bitcoin - Working with Bitcoins – The twork: Network Discovery for a New Node – Bitcoin Transac – Full Nodes vs. SPVs – Bitcoin Wallets. Ethereum and Introduction to Hyperledger: eum – Ethereum Blockchain – Ethereum Smart Contracts – stem – Swarm – Whisper – DApp – Development Compor Iroha – Blockchain Explorer – Fabric Chaintool – Fabric Stem – Stem – Suckchain Application Development: pplications – Blockchain Application Development – Interact Contract – Executing Smart Contract Functions – Publication – Pu	- Ethereum Virtual nents – Hyperledg DK Py – Corda.	Machine and er - Introducti	I Cocon –	– Blo	ecuticects: F	esis Blocopagation 9 on — Fabric — 9 ctions —
Unit - III The History of M - The Bitcoin Ne - Bitcoin Scripts Unit - IV Bitcoin to Ethere Ethereum Ecosy Sawtooth lake - Unit - V Decentralized A Creating a Smar	Bitcoin: oney – Introduction to Bitcoin - Working with Bitcoins – The twork: Network Discovery for a New Node – Bitcoin Transac – Full Nodes vs. SPVs – Bitcoin Wallets. Ethereum and Introduction to Hyperledger: eum – Ethereum Blockchain – Ethereum Smart Contracts – stem – Swarm – Whisper – DApp – Development Compor Iroha – Blockchain Explorer – Fabric Chaintool – Fabric Stem – Stem – Suckchain Application Development: pplications – Blockchain Application Development – Interact Contract – Executing Smart Contract Functions – Publication – Pu	- Ethereum Virtual nents – Hyperledg DK Py – Corda.	Machine and er - Introducti	I Cocon –	– Blo	ecuticects: F	esis Blocopagation 9 on — Fabric — 9 ctions — ation
Unit - III The History of M - The Bitcoin Ne - Bitcoin Scripts Unit - IV Bitcoin to Ethere Ethereum Ecosy Sawtooth lake - Unit - V Decentralized A Creating a Smar Architecture - B TEXT BOOK: Bikrama	Bitcoin: oney – Introduction to Bitcoin - Working with Bitcoins – The twork: Network Discovery for a New Node – Bitcoin Transac – Full Nodes vs. SPVs – Bitcoin Wallets. Ethereum and Introduction to Hyperledger: eum – Ethereum Blockchain – Ethereum Smart Contracts – stem – Swarm – Whisper – DApp – Development Compor Iroha – Blockchain Explorer – Fabric Chaintool – Fabric Stem – Stem – Suckchain Application Development: pplications – Blockchain Application Development – Interact Contract – Executing Smart Contract Functions – Publication – Pu	tions – Consensus - Ethereum Virtual nents – Hyperledg DK Py – Corda. cting with Bitcoin I vs. Private Blockc	Machine and er - Introducti Blockchain - Shains - Dece	I Coc on – Send ntrali	– Blo	ecuticects: F	esis Blocopagation 9 on — fabric — 9 ctions — ation Total:
Unit - III The History of M - The Bitcoin Ne - Bitcoin Scripts Unit - IV Bitcoin to Ethere Ethereum Ecosy Sawtooth lake - Unit - V Decentralized A Creating a Smar Architecture - B	Bitcoin: oney – Introduction to Bitcoin - Working with Bitcoins – The twork: Network Discovery for a New Node – Bitcoin Transac – Full Nodes vs. SPVs – Bitcoin Wallets. Ethereum and Introduction to Hyperledger: Eum – Ethereum Blockchain – Ethereum Smart Contracts – System – Swarm – Whisper – DApp – Development Comport Iroha – Blockchain Explorer – Fabric Chaintool – Fabric Step Blockchain Application Development: Publications – Blockchain Application Development – Interact Contract – Executing Smart Contract Functions – Publication and Ethereum DApp.	tions – Consensus - Ethereum Virtual nents – Hyperledg DK Py – Corda. cting with Bitcoin I vs. Private Blockc	Machine and er - Introducti Blockchain - Shains - Dece	I Coc on – Send ntrali	– Blo	ecuticects: F	esis Blocopagation 9 on — Fabric — 9 ctions — ation Total:4
Unit - III The History of M - The Bitcoin Ne - Bitcoin Scripts Unit - IV Bitcoin to Ethere Ethereum Ecosy Sawtooth lake - Unit - V Decentralized A Creating a Smar Architecture - B TEXT BOOK: 1. Bikrama Blockch REFERENCES: 1. Brenn H applicat	Bitcoin: oney – Introduction to Bitcoin - Working with Bitcoins – The twork: Network Discovery for a New Node – Bitcoin Transac – Full Nodes vs. SPVs – Bitcoin Wallets. Ethereum and Introduction to Hyperledger: Eum – Ethereum Blockchain – Ethereum Smart Contracts – System – Swarm – Whisper – DApp – Development Comport Iroha – Blockchain Explorer – Fabric Chaintool – Fabric Step Blockchain Application Development: Publications – Blockchain Application Development – Interact Contract – Executing Smart Contract Functions – Publication and Ethereum DApp.	- Ethereum Virtual nents – Hyperledg DK Py – Corda. cting with Bitcoin Evs. Private Blocko	Machine and er - Introducti Blockchain - Shains - Dece	I Coo	- Blo	ecuticects: F	esis Blocopagation 9 on - Fabric - 9 ctions - ation Total:

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	explore the history, background, and theoretical aspects of blockchain and apply in real case scenarios	Applying (K3)
CO2	demonstrate core components and working of blockchain	Applying (K3)
CO3	apply Bitcoin's technical concepts for real case scenarios	Applying (K3)
CO4	adapt Ethereum blockchain for different use cases	Applying (K3)
CO5	demonstrate the end-to-end development of a decentralized application	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	2	1											
CO3	3	2	1											
CO4	3	2	1											
CO5	3	2	1											

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	50	20				100
CAT2	30	50	20				100
CAT3	30	50	20				100
ESE	30	50	20				100

		22ITO01 - ARTIFICIAL INTELLIGENCE					
Progra Branch	amme &	All Engineering and Technology Branches except IT Sen	. Category	L	T	P	Credit
rereq	quisites	Nil 5	OE	3	1	0	4
Preamb	ble	This course focuses on the methodology of how to translate a data solution by using powerful Al technologies and Machine Learning page 1.		s prob	olem	into a	n effective
Jnit - I	l	Introduction to Artificial Intelligence					9+3
		ition, Symbolic and Non-Symbolic Representation, Research Focus of As, Objectives, Artificial Intelligence Programming and future of Al.	Artificial Intellig	ence.	Artifi	cial In	telligence:
Jnit - I	II	Machine Learning Definition and Basics					9+3
		rgence of ML, Relation with Artificial Intelligence (AI), Machine Learninq rical Methods, Probability and Statistics, Linear Algebra and Differential					
Jnit - I		Machine Learning Categories and Tool Box					9+3
		ng – Unsupervised Learning – Reinforcement Learning – ML Toolbox: Da - Infrastructure – Advanced Algorithms. Machine Learning tool kit in M		ıre - A	Algori	thms.	Advanced
Jnit - I		Data Scrubbing and Setting up your Data					9+3
arianc	ce and Stand needed – C	eature Selection – Row Comparison – One hot Encoding – Binning – Hardard Deviation. Setting up your Data: Generalization of Data – Train and Cross Validation. Basics of Regression, Clustering and Error Measurements					
/ariand of data Jnit - \ inear and Va	ce and Stand needed – C V Regression ariance. Erro	dard Deviation. Setting up your Data: Generalization of Data – Train and	Test segments t Neighbors –	– De K Me	ciding	g of to - Sett	9+3 ing K. Bias
/ariand of data Jnit - \ Jnit - \ Jnit - \ Jinear Jind Va Relative	ce and Stand needed – C V Regression ariance. Erro re Absolute E	dard Deviation. Setting up your Data: Generalization of Data – Train and Cross Validation. Basics of Regression, Clustering and Error Measurements Multilinear Regression - Logistic Regression – Clustering: K-Neares or calculation: Mean Absolute Error (MAE) - Root Mean Squared Error	Test segments t Neighbors – (RMSE) - Rela	– De K Me tive S	ans -	g of to - Sett ed Er	9+3 ing K. Bias
/ariand f data Init - \ inear and Va Relative	ce and Stand needed – C V Regression ariance. Erro re Absolute E	dard Deviation. Setting up your Data: Generalization of Data – Train and Cross Validation. Basics of Regression, Clustering and Error Measurements Multilinear Regression - Logistic Regression – Clustering: K-Neares or calculation: Mean Absolute Error (MAE) - Root Mean Squared Error (RAE) - Coefficient of Determination (R2 or R-squared)	Test segments t Neighbors – (RMSE) - Rela	– De K Me tive S	ans - Squar	g of to - Sett ed Er	tal quantity 9+3 ing K. Bias ror (RSE) -
/ariand If data Init - \ Ininear Ind Va Relative	ce and Stand needed – C V Regression ariance. Erro re Absolute E	dard Deviation. Setting up your Data: Generalization of Data – Train and Cross Validation. Basics of Regression, Clustering and Error Measurements Multilinear Regression - Logistic Regression – Clustering: K-Neares or calculation: Mean Absolute Error (MAE) - Root Mean Squared Error	Test segments t Neighbors – (RMSE) - Rela	– De K Me tive S	ans - Squar	g of to - Sett ed Er	tal quantity 9+3 ing K. Bias ror (RSE) -
/ariand If data Init - \ Ininear Ind Va Relative	ce and Standaneeded – Covariance. Errove Absolute E	dard Deviation. Setting up your Data: Generalization of Data – Train and Cross Validation. Basics of Regression, Clustering and Error Measurements Multilinear Regression - Logistic Regression – Clustering: K-Neares or calculation: Mean Absolute Error (MAE) - Root Mean Squared Error (RAE) - Coefficient of Determination (R2 or R-squared)	Test segments t Neighbors – (RMSE) - Rela Lecture shed, 2 nd Edition	– De K Me tive S ∋:45 ,	ans - Squar	g of to - Sett ed Er	tal quantity 9+3 ing K. Bias ror (RSE) -
Variance of data Jnit - \ Jnit - \ Linear and Va Relative EEXT E	ce and Standa needed – Covariance. Errove Absolute E	dard Deviation. Setting up your Data: Generalization of Data – Train and Cross Validation. Basics of Regression, Clustering and Error Measurements Multilinear Regression - Logistic Regression – Clustering: K-Neares or calculation: Mean Absolute Error (MAE) - Root Mean Squared Error (RAE) - Coefficient of Determination (R2 or R-squared) Obald, "Machine Learning for Absolute Beginners", Independently Publications	Test segments t Neighbors – (RMSE) - Rela Lecture shed, 2 nd Edition	– De K Me tive S 2:45 ,	ans - Gquar	g of to	tal quantity 9+3 ing K. Bias ror (RSE) - 5, Total:60
Variance of data Jnit - Variance of data Jnit - Variance of data Relative REFER COURS	ce and Standa needed – Cov V Regression ariance. Errove Absolute E BOOK: Oliver Theo RENCES: Rajendra A Gopinath F	dard Deviation. Setting up your Data: Generalization of Data – Train and Cross Validation. Basics of Regression, Clustering and Error Measurements Multilinear Regression - Logistic Regression – Clustering: K-Neares or calculation: Mean Absolute Error (MAE) - Root Mean Squared Error (RAE) - Coefficient of Determination (R2 or R-squared) Obald, "Machine Learning for Absolute Beginners", Independently Public Akerkar, "Introduction to Artificial Intelligence", PHI Learning Pvt Ltd, 2nd Rebala, Ajay Ravi, Sanjay Churiwala, "An Introduction to Machine Learn MES:	Test segments t Neighbors – (RMSE) - Rela Lecture shed, 2 nd Edition	– De K Me tive S 2:45 ,	ans - Comment of the	g of to Sett ed Er rial:1:	tal quantity 9+3 ing K. Bias ror (RSE) - 5, Total:60 .
/ariand of data Jnit - \ Jnit	ce and Standa needed – Cov Regression ariance. Errove Absolute E BOOK: Oliver Theo RENCES: Rajendra A Gopinath F SE OUTCOM mpletion of	dard Deviation. Setting up your Data: Generalization of Data – Train and Cross Validation. Basics of Regression, Clustering and Error Measurements Multilinear Regression - Logistic Regression – Clustering: K-Neares or calculation: Mean Absolute Error (MAE) - Root Mean Squared Error Error (RAE) - Coefficient of Determination (R2 or R-squared) Obald, "Machine Learning for Absolute Beginners", Independently Public Akerkar, "Introduction to Artificial Intelligence", PHI Learning Pvt Ltd, 2 Rebala, Ajay Ravi, Sanjay Churiwala, "An Introduction to Machine Learn MES: the course, the students will be able to	Test segments t Neighbors – (RMSE) - Rela Lecture shed, 2 nd Edition Edition, 2014. ing", Springer,	– De K Me tive S 2:45 ,	ans - quar Tuto 17.	y of to Sett ed Er rial:1:	tal quantity 9+3 ing K. Bias ror (RSE) - 5, Total:60 . pped t Level)
Variance of data Jnit - Variance of data Jnit - Variance of data Relative REFER COURS	ce and Standa needed – C V Regression ariance. Erro re Absolute E BOOK: Oliver Theo Rences: Rajendra A Gopinath F SE OUTCOM mpletion of illustrate A plan to rel	dard Deviation. Setting up your Data: Generalization of Data – Train and Cross Validation. Basics of Regression, Clustering and Error Measurements Multilinear Regression - Logistic Regression – Clustering: K-Neares or calculation: Mean Absolute Error (MAE) - Root Mean Squared Error (RAE) - Coefficient of Determination (R2 or R-squared) Obald, "Machine Learning for Absolute Beginners", Independently Public Akerkar, "Introduction to Artificial Intelligence", PHI Learning Pvt Ltd, 2nd Rebala, Ajay Ravi, Sanjay Churiwala, "An Introduction to Machine Learn MES:	Test segments t Neighbors – (RMSE) - Rela Lecture shed, 2 nd Edition Edition, 2014. ing", Springer,	– De K Me tive S	ans - Gquar Tuto 117. Ethicological distriction (Hida A)	g of to Sett ed Er rial:1:	tal quantity 9+3 ing K. Bias ror (RSE) - 5, Total:60 .
Variance of data Jnit - Variance of data Jnit - Variance of data Jnit - Variance of data Relative REFER COURS On core CO1	ce and Standa needed – C V Regression ariance. Erro re Absolute E BOOK: Oliver Theo RENCES: Rajendra A Gopinath F SE OUTCOM mpletion of illustrate A plan to rel learning tee	dard Deviation. Setting up your Data: Generalization of Data – Train and Cross Validation. Basics of Regression, Clustering and Error Measurements Multilinear Regression - Logistic Regression – Clustering: K-Neares or calculation: Mean Absolute Error (MAE) - Root Mean Squared Error (RAE) - Coefficient of Determination (R2 or R-squared) Obald, "Machine Learning for Absolute Beginners", Independently Public Rebala, Ajay Ravi, Sanjay Churiwala, "An Introduction to Machine Learning MES: the course, the students will be able to Il-based problems, and identify its key competitive advantages and issulate machine learning basics and the importance of mathematics to	Test segments t Neighbors – (RMSE) - Rela Lecture shed, 2 nd Edition Edition, 2014. ing", Springer,	– De K Me tive S	ans - Gquar Tuto 17. dition (Hi A	g of to Sett ed Er rial:1: , 2019 BT Ma ighes pplyin pplyin	tal quantity 9+3 ing K. Bias ror (RSE) - 5, Total:60 . pped t Level) g (K3)
Variance of data Jnit - Variance of data Jnit - Variance of data Jnit - Variance of data Relative EXT E REFER COURS OURS On core CO1 CO2	Regression ariance. Erro ve Absolute E BOOK: Oliver Theo Rajendra A Gopinath F SE OUTCOM mpletion of illustrate A plan to rel learning te- use toolbox	dard Deviation. Setting up your Data: Generalization of Data – Train and Cross Validation. Basics of Regression, Clustering and Error Measurements Multilinear Regression - Logistic Regression – Clustering: K-Neares or calculation: Mean Absolute Error (MAE) - Root Mean Squared Error (RAE) - Coefficient of Determination (R2 or R-squared) Obald, "Machine Learning for Absolute Beginners", Independently Public Akerkar, "Introduction to Artificial Intelligence", PHI Learning Pvt Ltd, 2 nd Rebala, Ajay Ravi, Sanjay Churiwala, "An Introduction to Machine Learn MES: the course, the students will be able to Il-based problems, and identify its key competitive advantages and issulate machine learning basics and the importance of mathematics to echnologies.	Test segments t Neighbors – (RMSE) - Rela Lecture shed, 2 nd Edition Edition, 2014. ing", Springer,	– De K Me tive S	ans - Gquar Tuto 17. Glition Hi A A	g of to Sett ed Er rial:1: , 2019 BT Ma ighes pplyin pplyin pplyin	tal quantity 9+3 ing K. Bias ror (RSE) - 5, Total:60 . pped t Level) g (K3) g (K3)

	Mapping of COs with POs and PSOs													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Programme & Branch	All Engineering and Technology Branches except IT	Sem.	Category	L	Т	Р	Credit					
Prerequisites	18CST52- WEB TECHNOLOGY	5	OE	3	0	2	4					
Preamble	amble This course provides an understanding of how to use Django framework to create a complete dynamic website from scratch very easily. The course also covers the integration of databases will order to get a complete application. In addition, the course also introduces NoSQL and HDFS data											
Unit - I	Introduction to Django, Templates and Models	o introdu	CES NOSQL a	шп	DFS	ualab	9 +3					
Installing Django , – Dynamic URLs, Using templates ii Models in Python	Starting a project, Views and URLconfs: generating static and dy Templates: Template System basic – using Template System - n views – template loading - Inheritance, Models: MTV Develop – Installing the Model – Data Access - Adding Model String R - Deleting Objects.	 Basic te ment pat 	mplate tags a tern – Config	and F uring	ilters data	– Lir base	coupling nitations - – defining					
Unit - II	Forms, Advanced Templates and Models in Django						9 +3					
Tying Form Object and Context Proce	tom ModelAdmin classes - Users, Groups, and Permissions, Formuts Into Views – Working with form fields, Advanced Views and Usessors - Automatic HTML Escaping -Extending the Template - Writin Standalone Mode, Advanced Models Session Management, caching and Database integration	RLconf, A	Advanced Ter	npla	es:	Reque	estContex					
	Generic Views of Objects - Extending Generic Views, Deploying	Diango ·	Diango with) nac	he n	nod n						
FastCGI, Generat	ing Non-HTML content : views and MIME-types - Producing C											
	nd registration: Framework – Authentication – Permission – Grou che -The Per-View Cache - Template Fragment Caching, Integrat	ps – Mes	sages, Cachir									
	nd registration: Framework – Authentication – Permission – Grou che -The Per-View Cache - Template Fragment Caching, Integrat NoSQL Databases	ps – Mes	sages, Cachir									
- The Per-Site Car Unit - IV Introduction to Mo Introduction to Ap and Export - Que	che -The Per-View Cache - Template Fragment Caching, Integrat NoSQL Databases ongoDB - Term used in RDBMS and MongoDB - Data Types ache Cassandra - CRUD operations -Collections - Using a courying System Tables.	ps – Mesing with d	sages, Cachir atabases. goDB – Mong	ng : S JoDE	Settin Que	g Up tery La	the Cache 9 +3 anguage – s – Import					
- The Per-Site Car Unit – IV Introduction to Mo Introduction to Ap and Export – Que Unit - V	che -The Per-View Cache - Template Fragment Caching, Integrate NoSQL Databases ongoDB - Term used in RDBMS and MongoDB - Data Types ache Cassandra - CRUD operations -Collections - Using a courying System Tables. Big Data Storage Systems	ps – Mesang with design in Mongonter – Tir	sages, Cachir atabases. goDB – Mono ne to Live – A	ng : S yoDE Alter	Settin Que Com	g Up tery La	the Cache 9 +3 anguage - s - Impor					
- The Per-Site Car Unit - IV Introduction to Mo Introduction to Ap and Export - Que Unit - V Introduction to Hiv Shell - Database	che -The Per-View Cache - Template Fragment Caching, Integrat NoSQL Databases ongoDB - Term used in RDBMS and MongoDB - Data Types ache Cassandra - CRUD operations -Collections - Using a courying System Tables.	ps – Mesing with desired in Mongonter – Tiree Query L	sages, Cachir atabases. goDB – Mono me to Live – A	ng : S goDE Alter	Que Com	g Up tery Lamand	the Cache 9 +3 anguage - s - Impor 9 +3 arting Hive					
- The Per-Site Car Unit - IV Introduction to Montroduction to Ap and Export - Que Unit - V Introduction to Hiv Shell - Database Implementation -	che -The Per-View Cache - Template Fragment Caching, Integrate NoSQL Databases IngoDB - Term used in RDBMS and MongoDB - Data Types ache Cassandra - CRUD operations -Collections - Using a courying System Tables. Big Data Storage Systems e - Hive Architecture - Hive Data Types - Hive File Format - Hive Tables - Partitions - Bucketing - Views - Subquery - Joins	ps – Mesing with desired in Mongonter – Tiree Query L	sages, Cachir atabases. goDB – Mono me to Live – A	ng : S goDE Alter	Que Com	g Up tery Lamand	the Cache 9 +3 anguage - s - Impor 9 +3 arting Hive					
- The Per-Site Car Unit - IV Introduction to Montroduction to Ap and Export - Que Unit - V Introduction to Hiv Shell - Database Implementation -	che -The Per-View Cache - Template Fragment Caching, Integrate NoSQL Databases ongoDB - Term used in RDBMS and MongoDB - Data Types ache Cassandra - CRUD operations -Collections - Using a courying System Tables. Big Data Storage Systems e - Hive Architecture - Hive Data Types - Hive File Format - Hive - Tables - Partitions - Bucketing - Views - Subquery - Joins User Defined Function.	ps – Mesing with desired in Mongonter – Tiree Query L	sages, Cachir atabases. goDB – Mono me to Live – A	ng : S goDE Alter	Que Com	g Up tery Lamand	the Cache 9 +3 anguage - s - Impor 9 +3 arting Hive					
- The Per-Site Car Unit - IV Introduction to Mo Introduction to Ap and Export - Que Unit - V Introduction to Hiv Shell - Database Implementation - LIST OF EXPERI	che -The Per-View Cache - Template Fragment Caching, Integrate NoSQL Databases ongoDB - Term used in RDBMS and MongoDB - Data Types ache Cassandra - CRUD operations - Collections - Using a courying System Tables. Big Data Storage Systems e - Hive Architecture - Hive Data Types - Hive File Format - Hive - Tables - Partitions - Bucketing - Views - Subquery - Joins User Defined Function. MENTS / EXERCISES:	ps – Mesing with desired in Mongonter – Tiree Query L	sages, Cachir atabases. goDB – Mono me to Live – A	ng : S goDE Alter	Que Com	g Up tery Lamand	the Cache 9 +3 anguage - s - Impor 9 +3 arting Hive					
- The Per-Site Car Unit – IV Introduction to Mo Introduction to Ap and Export – Que Unit - V Introduction to Hiv Shell – Database Implementation – LIST OF EXPERION Create a second content of the c	che -The Per-View Cache - Template Fragment Caching, Integrate NoSQL Databases ongoDB - Term used in RDBMS and MongoDB - Data Types ache Cassandra - CRUD operations - Collections - Using a courying System Tables. Big Data Storage Systems e - Hive Architecture - Hive Data Types - Hive File Format - Hive - Tables - Partitions - Bucketing - Views - Subquery - Joins User Defined Function. MENTS / EXERCISES: simple Django application with static and dynamic content	ps – Mesing with desired in Mongonter – Tiree Query L	sages, Cachir atabases. goDB – Mono me to Live – A	ng : S goDE Alter	Que Com	g Up tery Lamand	9 +3 anguage - s - Impor 9 +3 arting Hive					
- The Per-Site Car Unit - IV Introduction to Me Introduction to Ap and Export - Que Unit - V Introduction to Hiv Shell - Database Implementation - LIST OF EXPERINATION - Create a second of the complement o	che -The Per-View Cache - Template Fragment Caching, Integrate NoSQL Databases ongoDB - Term used in RDBMS and MongoDB - Data Types ache Cassandra - CRUD operations -Collections - Using a courying System Tables. Big Data Storage Systems e - Hive Architecture - Hive Data Types - Hive File Format - Hive - Tables - Partitions - Bucketing - Views - Subquery - Joins User Defined Function. MENTS / EXERCISES: simple Django application with static and dynamic content a Django application using templates and models	ps – Mesing with desired in Mongonter – Tiree Query L	sages, Cachir atabases. goDB – Mono me to Live – A	ng : S goDE Alter	Que Com	g Up tery Lamand	9 +3 anguage - s - Impor 9 +3 arting Hive					
- The Per-Site Cac Unit - IV Introduction to Me Introduction to Ap and Export - Que Unit - V Introduction to Hiv Shell - Database Implementation - LIST OF EXPERINATION 1. Create as 3. Implementation 4. Develop as 4. Create Bit Cre	che -The Per-View Cache - Template Fragment Caching, Integrate NoSQL Databases ongoDB - Term used in RDBMS and MongoDB - Data Types ache Cassandra - CRUD operations - Collections - Using a courying System Tables. Big Data Storage Systems e - Hive Architecture - Hive Data Types - Hive File Format - Hive - Tables - Partitions - Bucketing - Views - Subquery - Joins User Defined Function. MENTS / EXERCISES: simple Django application with static and dynamic content a Django application using templates and models at form processing in Django	ps – Mesing with desired in Mongonter – Tiree Query L	sages, Cachir atabases. goDB – Mono me to Live – A	ng : S goDE Alter	Que Com	g Up tery Lamand	9 +3 anguage - s - Impor 9 +3 arting Hive					
- The Per-Site Cac Unit - IV Introduction to Me Introduction to Ap and Export - Que Unit - V Introduction to Hiv Shell - Database Implementation - LIST OF EXPERINATION 1. Create a secondary 2. Implementation - Implementation - Create Associated assoc	che -The Per-View Cache - Template Fragment Caching, Integrate NoSQL Databases ongoDB - Term used in RDBMS and MongoDB - Data Types ache Cassandra - CRUD operations - Collections - Using a courying System Tables. Big Data Storage Systems e - Hive Architecture - Hive Data Types - Hive File Format - Hive - Tables - Partitions - Bucketing - Views - Subquery - Joins User Defined Function. MENTS / EXERCISES: simple Django application with static and dynamic content a Django application using templates and models at form processing in Django a Django Admin site	ps – Mesing with desired in Mongonter – Tiree Query L	sages, Cachir atabases. goDB – Mono me to Live – A	ng : S goDE Alter	Que Com	g Up tery Lamand	9 +3 anguage - s - Impor 9 +3 arting Hive					
- The Per-Site Car Unit - IV Introduction to Me Introduction to Ap and Export - Que Unit - V Introduction to Hiv Shell - Database Implementation - LIST OF EXPERII 1. Create a: 2. Develop a: 3. Implemer 4. Develop a: 5. Create R: 6. Session r	che -The Per-View Cache - Template Fragment Caching, Integrate NoSQL Databases ongoDB - Term used in RDBMS and MongoDB - Data Types ache Cassandra - CRUD operations - Collections - Using a courying System Tables. Big Data Storage Systems e - Hive Architecture - Hive Data Types - Hive File Format - Hive - Tables - Partitions - Bucketing - Views - Subquery - Joins User Defined Function. MENTS / EXERCISES: simple Django application with static and dynamic content a Django application using templates and models at form processing in Django a Django Admin site SS and Atom feeds using Syndication Feed Framework	ps – Mesing with desired in Mongonter – Tiree Query L	sages, Cachir atabases. goDB – Mono me to Live – A	ng : S goDE Alter	Que Com	g Up tery Lamand	the Cache 9 +3 anguage - s - Impor 9 +3 arting Hive					
- The Per-Site Car Unit - IV Introduction to Me Introduction to Ap and Export - Que Unit - V Introduction to Hiv Shell - Database Implementation - LIST OF EXPERII 1. Create a 1 2. Develop a 3. Implemer 4. Develop a 5. Create R: 6. Session r 7. Implemer	che -The Per-View Cache - Template Fragment Caching, Integrate NoSQL Databases ongoDB - Term used in RDBMS and MongoDB - Data Types ache Cassandra - CRUD operations - Collections - Using a courying System Tables. Big Data Storage Systems e - Hive Architecture - Hive Data Types - Hive File Format - Hive - Tables - Partitions - Bucketing - Views - Subquery - Joins User Defined Function. MENTS / EXERCISES: simple Django application with static and dynamic content a Django application using templates and models at form processing in Django a Django Admin site SS and Atom feeds using Syndication Feed Framework management in Django	ps – Mesing with desired in Mongonter – Tiree Query L	sages, Cachir atabases. goDB – Mono me to Live – A	ng : S goDE Alter	Que Com	g Up tery Lamand	the Cache 9 +3 anguage - s - Impor 9 +3 arting Hive					
- The Per-Site Car Unit - IV Introduction to Me Introduction to Ap and Export - Que Unit - V Introduction to Hiv Shell - Database Implementation - LIST OF EXPERII 1. Create a 1 2. Develop a 3. Implemer 4. Develop a 5. Create R: 6. Session r 7. Implemer 8. Create ar	che -The Per-View Cache - Template Fragment Caching, Integrate NoSQL Databases ongoDB — Term used in RDBMS and MongoDB — Data Types ache Cassandra — CRUD operations —Collections — Using a courying System Tables. Big Data Storage Systems e — Hive Architecture — Hive Data Types — Hive File Format — Hive — Tables — Partitions — Bucketing — Views — Subquery — Joins User Defined Function. MENTS / EXERCISES: simple Django application with static and dynamic content a Django application using templates and models at form processing in Django a Django Admin site SS and Atom feeds using Syndication Feed Framework management in Django at CRUD operations in MongoDB	ps – Mesing with desired in Mongonter – Tiree Query L	sages, Cachir atabases. goDB – Mono me to Live – A	ng : S goDE Alter	Que Com	g Up tery Lamand	9 +3 anguage - s - Impor 9 +3 arting Hive					

Lecture:45, Practical:30, Total:75

TEXT BOOK:

- 1. Adrian Holovaty, Jacob Kaplan Moss, "The Django Book Release 2.0", A press, 2013. (For Units I,II,III)
- 2. Seema Acharya and Subhashini Chellappan, "Big Data and Analytics", 1st Edition, Wiley India Pvt. Ltd, 2015. (For Units IV, V)

REFERENCES/ MANUAL / SOFTWARE:

- 1. Andrew Pinkham, "Django unleashed", Sams Publishing, 1st Edition, 2015
- 2. Beau Curtin, "Django Cookbook: Web Development with Django Step by Step Guide", 2nd Edition, 2016

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	develop static and dynamic web content using Django templates with models	Applying (K3)
CO2	create Django user models, templates and forms and develop simple web applications	Applying (K3)
CO3	build Django applications using sessions and databases	Applying (K3)
CO4	identify the significant features of NOSQL Databases	Applying (K3)
CO5	apply the bigdata storage concepts using Hive	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	20	60				100
CAT2	20	20	60				100
CAT3	10	20	70				100
ESE	15	25	60				100

Bran	ramme & ch	All BE/BTech branches except Information Technology	Sem.	Category	L	Т	Р	Credit
Prere	quisites	Nil	6	OE	3	0	2	4
Prear	mble	This course enables the students to develop, test, and deploy a establish them as cloud-based applications using Spring Boot.	applica	tions ready f	or pr	oduc	tion a	nd how to
Unit -	·	Spring Boot						9+3
Initial	izr, Build Tool	ures - Advantages, Microservices, System Requirements, Setting us – Maven and Gradle, pom.xml and build.gradle, Building applicatioplication Context, Spring Boot Starter Dependencies - Auto-Config	on usir	ng Maven and				
Unit -	·	Spring Annotations and Data						9+3
Sprin	g Data JPA a	ations: Java annotations – Existence of Spring Annotations - Sprin nd Caching: Accessing relational data using JdbcTemplate and Spymethods in Spring Data JPA - Caching.						
Unit -	· III	Learning RESTFul API						9+
– Exc Authe REST	eption handlinentication and secured API	Microservices: Creating and Consuming RESTFul APIs- Spring Boong -Service discovery – RestTemplate - Routing a request – Spring Authorization concepts – Spring security filters – Enabling and Diss –REST services	Cloud	Gateway. Se	curin	g a V	leb A	pplication: Accessing
Unit -	= =	Implementing Resilience4J and Swagger						9+3
Logba	ack – Spring (System: Client-side load balancing – Circuit breaker – Implementing Cloud Sleuth and Zipkin – ELK. Working with the Swagger API Man gger - Swagger UI – Swagger documentation – Swagger Codegen.	ageme					
Unit -	· V	Testing and Deploying						9+3
		Type Conversion – Operators – Arrays – Strings Comparisons – S						pressions
– Rep	oresenting Pa	Type Conversion – Operators – Arrays – Strings Comparisons – Strens – Finding Matches – Character Classes – Finding Multiple In Database Connectivity – Session Tracking.		of a Pattern	– R	egula	r Exp	ressions -
- Rep Form	presenting Pa Processing –	tterns – Finding Matches – Character Classes – Finding Multiple In		of a Pattern	– R	egula	r Exp	ressions -
- Rep	oresenting Pa Processing –	tterns – Finding Matches – Character Classes – Finding Multiple In Database Connectivity – Session Tracking.		of a Pattern	– R	egula	r Exp	ressions -
- Rep Form LIST 1.	oresenting Pa Processing – OF EXPERIM Build sim	tterns – Finding Matches – Character Classes – Finding Multiple In Database Connectivity – Session Tracking. IENTS / EXERCISES:		of a Pattern	– R	egula	r Exp	ressions -
- Rep Form LIST	OF EXPERIM Build sim Develop	tterns – Finding Matches – Character Classes – Finding Multiple In Database Connectivity – Session Tracking. IENTS / EXERCISES: ple micro services using Java	nstance	e of a Pattern Lecture	– Ro	egula Tuto	r Exp	ressions –
- Rep Form LIST 1. 2.	OF EXPERIM Build sim Develop Utilize Bo	tterns – Finding Matches – Character Classes – Finding Multiple In Database Connectivity – Session Tracking. IENTS / EXERCISES: ple micro services using Java a simple web application Maven and Gradle	to con	Lecture	– Ro	egula Tuto	r Exp	ressions –
- Rep Form LIST 1. 2.	OF EXPERIN Build sim Develop Utilize Bo Develop Implemen	tterns – Finding Matches – Character Classes – Finding Multiple In Database Connectivity – Session Tracking. IENTS / EXERCISES: ple micro services using Java a simple web application Maven and Gradle totstrap Application Context and Spring Boot Starter Dependencies a simple web application to access relational data using JdbcTemple advanced search operations in a relational data from your web application to access relational data from your web application.	to conate in S	Lecture figure a web a	– Ro	Tuto:	r Exp	cpressions ressions – 5, Total:60
- Rep Form LIST 1. 2. 3. 4.	OF EXPERIM Build sim Develop Utilize Bo Develop Implement Data JPA	tterns – Finding Matches – Character Classes – Finding Multiple In Database Connectivity – Session Tracking. IENTS / EXERCISES: ple micro services using Java a simple web application Maven and Gradle botstrap Application Context and Spring Boot Starter Dependencies a simple web application to access relational data using JdbcTemple advanced search operations in a relational data from your web application.	to contate in Spolication	Lecture figure a web a	– Ro	Tuto:	r Exp	cpressions ressions – 5, Total:60
- Rep Form LIST 1. 2. 3. 4. 5.	OF EXPERIM Build sim Develop Utilize Bo Develop Implement Data JPA Create a	tterns – Finding Matches – Character Classes – Finding Multiple In Database Connectivity – Session Tracking. IENTS / EXERCISES: ple micro services using Java a simple web application Maven and Gradle potstrap Application Context and Spring Boot Starter Dependencies a simple web application to access relational data using JdbcTemple advanced search operations in a relational data from your web application to access relational data from your web application. RESTFul API using SpringBoot and consume it in your web applications.	to contate in Speciation	Lecture figure a web a	– Ro	Tuto:	r Exp	cpressions ressions – 5, Total:60
- Rep Form 1. 2. 3. 4. 5.	OF EXPERIM Build sim Develop Utilize Bo Develop Implement Data JPA Create a Create a	tterns – Finding Matches – Character Classes – Finding Multiple In Database Connectivity – Session Tracking. IENTS / EXERCISES: ple micro services using Java a simple web application Maven and Gradle botstrap Application Context and Spring Boot Starter Dependencies a simple web application to access relational data using JdbcTemple advanced search operations in a relational data from your web application.	to contate in Splication	Lecture Lecture figure a web a SpringBoot on using Que	– Ro	Tuto:	r Exp	cpressions ressions – 5, Total:60
- Rep Form LIST 1. 2. 3. 4.	OF EXPERIM Build sim Develop Utilize Bo Develop Implement Data JPA Create a Implement	tterns – Finding Matches – Character Classes – Finding Multiple In Database Connectivity – Session Tracking. IENTS / EXERCISES: ple micro services using Java a simple web application Maven and Gradle totstrap Application Context and Spring Boot Starter Dependencies a simple web application to access relational data using JdbcTempl at advanced search operations in a relational data from your web application API using SpringBoot and consume it in your web applications secured web application using various security features in SpringBoot	to contate in Splication	Lecture Lecture figure a web a SpringBoot on using Que	– Ro	Tuto:	r Exp	cpressions ressions – 5, Total:60
- Rep Form LIST 1. 2. 3. 4. 5. 6. 7.	OF EXPERIM Build sim Develop Utilize Bo Develop Implement Data JPA Create a Implement Testing y	tterns – Finding Matches – Character Classes – Finding Multiple In Database Connectivity – Session Tracking. IENTS / EXERCISES: ple micro services using Java a simple web application Maven and Gradle potstrap Application Context and Spring Boot Starter Dependencies a simple web application to access relational data using JdbcTemple advanced search operations in a relational data from your web application to access relational data from your web application. RESTFul API using SpringBoot and consume it in your web applications are currently features in SpringBoot and consume it in your microservices using the print of fault tolerance and load balancing in your microservices using the print of the	to contate in Splication	Lecture Lecture figure a web a SpringBoot on using Que	– Ro	Tuto:	r Exp	cpressions ressions – 5, Total:60
- Rep Form LIST 1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	OF EXPERIM Build sim Develop Utilize Bo Develop Implement Data JPA Create a Create a Implement Testing y Deploying	tterns – Finding Matches – Character Classes – Finding Multiple In Database Connectivity – Session Tracking. IENTS / EXERCISES: ple micro services using Java a simple web application Maven and Gradle totstrap Application Context and Spring Boot Starter Dependencies a simple web application to access relational data using JdbcTempl at advanced search operations in a relational data from your web application API using SpringBoot and consume it in your web application using various security features in SpringBoutation of fault tolerance and load balancing in your microservices used our web application and RestFul Web Serives	to contate in Splication	Lecture Lecture figure a web a SpringBoot on using Que	– Ro	Tuto:	r Exp	cpressions ressions – 5, Total:60
- Rep Form 1. 2. 3. 4. 5. 6. 7. 8. 9.	OF EXPERIM Build sim Develop Utilize Bo Develop Implement Data JPA Create a Implement Testing y	tterns – Finding Matches – Character Classes – Finding Multiple In Database Connectivity – Session Tracking. IENTS / EXERCISES: ple micro services using Java a simple web application Maven and Gradle totstrap Application Context and Spring Boot Starter Dependencies a simple web application to access relational data using JdbcTempl at advanced search operations in a relational data from your web application API using SpringBoot and consume it in your web application using various security features in SpringBoutation of fault tolerance and load balancing in your microservices used our web application and RestFul Web Serives	to contate in Splication	Lecture Lecture figure a web a SpringBoot on using Que	– Ro	Tuto:	r Exp	cpressions ressions – 5, Total:60
- Rep Form LIST 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. TEXT	Develop a Utilize Book:	tterns – Finding Matches – Character Classes – Finding Multiple In Database Connectivity – Session Tracking. IENTS / EXERCISES: ple micro services using Java a simple web application Maven and Gradle totstrap Application Context and Spring Boot Starter Dependencies a simple web application to access relational data using JdbcTempl at advanced search operations in a relational data from your web application API using SpringBoot and consume it in your web application using various security features in SpringBoutation of fault tolerance and load balancing in your microservices used our web application and RestFul Web Serives	to contate in Splication pot sing Re	Lecture Lecture figure a web a SpringBoot on using Que	- Ro	Tutor cation ethocoative attive	rial:19	cations by
- Rep Form 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. TEXT	Develop: Utilize Bo Develop: Implement Data JPA Create a Implement Testing y Deploying: BOOK: Shagun Ba Learning F 2021. ERENCES:	Items – Finding Matches – Character Classes – Finding Multiple In Database Connectivity – Session Tracking. IENTS / EXERCISES: ple micro services using Java a simple web application Maven and Gradle potstrap Application Context and Spring Boot Starter Dependencies a simple web application to access relational data using JdbcTempl at advanced search operations in a relational data from your web application RESTFul API using SpringBoot and consume it in your web application secured web application using various security features in SpringBout attaition of fault tolerance and load balancing in your microservices used our web application and RestFul Web Serives g your web application using Docker and Containerization akliwal, "Hands-on Application Development using Spring Boot: But RESTFul API, Microservices, CRUD Operations, Unit Testing, and	to contate in Spelication bot sing Resulting Deplo	figure a web a SpringBoot on using Que esilience4J Modern Clouyment", BPB	- Ro	cation ethoc	r Exp	cations by
- Rep Form LIST 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. TEXT	Develop: Utilize Bo Develop: Implement Data JPA Create a Implement Testing y Deploying: BOOK: Shagun Ba Learning F 2021. ERENCES:	Items – Finding Matches – Character Classes – Finding Multiple In Database Connectivity – Session Tracking. IENTS / EXERCISES: ple micro services using Java a simple web application Maven and Gradle potstrap Application Context and Spring Boot Starter Dependencies a simple web application to access relational data using JdbcTemple at advanced search operations in a relational data from your web application. RESTFul API using SpringBoot and consume it in your web applications are curred web application using various security features in SpringBout and consume it in your microservices used to the provided application and RestFul Web Serives glyour web application using Docker and Containerization akliwal, "Hands-on Application Development using Spring Boot: Butch and Containerization and RestFul API, Microservices, CRUD Operations, Unit Testing, and "Mastering Spring Boot 2.0: Build modern, cloud-native, and distrib	to contate in Spelication bot sing Resulting Deplo	figure a web a SpringBoot on using Que esilience4J	- Ro	cation ethoc	r Exp	cations by

	COURSE OUTCOMES: On completion of the course, the students will be able to					
CO1	Apply the Spring Boot and all its capabilities.	Applying (K3)				
CO2	Demonstrate thecommon annotations of the Spring Data and Spring Data JPA	Applying (K3)				
CO3	Build RESTFul Microservices and Secured Web Application	Applying (K3)				
CO4	Implement Resilience4J and Swagger API and host the apps on Cloud.	Applying (K3)				
CO5	Learn to demonstrate Testing and Deploying a Spring Boot Application	Applying (K3)				

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	2	1											
CO3	3	2	1											
CO4	3	2	3	2	1									
CO5	3	2	3	2	1									

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	5	20	75				100
CAT2	10	20	70				100
CAT3	10	20	70				100
ESE	10	20	70				100

Branch	mme &	All Engineering and Technology Branches except IT	Sem.	Category	L	Т	Р	Credit
Prereq		Computer Networks	6	ES	3	1	0	4
Preamb	ole	This course provides an introduction to Internet of Things	and its tec	hnologies tha	at en	able	the st	udents to
		develop real world applications using it.						
Unit - I		Introduction to Internet of Things	Daniera af la	T InT Dunks		I ₂ T /	O =	9+3
Models	- IoT Comr	rnet of Things: Definition and Characteristics of IoT, Physical nunication APIs – IoT enabled Technologies – Wireless Senso Protocols- Embedded Systems – IoT Levels and Templates.						
Unit - II	l	Design Methodology and Endpoints						9+3
		between M2M &IoT - Software defined networks - Netw						
	SPI- 12C-	omain Specific IoT – Home Automation – Smart Agriculture. Er Programming –Interfacing with external gadgets – controllin						
Unit - II		IoT Protocols						9+3
		ologies: Physical and MAC layers, topology and Security						
		aWAN – Network Layer: IP versions, ConstrainedNodes and 0 ,Routing overLow Power and Lossy Networks – Applicat						
		Application Layer Protocols: CoAP and MQTT.			-		., .	
Unit - I		Data Analytics and Supporting Services						9+3
		tructured Data and Data in Motion Vs Data in Rest - Role of						
	tion Frame	the Kafka, Apache Spark – Edge Streaming Analyticsand Net work – Django –AWS for IoT – System Management with NET			ioua	TOT IC	51, P)	
		IoT Seurity and Case Studies	- Other sec	ırity features	and i	relate	ıd issi	
Attacks Middlev	and Count ware – Cros	IoT Seurity and Case Studies ermeasures – Authentication and Authorization at IoT Layers - s Layer security – Privacy and Risk Mitigations – Blockchain - t Management The Smart Grid Commercial Building Automati	- 5G – Fog a	and Edge Cor	and i	relate	ed issu oT	
Attacks Middlev USECA	and Count ware – Cros ASES: Asse	ermeasures – Authentication and Authorization at IoT Layers s Layer security – Privacy and Risk Mitigations – Blockchain -	- 5G – Fog a	and Edge Cor ties.	nputi	ing. Id	т	ies –
Attacks Middlev USECA	and Count ware – Cros ASES: Asse BOOK:	ermeasures – Authentication and Authorization at IoT Layers s Layer security – Privacy and Risk Mitigations – Blockchain - t Management The Smart Grid Commercial Building Automation of the Smart Grid Commercial Building Automation of Things – A Hands-on A	- 5G – Fog a	and Edge Corties. Lecture	mputi : 45 , ⁻	ing. Id	oT rial:15	ies – i, Total:60
Attacks Middlev USECA TEXT E	and Count ware – Cros ASES: Asse BOOK: Arshdeep (For Units David Har	ermeasures – Authentication and Authorization at IoT Layers s Layer security – Privacy and Risk Mitigations – Blockchain - t Management The Smart Grid Commercial Building Automation of	- 5G – Fog a on Smart Ci Approach", 1	Lecture st Edition, Un	:45, ivers	Tutor	oT rial:15	ies – 5, Total:60 2015.
Attacks Middlev USECA TEXT E 1.	and Count ware – Cros ASES: Asse BOOK: Arshdeep (For Units David Han Technolog	ermeasures – Authentication and Authorization at IoT Layers s Layer security – Privacy and Risk Mitigations – Blockchain - t Management The Smart Grid Commercial Building Automation of the Smart Grid Commercial Building Automation of Things – A Hands-on A I, II, V)	- 5G – Fog a on Smart Ci Approach", 1	Lecture st Edition, Un	:45, ivers	Tutor	oT rial:15	i, Total:60
Attacks Middlev USECA TEXT E 1. 2. REFER	and Count ware – Cros ASES: Asse BOOK: Arshdeep (For Units David Han Technolog	ermeasures – Authentication and Authorization at IoT Layers s Layer security – Privacy and Risk Mitigations – Blockchain - t Management The Smart Grid Commercial Building Automation of	- 5G – Fog a on Smart Ci Approach", 1 erome Henry ess, 2017. (Lecture st Edition, Un r, "IoT Fundar For Units III,	:45, - ivers menta	Tutority Pr	ess, 2	ies – 5, Total:6 0
TEXT E 1.	and Count ware – Cros ASES: Asse BOOK: Arshdeep (For Units David Har Technolog EENCES: Honbo Zha	ermeasures – Authentication and Authorization at IoT Layers s Layer security – Privacy and Risk Mitigations – Blockchain - t Management The Smart Grid Commercial Building Automation to Management The Smart Grid Commercial Building Automation Description of Things – A Hands-on A. I., II., V) es, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jesies, Protocols and Use Cases for Internet of Things", Cisco Procou, "The Internet of Things in the Cloud: A Middleware Perspectation, The Internet of Things in the Cloud: A Middleware Perspectation of Things and Pradeep Kumar, Mika Ylianttila, "Io"	Approach", 1 erome Henry ess, 2017. (Lecture st Edition, Un r, "IoT Fundar For Units III, dition, CRC P	:45, ivers menta	Tutor ity Pr als: N	ess, 2	ies – i, Total:6 0 2015. king
Attacks Middlev USECA TEXT E 1. 2. REFER 1.	and Count ware – Cros ASES: Asse BOOK: Arshdeep (For Units David Han Technolog ENCES: Honbo Zho Madhusar Publication	ermeasures – Authentication and Authorization at IoT Layers s Layer security – Privacy and Risk Mitigations – Blockchain - t Management The Smart Grid Commercial Building Automation to Management The Smart Grid Commercial Building Automation of Things and Vijay Madisetti, "Internet of Things – A Hands-on A I, II, V) es, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jegies, Protocols and Use Cases for Internet of Things", Cisco Propou, "The Internet of Things in the Cloud: A Middleware Perspending."	Approach", 1 erome Henry ess, 2017. (Lecture st Edition, Un r, "IoT Fundar For Units III, dition, CRC P	:45, ivers menta	Tutor ity Pr als: N	ess, 2	ies – i, Total:60 2015. king
Attacks Middlev USECA TEXT E 1. 2. REFER 1. 2. 3.	and Count ware – Cros ASES: Asse BOOK: Arshdeep (For Units David Han Technolog EENCES: Honbo Zho Madhusar Publication https://aws	ermeasures – Authentication and Authorization at IoT Layers s Layer security – Privacy and Risk Mitigations – Blockchain - t Management The Smart Grid Commercial Building Automation of All Management The Smart Grid Commercial Building Automation of All Management The Smart Grid Commercial Building Automation of All Management The Smart Grid Commercial Building Automation of All Management The Smart Grid Commercial Building Automation of All Management The Smart Grid Commercial Building Automation of All Management The Smart Grid Commercial Building Automation of All Management The Smart Grid Commercial Building Automation of All Management The Smart Grid Commercial Building Automation of All Management The Smart Grid Commercial Building Automation of All Management The Smart Grid Commercial Building Automation of All Management The Smart Grid Commercial Building Automation of All Management The Smart Grid Commercial Building Automation of All Management The Smart Grid Commercial Building Automation of All Management The Smart Grid Commercial Building Automation of All Management The Smart Grid Commercial Building Automatic of All Management The Smart Grid Commercial Building Automatic of All Management The Smart Grid Commercial Building Automatic of All Management The Smart Grid Commercial Building Automatic of All Management The Smart Grid Commercial Building Automatic of All Management The Smart Grid Commercial Building Automatic of All Management The Smart Grid Commercial Buildi	Approach", 1 erome Henry ess, 2017. (Lecture st Edition, Un r, "IoT Fundar For Units III, dition, CRC P	:45, ivers menta	Tutor ity Pr als: N	ess, 2 letwor 2 tion", '	ies – i, Total:60 2015. king Wiley
Attacks Middlev USECA TEXT E 1. 2. REFER 1. 2. COURS On con	and Count ware – Cros ASES: Asse BOOK: Arshdeep (For Units David Har Technolog ENCES: Honbo Zhar Madhusar Publication https://aws	ermeasures – Authentication and Authorization at IoT Layers s Layer security – Privacy and Risk Mitigations – Blockchain t Management The Smart Grid Commercial Building Automation of Automatical Building Automation of Automatical Building Automatical B	Approach", 1 erome Henry ess, 2017. (ctive", 1st E	Lecture st Edition, Un r, "IoT Fundar For Units III, dition, CRC P	:45, ivers menta	Tutor Tutor ity Pr als: N 201 ntica	ess, 2 letwor tion", '	ies – i, Total:60 2015. cking Wiley pped Level)
Attacks Middlev USECA TEXT E 1. 2. REFER 1. 2. COURS On con CO1	and Count ware – Cros ASES: Asse BOOK: Arshdeep (For Units David Han Technolog EENCES: Honbo Zho Madhusar Publication https://aws	ermeasures – Authentication and Authorization at IoT Layers s Layer security – Privacy and Risk Mitigations – Blockchain - t Management The Smart Grid Commercial Building Automation of Internet of Things – A Hands-on A I, II, V) es, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jegies, Protocols and Use Cases for Internet of Things", Cisco Proposition, "The Internet of Things in the Cloud: A Middleware Perspersiva Liyanage, An Braeken, Pradeep Kumar, Mika Ylianttila, "Ioms, 2020. (For Unit V) s.amazon.com/ MES: the course, the students will be able to of IoT architecture, infrastructure and constraints of Internet of	Approach", 1 Approach", 1 Approach", 1 Approach", 1 Approach Tome Henry Continue Tome	Lecture st Edition, Un r, "IoT Fundar For Units III, dition, CRC P	:45, ivers menta	Tutor Tutor ity Pr als: N 201 ntica Bi (Hid	ess, 2 letwor 2 tion", '	ies – io, Total:60 2015. cking Wiley pped Level) g (K3)
Attacks Middlev USECA TEXT E 1. 2. REFER 1. 2. 3.	and Count ware – Cros ASES: Asse BOOK: Arshdeep (For Units David Han Technolog EENCES: Honbo Zho Madhusar Publication https://aws	ermeasures – Authentication and Authorization at IoT Layers s Layer security – Privacy and Risk Mitigations – Blockchain t Management The Smart Grid Commercial Building Automation to Management The Smart Grid Commercial Building Automation I, II, V) es, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jegies, Protocols and Use Cases for Internet of Things", Cisco Proposition, "The Internet of Things in the Cloud: A Middleware Perspersion, and Evaluation of Internet of Management Will Beable to Managemen	Approach", 1 Approach", 1 Approach", 1 Approach", 1 Approach Tome Henry Continue Tome	Lecture st Edition, Un r, "IoT Fundar For Units III, dition, CRC P	:45, ivers menta	Tutor Tutor ity Pr als: N 201 ntica Bi (Hid	ess, 2 letwor 2 tion", '	ies – in Total:60 2015. Eking Wiley Pped Level)
Attacks Middlev USECA TEXT E 1. 2. REFER 1. 2. COURS On con CO1 CO2	and Count ware – Cros ASES: Asse BOOK: Arshdeep (For Units David Han Technolog ENCES: Honbo Zh Madhusan Publication https://aws	ermeasures – Authentication and Authorization at IoT Layers s Layer security – Privacy and Risk Mitigations – Blockchain t Management The Smart Grid Commercial Building Automation to Management The Smart Grid Commercial Building Automation I, II, V) es, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jegies, Protocols and Use Cases for Internet of Things", Cisco Proposition, "The Internet of Things in the Cloud: A Middleware Perspersion, and Evaluation of Internet of Management Will Beable to Managemen	Approach", 1 Approach", 1 Approach", 1 Approach", 1 Approach Tome Henry Continue Tome	Lecture st Edition, Un r, "IoT Fundar For Units III, dition, CRC P	:45, ivers menta	Tutor Tutor ity Pr als: N 201 ntica High	ess, 2 letwor 2 tion", ' T Maghest pplying	ies – i, Total:6i 2015. king Wiley pped Level) g (K3)
Attacks Middlev USECA TEXT E 1. 2. REFER 1. 2. COURS On con CO1	and Count ware – Cros ASES: Asse BOOK: Arshdeep (For Units David Han Technolog EENCES: Honbo Zho Madhusar Publication https://aws BE OUTCO mpletion of make use utilize the using Ras apply the	ermeasures – Authentication and Authorization at IoT Layers s Layer security – Privacy and Risk Mitigations – Blockchain t Management The Smart Grid Commercial Building Automation of It. II, V) Bahga and Vijay Madisetti, "Internet of Things – A Hands-on A II, II, V) Bahga and Vijay Madisetti, "Internet of Things – A Hands-on A II, II, V) Bes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jegies, Protocols and Use Cases for Internet of Things", Cisco Proposition, "The Internet of Things in the Cloud: A Middleware Perspensive Liyanage, An Braeken, Pradeep Kumar, Mika Ylianttila, "Ioms, 2020. (For Unit V) Bes, 2020. (For Unit V) Bes: The course, the students will be able to Of IoT architecture, infrastructure and constraints of Internet of the design methodologies for IoT applications and experiment with poberry Pi	Approach", 1 Approach	Lecture st Edition, Un r, "IoT Fundar For Units III, dition, CRC P	:45, ivers menta	Tutor ity Pr als: N 201 ntica Hi Ar	ess, 2 letwor 2 tion", ' T Maghest pplying pplying pplying	ies – i, Total:6 io, Total:6 ion Total:6 i

					Mappin	g of CO	s with	POs an	d PSOs	5				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	20	50	30				100
CAT3	30	40	30				100
ESE	25	45	30				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

		(Common to All Engineering and Technology Branches)					
Progra Branc	amme &	All Engineering and Technology Branches except IT Sem. Category	gory	L	Т	Р	Credit
Prere	quisites	NIL 6 OF	E :	3	1	0	4
Pream	nble	This course provides knowledge on basic concepts of software construction, coding in software development	ı, Quality	of	cod	e and	l Effective
Unit -	I	Foundation on Software Construction					9+3
Proble	em-Definition,	ion – Metaphors – Upstream Prerequisites: Importance of Prerequisites-Dete Requirement, Architecture Prerequisites-Amount of time to spend on Upstream P of Programming Language - Programming Conventions - Selection of Major Cons	Prerequis	sites	s – K	ey Co	Software onstruction
Unit -	II	Creating High–Quality Code					9+3
Found Progra	lation – Interf amming: Asse	ction: Design Challenges and Concepts - Design Building Blocks and Practic faces - Design and Implementation Issues - Reason for Class Creation - Hig artion - Error-Handling Techniques - Exceptions.					
Unit -	Ш	Variables					9+3
Organ	izing Straight	sing Variables -The Power of Variable Names - Fundamental Data Types - Unu -Line Code - Using Conditionals - Controlling Loops - Unusual Control Structus - Compound and null Statements.					
Unit -	IV	Code Improvements					0.2
Quality Strates Unit -	y Assurance gies and Tech V	ty Landscape: Characteristics - Techniques for improvement - Relative Effective - Collaborative Construction - Developer Testing - Debugging - Introduction niques. System Considerations					
Quality Strate Unit - Progra	y Assurance gies and Tech V am size Vs Co	ty Landscape: Characteristics - Techniques for improvement - Relative Effective - Collaborative Construction - Developer Testing - Debugging - Introduction niniques. System Considerations onstruction - Managing Construction - Integration - Programming Tools.		acto	oring	- Co	chniques ode tunir 9+3
Quality Strates Unit - Progra	y Assurance gies and Tech V am size Vs Co	ty Landscape: Characteristics - Techniques for improvement - Relative Effective - Collaborative Construction - Developer Testing - Debugging - Introduction niques. System Considerations onstruction - Managing Construction - Integration - Programming Tools. Lea	n to Refa	5, T	oring - utor	- Co	chniques ode tunir 9+3 i, Total:6
Quality Strate Unit - Progra	y Assurance gies and Tech V am size Vs Co BOOK:	ty Landscape: Characteristics - Techniques for improvement - Relative Effective - Collaborative Construction - Developer Testing - Debugging - Introduction niniques. System Considerations onstruction - Managing Construction - Integration - Programming Tools.	n to Refa	5, T	oring - utor	- Co	chniques ode tunir 9+3 i, Total:6
Quality Strates Unit - Progra TEXT 1.	y Assurance gies and Tech V am size Vs Co BOOK: Steve McCo RENCES:	ty Landscape: Characteristics - Techniques for improvement - Relative Effective - Collaborative Construction - Developer Testing - Debugging - Introduction naiques. System Considerations System Considerations Onstruction - Managing Construction - Integration - Programming Tools. Lead	ecture:45	octo	oring - utor	- Co	chniques ode tunir 9+3 i, Total:6
Quality Strates Unit - Progra TEXT 1. REFE	y Assurance gies and Tech V am size Vs Co BOOK: Steve McCo RENCES: Ali Bahrami	ty Landscape: Characteristics - Techniques for improvement - Relative Effective - Collaborative Construction - Developer Testing - Debugging - Introduction iniques. System Considerations System Considerations Onstruction - Managing Construction - Integration - Programming Tools. Lead on the Consideration	ecture:45	octo	oring - utor	- Co	9+3 Total:6
Quality Strate Unit - Progra TEXT 1.	y Assurance gies and Tech V am size Vs Co BOOK: Steve McCo RENCES: Ali Bahrami Infosys spri	ty Landscape: Characteristics - Techniques for improvement - Relative Effective - Collaborative Construction - Developer Testing - Debugging - Introduction naiques. System Considerations System Considerations Onstruction - Managing Construction - Integration - Programming Tools. Lead	ecture:45	octo	oring - utor	- Co	chniques ode tunir 9+3 i, Total:6
Quality Strate Unit - Progra TEXT 1. REFE 1.	y Assurance gies and Tech V am size Vs Co BOOK: Steve McCo RENCES: Ali Bahrami Infosys spri https://infys	ty Landscape: Characteristics - Techniques for improvement - Relative Effective - Collaborative Construction - Developer Testing - Debugging - Introduction niques. System Considerations Onstruction - Managing Construction - Integration - Programming Tools. Lector onnell, "Code Complete - A practical handbook of software construction", 2 nd edition, "Object Oriented Systems Development", 1 st Edition, Tata McGraw-Hill, New Design board contents provided by Infosys at pringboard.onwingspan.com/web/en/page/home	ecture:45	octo	oring □utor oft pi	ial:15	9+3 Total:6
Quality Strates Unit - Progra TEXT 1. REFE 1. 2. COUR On co	y Assurance gies and Tech V am size Vs Co BOOK: Steve McCo RENCES: Ali Bahrami Infosys spri https://infys	ty Landscape: Characteristics - Techniques for improvement - Relative Effective - Collaborative Construction - Developer Testing - Debugging - Introduction iniques. System Considerations	ecture:45	5, T	oft pr	ial:15	9+3 5, Total:6 2006.
Quality Strate Strate Unit - Progra TEXT 1. REFE 1. COUR On co CO1	y Assurance gies and Tech V am size Vs Co BOOK: Steve McCo RENCES: Ali Bahrami Infosys spri https://infysi RSE OUTCOM plan for soft develop the software de	ty Landscape: Characteristics - Techniques for improvement - Relative Effective - Collaborative Construction - Developer Testing - Debugging - Introduction Introduction - Integration - Debugging - Introduction - Integration - Programming Tools. System Considerations Integration - Programming Tools. Let Connell, "Code Complete - A practical handbook of software construction", 2 nd edition, "Object Oriented Systems Development", 1 st Edition, Tata McGraw-Hill, New Debugg board contents provided by Infosys at pringboard.onwingspan.com/web/en/page/home IES: The course, the students will be able to tware construction prerequisites and key construction decisions a ability to create high-quality code that adheres to best practices and standards in evelopment	ecture:45	5, Tros	Tutor oft pi Hiç (Hiç pplyir	ial:15 ress, T Maaghest ng (K:	9+3 5, Total:6 2006.
Quality Strate Strate Jnit - Progra TEXT 1. REFE 1. COUR On co CO1	y Assurance gies and Tech V am size Vs Co BOOK: Steve McCo RENCES: Ali Bahrami Infosys spri https://infys	Ty Landscape: Characteristics - Techniques for improvement - Relative Effective - Collaborative Construction - Developer Testing - Debugging - Introduction iniques. System Considerations Construction - Managing Construction - Integration - Programming Tools. Lead onnell, "Code Complete - A practical handbook of software construction", 2nd edition, "Object Oriented Systems Development", 1st Edition, Tata McGraw-Hill, New Desire Board contents provided by Infosys at pringboard.onwingspan.com/web/en/page/home IES: The course, the students will be able to the tware construction prerequisites and key construction decisions The ability to create high-quality code that adheres to best practices and standards in evelopment comprehensive understanding of variables, data types, statements, and control to write efficient, organized, and error-free code for solving complex problems	ecture:45	Ap	Tutor Oft pi Bi (High pplyir pplyir	T Ma Thest T	pped Level) 3)
Quality Strates Unit - Progra TEXT 1. REFE 1. 2.	y Assurance gies and Tech V am size Vs Co BOOK: Steve McCo RENCES: Ali Bahrami Infosys spri https://infys	ty Landscape: Characteristics - Techniques for improvement - Relative Effective - Collaborative Construction - Developer Testing - Debugging - Introduction iniques. System Considerations Instruction - Managing Construction - Integration - Programming Tools. Lead onnell, "Code Complete - A practical handbook of software construction", 2nd edition of edition o	tion, Micropelli, 200	Ap Ap	B (High	ial:15 ress, T Maaghest ng (K:	pped Level) 3)

					Mappin	g of CO	s with	POs an	d PSOs	5				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	40	50				100
CAT2	10	40	50				100
CAT3	10	40	50				100
ESE	10	40	50				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Programme& Branch All Engineering and Technology Branches except IT Prerequisites Java Programming 6 OE 7 Introduction to Android Introduction – Android Architecture – Environmental setup – Develop simple Hello World application – App Folder struct virtual device - Application Components – Toast message - Activity – Activity Life cycle – Log messages. Unit – I Layout and UI Intenduction to Android Introduction – Square and Services – Struct View, Progress Bar, Rating Bar – Event Listeners and Handlers. Unit – III Resources and Alerts Resources overview – Styles and Themes - Menu: Option menu, Context menu – Notification – Broadcast receivers – Phone call. Unit – IV Storage Introduction to Storages - Bundle - SQL Lite: CRUD operations - Content providers – Shared preferences - JSON pars Unit – V Services – Sending SMS – Sensors: Motion and Position - Accessing geo location – Basic Animations: rotate, fade, zoo move. Lecture: 45, Tutoria	9+3 ure - Andro 9+3 roup, Chec 9+3 Web View
Preamble This course provides knowledge on developing mobile applications using Android. Unit - I Introduction to Android Introduction - Android Architecture - Environmental setup - Develop simple Hello World application - App Folder struct virtual device - Application Components - Toast message - Activity - Activity Life cycle - Log messages. Unit - II Layout and UI Intent -types - Intent filters - Views - Layouts - UI components: Text View, Edit Text, Button, Toggle Button, Radio George Box, AutoComplete Text View, Progress Bar, Rating Bar - Event Listeners and Handlers. Unit - III Resources and Alerts Resources overview - Styles and Themes - Menu: Option menu, Context menu - Notification - Broadcast receivers - Phone call. Unit - IV Storage Introduction to Storages - Bundle - SQL Lite: CRUD operations - Content providers - Shared preferences - JSON pars Unit - V Services and Sensors Services - Sending SMS - Sensors: Motion and Position - Accessing geo location - Basic Animations: rotate, fade, zoo move.	9+3 ure - Andro 9+3 roup, Chee 9+3 Web View
Introduction to Android Introduction – Android Architecture – Environmental setup – Develop simple Hello World application – App Folder struct virtual device - Application Components – Toast message - Activity – Activity Life cycle – Log messages. Unit – II Layout and UI Intent – types - Intent filters - Views – Layouts - UI components: Text View, Edit Text, Button, Toggle Button, Radio George Box, AutoComplete Text View, Progress Bar, Rating Bar – Event Listeners and Handlers. Unit – III Resources and Alerts Resources overview – Styles and Themes - Menu: Option menu, Context menu – Notification – Broadcast receivers – Phone call. Unit – IV Storage Introduction to Storages - Bundle - SQL Lite: CRUD operations - Content providers – Shared preferences - JSON pars Unit – V Services and Sensors Services – Sending SMS – Sensors: Motion and Position - Accessing geo location – Basic Animations: rotate, fade, zoo move.	9+3 roup, Che 9+3 Web Viev
Introduction to Android Introduction – Android Architecture – Environmental setup – Develop simple Hello World application – App Folder struct virtual device - Application Components – Toast message - Activity – Activity Life cycle – Log messages. Unit – II Layout and UI Intent – types - Intent filters - Views – Layouts - UI components: Text View, Edit Text, Button, Toggle Button, Radio George Box, AutoComplete Text View, Progress Bar, Rating Bar – Event Listeners and Handlers. Unit – III Resources and Alerts Resources overview – Styles and Themes - Menu: Option menu, Context menu – Notification – Broadcast receivers – Phone call. Unit – IV Storage Introduction to Storages - Bundle - SQL Lite: CRUD operations - Content providers – Shared preferences - JSON pars Unit – V Services and Sensors Services – Sending SMS – Sensors: Motion and Position - Accessing geo location – Basic Animations: rotate, fade, zoo move.	9+3 roup, Che 9+3 Web Viev
Virtual device - Application Components -Toast message - Activity - Activity Life cycle - Log messages. Unit - II Intent -types - Intent filters - Views - Layouts - UI components: Text View, Edit Text, Button, Toggle Button, Radio Gebox, AutoComplete Text View, Progress Bar, Rating Bar - Event Listeners and Handlers. Unit - III Resources and Alerts Resources overview - Styles and Themes - Menu: Option menu, Context menu - Notification - Broadcast receivers - Phone call. Unit - IV Storage Introduction to Storages - Bundle - SQL Lite: CRUD operations - Content providers - Shared preferences - JSON pars Unit - V Services and Sensors Services -Sending SMS - Sensors: Motion and Position - Accessing geo location - Basic Animations: rotate, fade, zoo move.	9+3 roup, Chee 9+3 Web View 9+3
Unit – II Intent –types - Intent filters - Views – Layouts - UI components: Text View, Edit Text, Button, Toggle Button, Radio General Box, AutoComplete Text View, Progress Bar, Rating Bar – Event Listeners and Handlers. Unit – III Resources and Alerts Resources overview – Styles and Themes - Menu: Option menu, Context menu – Notification – Broadcast receivers – Phone call. Unit – IV Storage Introduction to Storages - Bundle - SQL Lite: CRUD operations - Content providers – Shared preferences - JSON pars Unit – V Services and Sensors Services –Sending SMS – Sensors: Motion and Position - Accessing geo location – Basic Animations: rotate, fade, zoo move.	roup, Cher
Box, AutoComplete Text View, Progress Bar, Rating Bar – Event Listeners and Handlers. Unit – III Resources and Alerts Resources overview – Styles and Themes - Menu: Option menu, Context menu – Notification – Broadcast receivers – Phone call. Unit – IV Storage Introduction to Storages - Bundle - SQL Lite: CRUD operations - Content providers – Shared preferences - JSON pars Unit – V Services and Sensors Services – Sending SMS – Sensors: Motion and Position - Accessing geo location – Basic Animations: rotate, fade, zoo move.	9+3 Web Viev
Resources and Alerts Resources overview – Styles and Themes - Menu: Option menu, Context menu – Notification – Broadcast receivers – Phone call. Unit – IV Storage Introduction to Storages - Bundle - SQL Lite: CRUD operations - Content providers – Shared preferences - JSON pars Unit – V Services and Sensors Services –Sending SMS – Sensors: Motion and Position - Accessing geo location – Basic Animations: rotate, fade, zoo move.	Web View
Resources overview – Styles and Themes - Menu: Option menu, Context menu – Notification – Broadcast receivers – Phone call. Unit – IV Storage Introduction to Storages - Bundle - SQL Lite: CRUD operations - Content providers – Shared preferences - JSON pars Unit – V Services and Sensors Services –Sending SMS – Sensors: Motion and Position - Accessing geo location – Basic Animations: rotate, fade, zoo move.	Web View
Phone call. Unit – IV Storage Introduction to Storages - Bundle - SQL Lite: CRUD operations - Content providers – Shared preferences - JSON pars Unit – V Services and Sensors Services –Sending SMS – Sensors: Motion and Position - Accessing geo location – Basic Animations: rotate, fade, zoo move.	9+3
Unit – IV Storage Introduction to Storages - Bundle - SQL Lite: CRUD operations - Content providers – Shared preferences - JSON pars Unit – V Services and Sensors Services –Sending SMS – Sensors: Motion and Position - Accessing geo location – Basic Animations: rotate, fade, zoo move.	
Introduction to Storages - Bundle - SQL Lite: CRUD operations - Content providers - Shared preferences - JSON pars Unit - V Services and Sensors Services - Sending SMS - Sensors: Motion and Position - Accessing geo location - Basic Animations: rotate, fade, zoo move.	
Services –Sending SMS – Sensors: Motion and Position - Accessing geo location – Basic Animations: rotate, fade, zoo move.	ng
move.	9+3
I. https://developer.android.com	
REFERENCES:	
John Horton, "Android Programming for Beginners", 3 rd Edition, Packt Publishing, 2021.	
2. Bill Phillips, Chris Stewart and Kristin Marsicano, "Android Programming", 3 rd Edition, BigNerd Ranch Guides,	2017.
	Mapped est Level)
CO1 Illustrate the steps to create android application and discuss its activity life cycle Appl	ing (K3)
CO2 develop an Android application using Layouts, UI components with event handling Apply	/ing (K3)
	9 (110)
CO3 design styles, themes and menu Appl	ring (K3)

					Mappin	g of CO	s with	POs an	d PSOs	5				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

ASSE	SSMENT	PATTFRN	- THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	30	40				100
CAT2	20	40	40				100
CAT2	20	40	40				100
ESE	25	35	40				100

 $^{^*}$ ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

		(Common to All Engineering and Technology Bra	ranches)				
Programm Branch	me &	All Engineering and Technology Branches except IT	Sem.	Category	L	Т	Р	Cred
Prerequis	sites	Nil	7	OE	3	0	0	3
	•				1		•	
Preamble		This course provides a basic introduction to cloud computing an analyzing a few case studies to appreciate the emergence of the paradigm.						
Unit – I		Introduction						9
		Computing – Roots of Cloud Computing – Desired Features of	f Cloud	Computing -	- Cha	allenç	ges ar	nd Risks
	nd Disadva	antages of Cloud Computing.						
Unit – II	\ \(\tau \) \(\tau \	Virtualization		\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	01			9
		on – Types of Virtualization – Implementation Levels of Virtualiz Alization of CPU – Memory – I/O Devices – Virtualization Support				uctur	res –	1 oois ar
Unit – III		Cloud Architecture, Services And Storage						9
		ing Reference Architecture – Public, Private and Hybrid Clouds -	- laaS -	- PaaS – Saa	aS –	Arch	itectu	ral Desi
Challenges	s – Cloud							
Unit – IV	I Danauman	Resource Management and Security In Cloud		Claud Ca	i.	. Ch	. 11	9
		e Management – Resource Provisioning Methods – Security Ov n Security – Virtual Machine Security.	verview	- Cloud Sec	curity	/ Cha	alleng	es – Da
Unit – V		Case Studies						9
	on Engine	/a.a. a.a	\ \ / -					
0 10 6		(GAE) – GAE Architecture – Functional Modules of GAE – Amaz	zon we	b Services (A	WS)	– M	icrosc	oft Azure
	tware Envi	(GAE) – GAE Architecture – Functional Modules of GAE – Amaz ronments – Eucalyptus – Open Nebula – Open Stack.	zon vve	b Services (A	WS)	– M	icroso	oft Azure
TEXT BOO	OK: uyya R., Bi for Unit I) ai Hwang,	ronments – Eucalyptus – Open Nebula – Open Stack. roberg J., Goscinski A., "Cloud Computing: Principles and Paradio Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Comp	igm", 1 ^s puting, F	Edition, Johr	n Wil	ey &	Sons	Total:
1. Bu (Fi	OK: uyya R., Br for Unit I) ai Hwang, ternet of T	ronments – Eucalyptus – Open Nebula – Open Stack. roberg J., Goscinski A., "Cloud Computing: Principles and Paradi	igm", 1 ^s puting, F	Edition, Johr	n Wil	ey &	Sons	Total:
1. Bu (Fo	OK: uyya R., Broor Unit I) ai Hwang, ternet of Toles: ittinghouse	roberg J., Goscinski A., "Cloud Computing: Principles and Paradig Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Comp hings", Morgan Kaufmann Publishers, 2017. (For Units II,III,IV,V)	igm", 1 ^s puting, f	Edition, Johr	n Wil	ey &	Sons	Total: , 2011.
1. Bu (Fi	OK: uyya R., Bror Unit I) ai Hwang, ternet of The Tolers: ittinghouse ress, 2017.	roberg J., Goscinski A., "Cloud Computing: Principles and Paradig Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Comp hings", Morgan Kaufmann Publishers, 2017. (For Units II,III,IV,V)	igm", 1 ^s puting, F) entation,	Edition, John From Parallel Managemen	n Wil	ey & cessir	Sons	Total: , 2011.
1. Bu (Fr) 2. Ka Int REFEREN 1. Rit Pr 2. Ra	OK: uyya R., Bu for Unit I) ai Hwang, ternet of T ICES: ittinghouse ress, 2017 ajkumar Bu	roberg J., Goscinski A., "Cloud Computing: Principles and Paradig Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Comp hings", Morgan Kaufmann Publishers, 2017. (For Units II,III,IV,V)	igm", 1s puting, F) entation, omputin	Edition, John From Parallel Managemen g", Tata McG	Procent and	ey & cessin	Sons ng to to urity",	Total: , 2011. the
1. Bu (Fr) 2. Ka Int REFEREN 1. Rit Pr 2. Ra 3. To	OK: uyya R., Bu for Unit I) ai Hwang, ternet of T ICES: ittinghouse ress, 2017 ajkumar Bu oby Velte,	ronments – Eucalyptus – Open Nebula – Open Stack. roberg J., Goscinski A., "Cloud Computing: Principles and Paradig Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Comp hings", Morgan Kaufmann Publishers, 2017. (For Units II,III,IV,V) e, John W., and James F. Ransome, "Cloud Computing: Implement Luyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Co Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practica	igm", 1s puting, F) entation, omputin	Edition, John From Parallel Managemen g", Tata McG	Procent and	ey & cessir	Sons ng to 1 urity", 2013	Total: , 2011. the CRC
1. Bu (Fr) 2. Ka Int REFEREN 1. Rii Pr 2. Ra 3. To	OK: uyya R., Bu for Unit I) ai Hwang, ternet of T ICES: ittinghouse ress, 2017 ajkumar Bu oby Velte, A	ronments – Eucalyptus – Open Nebula – Open Stack. roberg J., Goscinski A., "Cloud Computing: Principles and Paradig Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Comp hings", Morgan Kaufmann Publishers, 2017. (For Units II,III,IV,V) e, John W., and James F. Ransome, "Cloud Computing: Implement Luyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Co Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practica	igm", 1s puting, F) entation, omputin	Edition, John From Parallel Managemen g", Tata McG	Procent and	ey & cessir	Sons ng to f urity", 2013 II, 200	Total: , 2011. the CRC
1. Bu (Fi Fi Fi Fi Fi Fi Fi Fi	OK: uyya R., Bu for Unit I) ai Hwang, ternet of T ICES: ittinghouse ress, 2017 ajkumar Bu bby Velte, A OUTCOMI letion of th	ronments – Eucalyptus – Open Nebula – Open Stack. roberg J., Goscinski A., "Cloud Computing: Principles and Paradig Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Comp hings", Morgan Kaufmann Publishers, 2017. (For Units II,III,IV,V) e, John W., and James F. Ransome, "Cloud Computing: Implement uyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Co Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practica	igm", 1sputing, F) Intation, Intation, Intation	Edition, Johr From Parallel Managemen g", Tata McG ach", Tata M	Procent and	ey & cessir	Sons urity", 2013 II, 200 BT Ma ghest	Total: , 2011. the CRC
1. Bu (Fe Fe Fe Fe Fe Fe Fe Fe	OK: uyya R., Bi for Unit I) ai Hwang, ternet of T ICES: ittinghouse ress, 2017 ajkumar Bu bby Velte, A OUTCOMI letion of the ummarize to	roberg J., Goscinski A., "Cloud Computing: Principles and Paradig Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Comphings", Morgan Kaufmann Publishers, 2017. (For Units II,III,IV,V) e, John W., and James F. Ransome, "Cloud Computing: Implementary, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing Velte, Robert Elsenpeter, "Cloud Computing - A Practical Es: ne course, the students will be able to he main concepts, key technologies, strengths, and limitations of suitable scenarios for moving to the cloud platform. role of virtualization as the key enabling technology that helped in	igm", 1s puting, I) entation, omputin al Appro	Edition, John From Parallel Managemen g", Tata McG pach", Tata M	Procent and	ey & cessir	Sons ng to to urity", 2013 II, 200 BT Maghest oplyin	Total: , 2011. the CRC
TEXT BOC 1. Bu (Fe Fe Fe Fe Fe Fe Fe Fe	OK: uyya R., Bror Unit I) ai Hwang, ternet of Toles: ittinghouse ress, 2017, ajkumar Bubby Velte, abby Velte, and identify terpret the the cloud evelop the	roberg J., Goscinski A., "Cloud Computing: Principles and Paradig Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Comphings", Morgan Kaufmann Publishers, 2017. (For Units II,III,IV,V) e, John W., and James F. Ransome, "Cloud Computing: Implementary, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing Velte, Robert Elsenpeter, "Cloud Computing - A Practical Es: ne course, the students will be able to he main concepts, key technologies, strengths, and limitations of suitable scenarios for moving to the cloud platform. role of virtualization as the key enabling technology that helped in	igm", 1s puting, f) intation, omputin al Appro	Edition, John From Parallel Managemen g", Tata McG Pach", Tata McG Pomputing	Procent and	ey & cessir	Sons urity", 2013 II, 200 BT Ma ghest oplyin oplyin	Total: , 2011. the CRC
TEXT BOO 1. Bu (Fo	OK: uyya R., Bı for Unit I) ai Hwang, ternet of T ICES: ittinghouse ress, 2017. ajkumar Bu bby Velte, A OUTCOMI letion of the ummarize t nd identify terpret the ithe cloud evelop the ervices and	roberg J., Goscinski A., "Cloud Computing: Principles and Paradig Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Comphings", Morgan Kaufmann Publishers, 2017. (For Units II,III,IV,V) a, John W., and James F. Ransome, "Cloud Computing: Implementary, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing Velte, Robert Elsenpeter, "Cloud Computing - A Practica ES: ne course, the students will be able to the main concepts, key technologies, strengths, and limitations of suitable scenarios for moving to the cloud platform. role of virtualization as the key enabling technology that helped in platform ability to understand and use the architecture of compute cloud ar	igm", 1s puting, f) intation, omputin al Appro	Edition, John From Parallel Managemen g", Tata McG Pach", Tata McG Pach", Tata McG Pomputing	Procent and	ey & cessir	Sons ng to to urity", 2013 II, 200 BT Ma ghest oplyin oplyin	Total: , 2011. the CRC pped t Level) g (K3)

					Mappin	g of CO	s with	POs an	d PSOs	3				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	60	20				100
CAT3	20	60	20				100
ESE	30	40	30				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Programme & Branch	All Engineering and Technology Branches except IT	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	7	OE	3	0	0	3
Preamble	This course provides basic knowledge about different kinds countermeasures.	of hacking	methods and	their	•		
Unit- I	Introduction to Hacking						9
 Overview of TCF 	verview - Role of Security and Penetration Testers Penetration VIP-The Application Layer - The Transport Layer - The Internet Layer Imputer Attacks - Malware - Protecting Against Malware Attack	ayer - IP Ac	ldressing - Nu	ımbe	ring S	Syster	ns.
Unit- II	Foot printing & Scanning						9
	ng? - Internet Foot printing- Scanning – Determining if the system ng – Detecting the operating system – Processing and storing so		Determining	whicl	n ser	vices	are
Unit- III	Enumeration						9
	sic banner grabbing- Enumerating Common Network services and attacks – authenticated attacks – windows security features.	nd its coun	termeasures.	Hacl	king \	Windo)WS
Unit- IV	Hardware & Wireless Hacking						ç
DoS Attack Techr	ware. VPN Hacking. Wireless Equipment – Discovery and monit- niques – DoS- Countermeasures - Encryption attacks –Authentic			Allac	KS –	Comi	
	Application hacking & Countermeasures se Hacking – Web Server Hacking - Web application Hacking -	Common v	veb application	n Vu	Inera	abilitie	
	Application hacking & Countermeasures se Hacking – Web Server Hacking - Web application Hacking - g. Mobile Hacking – Hacking android – iOS.	Common v	veb applicatio	n Vu	Inera	abilitie	s –
Web and Databas	se Hacking - Web Server Hacking - Web application Hacking -	Common v	veb applicatio	n Vu	Inera	abilitie	s –
Web and Database Database Hacking	se Hacking – Web Server Hacking - Web application Hacking - g. Mobile Hacking – Hacking android – iOS.						s – Total:4
Web and Databas Database Hacking TEXT BOOK: Stuart Mo	se Hacking - Web Server Hacking - Web application Hacking -						s – Total:4
Web and Database Database Hacking FEXT BOOK: Stuart Mo Tata Mc Michael	se Hacking – Web Server Hacking - Web application Hacking - g. Mobile Hacking – Hacking android – iOS. CClure, Joel Scambray, Goerge Kurtz, "Hacking Exposed 7: Net	work Secur	ity Secrets ar	nd Sc	olutio	ns", 7¹	Total:45
Web and Database Database Hacking TEXT BOOK: 1. Stuart Mo Tata Mo Tata Mo Michael Technolo	se Hacking – Web Server Hacking - Web application Hacking - g. Mobile Hacking – Hacking android – iOS. cClure, Joel Scambray, Goerge Kurtz, "Hacking Exposed 7: Nets Graw Hill Publishers, 2012. T. Simpson, Kent Backman, and James E. Corley, "Hands-on Et	work Secur	ity Secrets ar	nd Sc	olutio	ns", 7¹	Total:45
Web and Database Database Hacking FEXT BOOK: 1. Stuart Mo Tata Mod Michael Technolog REFERENCES:	se Hacking – Web Server Hacking - Web application Hacking - g. Mobile Hacking – Hacking android – iOS. cClure, Joel Scambray, Goerge Kurtz, "Hacking Exposed 7: Nets Graw Hill Publishers, 2012. T. Simpson, Kent Backman, and James E. Corley, "Hands-on Et	work Secur	ity Secrets ar	nd Sc ork D	olutio	ns", 7¹	Total:45
Web and Database Database Hacking TEXT BOOK: 1. Stuart Mo Tata Mo: 2. Michael Technolo REFERENCES: 1. Patrick Ei 2. Rafay Ba	se Hacking – Web Server Hacking - Web application Hacking - g. Mobile Hacking – Hacking android – iOS. cClure, Joel Scambray, Goerge Kurtz, "Hacking Exposed 7: Nets Graw Hill Publishers, 2012. T. Simpson, Kent Backman, and James E. Corley, "Hands-on Et gy", Delmar Cengage Learning, 2010 ngebretson, "The Basics of Hacking and Penetration Testing", Siloch, "Ethical Hacking and Penetration Testing Guide", CRC Presented Services (CRC Presented Services)	work Secur hical Hacki	ity Secrets ar	nd Sc ork D	olutio	ns", 7¹	Total:45
Web and Database Database Hacking TEXT BOOK: 1. Stuart Mo Tata Mo: 2. Michael Technolo REFERENCES: 1. Patrick Ei 2. Rafay Ba	se Hacking – Web Server Hacking - Web application Hacking - g. Mobile Hacking – Hacking android – iOS. cclure, Joel Scambray, Goerge Kurtz, "Hacking Exposed 7: Nets Graw Hill Publishers, 2012. T. Simpson, Kent Backman, and James E. Corley, "Hands-on Et gy", Delmar Cengage Learning, 2010 ngebretson, "The Basics of Hacking and Penetration Testing", S	work Secur hical Hacki	ity Secrets ar	nd Sc ork D	olutio	ns", 7¹	Total:45
Web and Database Database Hacking TEXT BOOK: 1. Stuart More Tata More Michael Technology REFERENCES: 1. Patrick Eigen Rafay Bata Kevin Beata Scourse Outco	See Hacking – Web Server Hacking - Web application Hacking - g. Mobile Hacking – Hacking android – iOS. CClure, Joel Scambray, Goerge Kurtz, "Hacking Exposed 7: Nets Graw Hill Publishers, 2012. T. Simpson, Kent Backman, and James E. Corley, "Hands-on Etgy", Delmar Cengage Learning, 2010 Ingebretson, "The Basics of Hacking and Penetration Testing", Stoch, "Ethical Hacking and Penetration Testing Guide", CRC Preaver, "Ethical Hacking for Dummies", 6th Edition, Wiley, 2018.	work Secur hical Hacki	ity Secrets ar	nd Sc ork D	efens	ns", 7° se, Co	Total:4
Web and Database Database Hacking FEXT BOOK: Stuart More Tata More Michael Technolog REFERENCES: Rafay Ba Kevin Bea COURSE OUTCO On completion of	se Hacking – Web Server Hacking - Web application Hacking - g. Mobile Hacking – Hacking android – iOS. CClure, Joel Scambray, Goerge Kurtz, "Hacking Exposed 7: Nets Graw Hill Publishers, 2012. T. Simpson, Kent Backman, and James E. Corley, "Hands-on Etgy", Delmar Cengage Learning, 2010 Ingebretson, "The Basics of Hacking and Penetration Testing", Stoch, "Ethical Hacking and Penetration Testing Guide", CRC Preaver, "Ethical Hacking for Dummies", 6th Edition, Wiley, 2018.	work Secur hical Hacki	ity Secrets ar	nd Sc ork D	efen:	ns", 7° se, Co st Ma ghest	Total:4: Total:4: Edition, Durse pped Level)
Web and Database Database Hacking FEXT BOOK: Stuart More Tata More Michael Technology REFERENCES: Patrick Ed. Rafay Ba Kevin Beau Scourse Outcompletion of	See Hacking – Web Server Hacking - Web application Hacking - g. Mobile Hacking – Hacking android – iOS. CClure, Joel Scambray, Goerge Kurtz, "Hacking Exposed 7: Nets Graw Hill Publishers, 2012. T. Simpson, Kent Backman, and James E. Corley, "Hands-on Etgy", Delmar Cengage Learning, 2010 Ingebretson, "The Basics of Hacking and Penetration Testing", Stoch, "Ethical Hacking and Penetration Testing Guide", CRC Preaver, "Ethical Hacking for Dummies", 6th Edition, Wiley, 2018.	work Secur hical Hacki	ity Secrets ar	nd Sc ork D	efen: E (Hi	ns", 7° se, Co	Total:4 Total:4 Edition, Durse pped Level) g (K3)
Web and Database Database Hacking TEXT BOOK: Stuart More Tata More Michael Technology REFERENCES: Patrick Element Revin Beauties Course Outcompletion of Course Organize	se Hacking – Web Server Hacking - Web application Hacking - g. Mobile Hacking – Hacking android – iOS. CClure, Joel Scambray, Goerge Kurtz, "Hacking Exposed 7: Nets Graw Hill Publishers, 2012. T. Simpson, Kent Backman, and James E. Corley, "Hands-on Et gy", Delmar Cengage Learning, 2010 Ingebretson, "The Basics of Hacking and Penetration Testing", S'loch, "Ethical Hacking and Penetration Testing Guide", CRC Preaver, "Ethical Hacking for Dummies", 6th Edition, Wiley, 2018. DMES: the course, the students will be able to	work Secur hical Hacki	ity Secrets ar	nd Sc ork D	efen: E (Hi	ns", 7° se, Co	Total:4: Total:4: Edition, Durse pped Level)
Web and Database Database Hacking FEXT BOOK: 1. Stuart Mc Tata Mcc 2. Michael Technolo REFERENCES: 1. Patrick Ele 2. Rafay Ba 3. Kevin Bea COURSE OUTCO On completion of CO1 Organize CO2 Identify at Enumeral	See Hacking – Web Server Hacking - Web application Hacking - g. Mobile Hacking – Hacking android – iOS. CClure, Joel Scambray, Goerge Kurtz, "Hacking Exposed 7: Network Hill Publishers, 2012. T. Simpson, Kent Backman, and James E. Corley, "Hands-on Etter gy", Delmar Cengage Learning, 2010 Ingebretson, "The Basics of Hacking and Penetration Testing", Siloch, "Ethical Hacking and Penetration Testing Guide", CRC Preserver, "Ethical Hacking for Dummies", 6th Edition, Wiley, 2018. DMES: The course, the students will be able to a computer and network against a variety of attacks and explain the basic vulnerabilities in any computing system are the Computer network services and determine the possible services.	work Secur hical Hacki YNGRESS ess, 2014.	ity Secrets and Netwo	nd Sc ork D	efen: E (Hi Ap	ns", 7 ^s se, Co	Total:4: Total:4: burse pped Level) g (K3)
Web and Database Database Hacking TEXT BOOK: 1. Stuart Mc Tata Mcc 2. Michael Technolo REFERENCES: 1. Patrick Ele 2. Rafay Ba 3. Kevin Bea COURSE OUTCO On completion of CO1 Organize CO2 Identify an CO3 Enumerar Windows	See Hacking – Web Server Hacking - Web application Hacking - g. Mobile Hacking – Hacking android – iOS. CClure, Joel Scambray, Goerge Kurtz, "Hacking Exposed 7: Network Hill Publishers, 2012. T. Simpson, Kent Backman, and James E. Corley, "Hands-on Etter gy", Delmar Cengage Learning, 2010 Ingebretson, "The Basics of Hacking and Penetration Testing", Siloch, "Ethical Hacking and Penetration Testing Guide", CRC Preserver, "Ethical Hacking for Dummies", 6th Edition, Wiley, 2018. DMES: The course, the students will be able to a computer and network against a variety of attacks and explain the basic vulnerabilities in any computing system are the Computer network services and determine the possible services.	work Secur chical Hacki YNGRESS ess, 2014.	ity Secrets and Netwo	nd Sc ork D	E (Hi	st Maghest	Total:4 Total:4 Elition, Durse pped Level) g (K3) g (K3)

					Mappin	g of CO	s with	POs an	d PSOs	5				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	(Commor	to All Engineerin	g and Technology Br	anches)			
Programme & Branch	All Engineering and Technology Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	8	OE	3	0	0	3
Preamble	This course introduces the conce disaster. It also discusses variou business continuity.						
Jnit - I	Introduction:						
information-Alte Impact –Image-	ulnerability of today's business orga ernative Business operations –Lo -Market Position-Growth or decline ties-Business Continuity planning s	ss of information -Risk manageme Strategy	-Indirect impact-ripp	ling effects	of busines	s operation	ons-Long Tern
Jnit - II	Multilateral Continuity Plannin tinuity Planning: Multilateral continuity						
Operational risl Business strate Jnit - III	eting protection: a justification for k management-Senior manageme egy and business continuity planning Business Continuity Planning inuity Planning: The business cor	nt arrangements ng-BCP within a b	systems and contro usiness strategic cor	ols- Underst itext	anding the	organiza	tion's busines
orogramme ma assessment-Ris strategies for th	nagement-Understanding the orga sk evaluation and control-Business ne business or work areas-Busines	inization - A pract impact analysis-	ical approach-Risk e A walk through a cor	valuation an nprehensive	d control:p BIA-Deve	oractical gual Hoping bus	uidelines for ris siness continui
	<u> </u>	. 0					
Unit - IV Developing Bu	Developing Business Continuiusiness Continuity Strategies Bu	siness continuity					
strategies-Hard Strategies-Strat Business challe availability-Virtu	Developing Business Continuing usiness Continuity Strategies Business Continuity Strategies Business Continuity Strategies Business Continuity Business Business Continuity Business Bus	siness continuity ies- Network se s and services -U	rvice strategies-offsi nderstanding the bus	te storages iness inform	and facil ation flow-	lity strateo Vulnerabil	gies-Call centi ity assessmer
Unit - IV Developing Bustrategies-Hard Strategies-Strategies challe Business challe Business challe Unit - V	Developing Business Continuing usiness Continuity Strategies Business Continuity Strategies Business continuity Strategies Business strategies-Software strategies for communications product enges-Marketplace trends-Planning ualization Awareness and training:	isiness continuity ies- Network se s and services -U g to recover your	rvice strategies-offsi nderstanding the bus data – Availability-Ta	te storages iness inform pe backup -	and facil lation flow- - Disk-to-d	lity strateg Vulnerabil isk-High a	gies-Call cent ity assessmer vailability-WA
Unit - IV Developing Bustrategies-Hard Strategies-Strat Business challe availability-Virtu Unit - V Awareness and testing-BC plan	Developing Business Continuing usiness Continuity Strategies Business Continuity Strategies Business Continuity Strategies Business Continuity Business Business Continuity Business Bus	isiness continuity ies- Network se s and services -U g to recover your uiring or developi aintenance-BC au	rvice strategies-offsi nderstanding the bus data – Availability-Ta ng training aids-Awa	te storages siness inform spe backup - sreness thro	and facil nation flow- - Disk-to-d ugh mainte	lity stratege. Vulnerabilisk-High a	gies-Call cent ity assessmer vailability-WA eview, audit an ne organizatio
Unit - IV Developing Bustrategies-Hard Strategies-Strat Business challe availability-Virtu Unit - V Awareness and testing-BC plan Defining the au	Developing Business Continuing usiness Continuity Strategies Business Continuity Strategies Business Continuity Strategies Business For communications product the propersure of training Business and Straining: It training-Establish BC policy-Acquitesting — Overview — Testing — Margaretic Straining Business Continuity Strategies Business Continui	isiness continuity ies- Network se s and services -U g to recover your uiring or developi aintenance-BC au	rvice strategies-offsi nderstanding the bus data – Availability-Ta ng training aids-Awa	te storages siness inform spe backup - sreness thro	and facil nation flow- - Disk-to-d ugh mainte	lity stratege. Vulnerabilisk-High a	gies-Call cent ity assessmer vailability-WAI
Unit - IV Developing Bustrategies-Hard Strategies-Strat Business challe availability-Virtu Unit - V Awareness and testing-BC plan Defining the au	Developing Business Continuing usiness Continuity Strategies Business Continuity Strategies Business Continuity Strategies Business For communications product the propersure of training Business and Straining: It training-Establish BC policy-Acquitesting — Overview — Testing — Margaretic Straining Business Continuity Strategies Business Continui	isiness continuity ies- Network se s and services -U g to recover your uiring or developi aintenance-BC au eldwork-Analysis	rvice strategies-offsi nderstanding the bus data – Availability-Ta ng training aids-Awa idit-Audit objective-D	te storages iness inform pe backup - ireness thro etermining t	and facil lation flow- - Disk-to-d ugh mainte he maturity	lity strated Vulnerabil isk-High a enance, re y level of th	gies-Call cent ity assessmer vailability-WAl eview, audit ar ne organizatio
Unit - IV Developing Bustrategies-Hard Strategies-Strat Business challe availability-Virtu Unit - V Awareness and testing-BC plan Defining the au TEXT BOOK: 1. And	Developing Business Continuing usiness Continuity Strategies Business Continuity Strategies Business for communications product tegies for communications product teges for communications product tegies for comm	isiness continuity ies- Network se s and services -U g to recover your uiring or developi aintenance-BC au eldwork-Analysis	rvice strategies-offsi nderstanding the bus data – Availability-Ta ng training aids-Awa idit-Audit objective-D	te storages iness inform pe backup - ireness thro etermining t	and facil lation flow- - Disk-to-d ugh mainte he maturity	lity strated Vulnerabil isk-High a enance, re y level of th	gies-Call cent ity assessmer vailability-WAl eview, audit ar ne organizatio
Unit - IV Developing Bustrategies-Hard Strategies-Strat Business challe availability-Virtu Unit - V Awareness and cesting-BC plan Defining the au TEXT BOOK: 1. And REFERENCES	Developing Business Continuing usiness Continuity Strategies Business Continuity Strategies Business for communications product tegies for communications product teges for communications product tegies for comm	isiness continuity ies- Network se s and services -U g to recover your uiring or developi aintenance-BC au eldwork-Analysis	rvice strategies-offsi nderstanding the bus data – Availability-Ta ng training aids-Awa Idit-Audit objective-D	te storages siness inform ape backup - areness thro etermining t t", 2 nd Edition	and facil lation flow- - Disk-to-d ugh mainte he maturity	lity strated Vulnerabilisk-High a lenance, regularist plants of the length of the leng	gies-Call cent ity assessmer vailability-WAl eview, audit ar ne organizatio Total:4
Unit - IV Developing Bustrategies-Hard Strategies-Strat Business challe availability-Virtu Unit - V Awareness and resting-BC plan Defining the au TEXT BOOK: 1. And REFERENCES 1. Sne	Developing Business Continuiusiness Continuity Strategies Business Fractions Product Programmes Planning Latition Awareness and training: It training-Establish BC policy-Acquatesting — Overview — Testing — Madit programme-Audit planning — Figure Willes, "The Definitive Handbooks: It was a strategies Business Continuity Strategies Busines	isiness continuity ies- Network se s and services -U g to recover your uiring or developi aintenance-BC au eldwork-Analysis	rvice strategies-offsi nderstanding the bus data – Availability-Ta ng training aids-Awa Idit-Audit objective-D	te storages siness inform ape backup - areness thro etermining t t", 2 nd Edition	and facil lation flow- - Disk-to-d ugh mainte he maturity	lity strated Vulnerabilisk-High a lenance, regular level of the ley& Sons	gies-Call centity assessmer vailability-WA eview, audit are organization. Total:4 , 2007
Dnit - IV Developing Bustrategies-Hard Strategies-Strat Business challe availability-Virtu Jnit - V Awareness and esting-BC plan Defining the au FEXT BOOK: I. And REFERENCES I. Sne	Developing Business Continuiusiness Continuity Strategies Business Fractions Product Programmes Planning Latition Awareness and training: It training-Establish BC policy-Acquatesting — Overview — Testing — Madit programme-Audit planning — Figure Willes, "The Definitive Handbooks: It was a strategies Business Continuity Strategies Busines	isiness continuity ies- Network se s and services -U g to recover your uiring or developi aintenance-BC au eldwork-Analysis bk of Business Co	rvice strategies-offsi nderstanding the bus data – Availability-Ta ng training aids-Awa Idit-Audit objective-D	te storages siness inform ape backup - areness thro etermining t t", 2 nd Edition	and facil lation flow- - Disk-to-d ugh mainte he maturity	lity strated Vulnerabilisk-High a lenance, regular level of the ley& Sons le	gies-Call centity assessmer vailability-WA eview, audit and organization Total:4
Doubt - IV Developing Bustrategies-Hard Strategies-Strat Business challe availability-Virtu Jnit - V Awareness and esting-BC plan Defining the au FEXT BOOK: And REFERENCES Sne COURSE OUTO On completion	Developing Business Continuiusiness Continuiusiness Continuity Strategies Business Continuity Strategies Business Continuity Strategies Business Communications product tegies for communications product tegies and training: distraining-Establish BC policy-Acquitesting – Overview – Testing – Madit programme-Audit planning – Figure Hilles, "The Definitive Handbooks: daker, Susan, "Business continuity Communications are supported by the programme of the programme	isiness continuity ies- Network se s and services -U g to recover your uiring or developi aintenance-BC au eldwork-Analysis ok of Business Co v & disaster recov	rvice strategies-offsi nderstanding the bus data – Availability-Ta ng training aids-Awa idit-Audit objective-D intinuity Managemen ery planning for IT pr	te storages iness inform the backup - treness thro etermining to the treness through t	and facil lation flow- - Disk-to-d ugh mainte he maturity	lity strated Vulnerabilisk-High a lenance, regy level of the ley& Sons ley& Sons (High High High High High High High High	gies-Call centity assessmer vailability-WAleview, audit arne organization Total:4 , 2007 as, 2013.
Developing Bustrategies-Hard Strategies-Strat Business challe availability-Virtuunit - V Awareness and esting-BC plan Defining the au FEXT BOOK: 1. And REFERENCES 1. Sne COURSE OUTOn completion CO1 III	Developing Business Continuiusiness Continuiusiness Continuity Strategies Business Continuity Strategies Business Continuity Strategies Business for communications product tegies and training: distraining-Establish BC policy-Acquatesting — Overview — Testing — Madit programme-Audit planning — Figure Willes, "The Definitive Handbooks: daker, Susan, "Business continuity daker, Susan, "Business continuity tilize the significance of Business Collustrate multilateral continuity planritrategy	isiness continuity ies- Network se s and services -U g to recover your uiring or developi aintenance-BC au eldwork-Analysis bk of Business Co & disaster recov be able to Continuity Plannin ning and describe	rvice strategies-offsi nderstanding the bus data – Availability-Ta ng training aids-Awa idit-Audit objective-D entinuity Managemen ery planning for IT pr g in the event of a dis organization's busine	te storages siness inform pe backup - pe b	and facilination flow- Disk-to-d ugh maintene maturity n, John Wi	lity strated Vulnerabilisk-High a lenance, regular level of the level	gies-Call centity assessmer vailability-WAleview, audit arne organization Total:4 , 2007 ss, 2013. Mapped hest Level)
Double - IV Developing Bustrategies-Hard Strategies-Strat Business challe availability-Virtu Jnit - V Awareness and esting-BC plan Defining the au FEXT BOOK: And REFERENCES Sne COURSE OUT On completion CO1	Developing Business Continuiusiness Continuiusiness Continuity Strategies Business Continuity Strategies Business Continuity Strategies Business for communications product enges-Marketplace trends-Planning palization Awareness and training: It training-Establish BC policy-Acquitesting – Overview – Testing – Madit programme-Audit planning – Find the programme-Audit planning – Find the Course, "Business continuity COMES: In of the course, the students will tilize the significance of Business Coustrate multilateral continuity planning continuity planning of the course, the students will stilize the significance of Business Coustrate multilateral continuity planning product the strategies Business Coustrate Planning product the strategies Planning product the strategi	isiness continuity ies- Network se s and services -U g to recover your uiring or developi aintenance-BC au eldwork-Analysis bk of Business Co & disaster recov be able to Continuity Plannin ning and describe	rvice strategies-offsi nderstanding the bus data – Availability-Ta ng training aids-Awa idit-Audit objective-D entinuity Managemen ery planning for IT pr g in the event of a dis organization's busine	te storages siness inform pe backup - pe b	and facilination flow- Disk-to-d ugh maintene maturity n, John Wi	lity stratege Vulnerabilisk-High a lenance, regy level of the ley& Sons ley& Sons (High App App	gies-Call centity assessmer vailability-WAleview, audit arne organization. Total:4 , 2007 ss, 2013. Mapped hest Level) Dlying (K3)
Developing Bustrategies-Hard Strategies-Strat Business challe availability-Virtu Unit - V Awareness and esting-BC plan Defining the auditor of the second of	Developing Business Continuiusiness Continuiusiness Continuity Strategies Business Continuity Strategies Business Continuity Strategies Business for communications product tegies and training: distraining-Establish BC policy-Acquatesting — Overview — Testing — Madit programme-Audit planning — Figure Willes, "The Definitive Handbooks: daker, Susan, "Business continuity daker, Susan, "Business continuity tilize the significance of Business Collustrate multilateral continuity planritrategy	isiness continuity ies- Network se s and services -U g to recover your uiring or developi aintenance-BC au eldwork-Analysis ok of Business Co v & disaster recov be able to Continuity Plannin ning and describe control guidelines	rvice strategies-offsi nderstanding the bus data – Availability-Ta mg training aids-Awardit-Audit objective-D erry planning for IT prog in the event of a disorganization's business for risk assessment	te storages siness inform pe backup - preness thro etermining t t", 2 nd Edition ofessionals" saster ess process	and facilination flow- Disk-to-d ugh maintene maturity n, John Wi	lity stratege Vulnerabilisk-High a lenance, regy level of the lenance strategy lenance strategy level strategy lenance strategy lena	gies-Call centity assessmer vailability-WA eview, audit anne organization. Total: , 2007 ss, 2013. Mapped hest Level) Dlying (K3) blying (K3)

					Mappir	ng of Co	Os with	POs a	nd PSO	s				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

ASSESSMENT PATTERN - THEORY

					1	
Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
20	40	40				100
20	40	40				100
20	40	40				100
20	40	40				100
	(K1) % 20 20 20	(K1) % (K2) % 20 40 20 40 20 40	(K1) % (K2) % (K3) % 20 40 40 20 40 40 20 40 40	(K1) % (K2) % (K3) % (K4) % 20 40 40 20 40 40 20 40 40	(K1) % (K2) % (K3) % (K4) % (K5) % 20 40 40 20 40 40 20 40 40	(K1) % (K2) % (K3) % (K4) % (K5) % (K6) % 20 40 40 20 40 40 20 40 40

 $^{^*}$ ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Progra Branch	amme& h	Sem. Category	L	Т	Р	Credit
	quisites	Nil V OE	3	1	0	4
Preaml	ıble	The course helps the students to understand the basic principles of enzyme and its kinetics, mechanism of enzyme action and inhibitors and application of enzymes for processes				
	fication of er etics of enzy	INTRODUCTION TO ENZYMOLOGY nzymes. Mechanisms of enzyme action; History of Industrial enzyme development; me substrate complex formation; specificity of enzyme action; principles of catalysis -				
Unit –	•	KINETICS OF ENZYME ACTION				9 +
mecha	anisms and k	substrate reactions; estimation of Michaelis – Menten parameters, enzyme inhibition inetics for steady state; Allosteric regulation of enzymes, Monod Changeux Wyman r & deactivation kinetics.				
Unit –		PURIFICATION AND PRODUCTION OF INDUSTRIAL ENZYMES				9 +
		rification of crude enzyme extracts from plant, animal and microbial sources; meth al fermentation and downstream processing.	ods c	f cha	racter	ization o
Unit –		INDUSTRIAL APPLICATION OF ENZYME				9 +
	havlovni sar	in production process of Brewing and Baking industry, dairy industry, meat proces	sing,	Fruit	and \	/egetable
		aceutical industries				J
Unit – Modifice regulate toxicity	v cation of indutory aspects:		on of aluat	enzyr on of	enzyı	9 + Safety an me safet
Unit – Modific regulat toxicity TEXTE 1.	v cation of indutory aspects: / consideration BOOK: Trevor Pal Robert J. V	ALTERING ENZYME PERFORMANCE AND STABILITY ustrial enzyme function and stability by enzyme engineering approaches; immobilizati ethics in the use of enzymes in food products, medical and dietary considerations, ex	on of aluat	enzyr on of	enzyı + 15 :	9 + Safety an me safet
Unit – Modific regulat toxicity TEXTE 1. 2. REFER	v cation of indutory aspects: / consideration BOOK: Trevor Pal Robert J. V	ALTERING ENZYME PERFORMANCE AND STABILITY ustrial enzyme function and stability by enzyme engineering approaches; immobilizative thics in the use of enzymes in food products, medical and dietary considerations, even in the use of enzymes mer, "Enzymes", 2 nd Edition, Horwood Publishing Ltd, 2007. Whitehurst & Maarten van Oort, "Enzymes in Food Technology", 2nd Edition, John Wil	on of aluat	enzyr on of	enzyı + 15 :	9 + Safety an me safety
Unit – Modific regulat toxicity TEXTE 1. 2. REFEF 1.	v cation of indutory aspects: / consideration BOOK: Trevor Pal Robert J. V RENCES: Ed Godfre	ALTERING ENZYME PERFORMANCE AND STABILITY ustrial enzyme function and stability by enzyme engineering approaches; immobilizative thics in the use of enzymes in food products, medical and dietary considerations, even in the use of enzymes mer, "Enzymes", 2 nd Edition, Horwood Publishing Ltd, 2007. Whitehurst & Maarten van Oort, "Enzymes in Food Technology", 2nd Edition, John Willey and West, Industrial Enzymology- Macmillan Press Ltd 2nd edition, 1996.	Tot:	enzyron of	+ 15 :	9 + Safety an me safety
Unit – Modific regulat toxicity TEXTE 1. 2. REFEF 1. 2.	v cation of indutory aspects: / consideration BOOK: Trevor Pal Robert J. V RENCES: Ed Godfre	ALTERING ENZYME PERFORMANCE AND STABILITY Justrial enzyme function and stability by enzyme engineering approaches; immobilizations in the use of enzymes in food products, medical and dietary considerations, evon in the use of enzymes Mer, "Enzymes", 2nd Edition, Horwood Publishing Ltd, 2007. Whitehurst & Maarten van Oort, "Enzymes in Food Technology", 2nd Edition, John Wilder and West, Industrial Enzymology- Macmillan Press Ltd 2nd edition, 1996. TyChandrasekaran, "Enzymes in Food and Beverage Processing", 1st Edition, CRC Press and Statistics (CRC Press and Statistics).	Total	enzyron of al:45	+ 15 :: UK, 2	9 + Safety an me safety
Unit – Modific regulat toxicity TEXTE 1. 2. REFEF 1. 2.	v cation of indutory aspects: / consideration BOOK: Trevor Pal Robert J. V RENCES: Ed Godfre	ALTERING ENZYME PERFORMANCE AND STABILITY ustrial enzyme function and stability by enzyme engineering approaches; immobilizative thics in the use of enzymes in food products, medical and dietary considerations, even in the use of enzymes mer, "Enzymes", 2 nd Edition, Horwood Publishing Ltd, 2007. Whitehurst & Maarten van Oort, "Enzymes in Food Technology", 2nd Edition, John Willey and West, Industrial Enzymology- Macmillan Press Ltd 2nd edition, 1996.	Total	enzyron of al:45	+ 15 :: UK, 2	9 + Safety an me safety =60 hour
Unit – Modific regulat toxicity TEXTE 1. 2. REFEF 1. 2. COUR:	v cation of indutory aspects: / consideration BOOK: Trevor Pal Robert J. V RENCES: Ed Godfre Muthusam N Gray, M	ALTERING ENZYME PERFORMANCE AND STABILITY Justrial enzyme function and stability by enzyme engineering approaches; immobilizations, even in the use of enzymes in food products, medical and dietary considerations, even in the use of enzymes Mitter enzymes",2nd Edition, Horwood Publishing Ltd, 2007. Whitehurst & Maarten van Oort, "Enzymes in Food Technology", 2nd Edition, John Wilder and West, Industrial Enzymology- Macmillan Press Ltd 2nd edition, 1996. TyChandrasekaran, "Enzymes in Food and Beverage Processing", 1st Edition, CRC Processing, Enzymes Biotechnology SC Bhatia CBS Publishers and Distributors Pvt Limited.	Total	enzyrron of on of al:45 Gons, JSA, 2 B	enzyi + 15 = UK, 2 2016. 2010.	9 + Safety an me safety =60 hour
Unit – Modific regulat toxicity TEXTB 1. 2. REFEF 1. 3. COURS On cor	v cation of indutory aspects: / consideration BOOK: Trevor Pal Robert J. V RENCES: Ed Godfre Muthusam N Gray, M	ALTERING ENZYME PERFORMANCE AND STABILITY Justrial enzyme function and stability by enzyme engineering approaches; immobilizations, even in the use of enzymes in food products, medical and dietary considerations, even in the use of enzymes Mer, "Enzymes", 2nd Edition, Horwood Publishing Ltd, 2007. Whitehurst & Maarten van Oort, "Enzymes in Food Technology", 2nd Edition, John Wilder and West, Industrial Enzymology- Macmillan Press Ltd 2nd edition, 1996. TyChandrasekaran, "Enzymes in Food and Beverage Processing", 1st Edition, CRC Processing, Enzymes Biotechnology SC Bhatia CBS Publishers and Distributors Pvt Limited MES:	Totaluat Totaluat Each of the search of th	enzyron of of of one of the state of the sta	enzyi + 15 : UK, 2 2016. 2010. T Maj	9 + Safety an me safet =60 hour
Unit – Modific regulat toxicity TEXTE 1. 2. REFEF 1. 2. COUR: On cor	v cation of indutory aspects: / consideration BOOK: Trevor Pal Robert J. V RENCES: Ed Godfree Muthusam N Gray, M SE OUTCOI mpletion of infer the fu	ALTERING ENZYME PERFORMANCE AND STABILITY ustrial enzyme function and stability by enzyme engineering approaches; immobilizatic ethics in the use of enzymes in food products, medical and dietary considerations, evon in the use of enzymes mer, "Enzymes", 2nd Edition, Horwood Publishing Ltd, 2007. Whitehurst & Maarten van Oort, "Enzymes in Food Technology", 2nd Edition, John Wilder Van West, Industrial Enzymology- Macmillan Press Ltd 2nd edition, 1996. TyChandrasekaran, "Enzymes in Food and Beverage Processing", 1st Edition, CRC Processing, Enzymes Biotechnology SC Bhatia CBS Publishers and Distributors Pvt Limited MES: the course, the students will be able to	Total Edition of Land Edition	enzyrron of of of one of of of one of of of one of of of one of of one of of one of of one of of of one of of of one of of of one of of one of of one of of of one of of of one of of of one of o	enzyi + 15 : UK, 2 2016. 2010. T Maj	9 + Safety an me safet =60 hour 2009. pped Level) ng (K2)
Unit – Modific regulat toxicity TEXTE 1. 2. REFEF 1. 2. 3. COUR: On cor CO1	v cation of indutory aspects: / consideration BOOK: Trevor Pal Robert J. V RENCES: Ed Godfree Muthusam N Gray, M SE OUTCOI mpletion of infer the fu	ALTERING ENZYME PERFORMANCE AND STABILITY ustrial enzyme function and stability by enzyme engineering approaches; immobilizations, even in the use of enzymes in food products, medical and dietary considerations, even in the use of enzymes mer, "Enzymes", 2nd Edition, Horwood Publishing Ltd, 2007. Whitehurst & Maarten van Oort, "Enzymes in Food Technology", 2nd Edition, John Willey and West, Industrial Enzymology- Macmillan Press Ltd 2nd edition, 1996. TyChandrasekaran, "Enzymes in Food and Beverage Processing", 1st Edition, CRC Proceedings, Enzymes Biotechnology SC Bhatia CBS Publishers and Distributors Pvt Limited MES: The course, the students will be able to undamental concepts of economics and forecasting in food processing	Total Personal Control Contro	enzyrron of on of one o	enzyi + 15 = UK, 2 2016. 2010. T Maphest standi	9 + Safety an me safet =60 hour 2009. pped Level) ng (K2)
Unit – Modific regulat toxicity TEXTE 1. 2. REFEF 1. 2. 3.	v cation of indutory aspects: / consideration of consideration of the co	ALTERING ENZYME PERFORMANCE AND STABILITY ustrial enzyme function and stability by enzyme engineering approaches; immobilizations in the use of enzymes in food products, medical and dietary considerations, evon in the use of enzymes mer, "Enzymes", 2nd Edition, Horwood Publishing Ltd, 2007. Whitehurst & Maarten van Oort, "Enzymes in Food Technology", 2nd Edition, John Willer and West, Industrial Enzymology- Macmillan Press Ltd 2nd edition, 1996. yChandrasekaran, "Enzymes in Food and Beverage Processing", 1st Edition, CRC Proceeding, Enzymes Biotechnology SC Bhatia CBS Publishers and Distributors Pvt Limited MES: the course, the students will be able to and amental concepts of economics and forecasting in food processing e cost economics in food industry	Total Land A	enzyron of on of one of	+ 15 : UK, 2 2016. T Malghest standi	9 + Safety an me safety =60 hour 2009. pped Level) ng (K2) (4)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2							1	1	2		
CO2	2	2	2							2	2	2		
CO3	2	2	2							1	1	2		
CO4	2	2	1							2	2	2		
CO5	2	2	1							2	2	2		

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Tota I %
CAT1	20	40	20	20			100
CAT2	20	20	40	20			100
CAT3	20	40	40				100
ESE	20	40	30	10			100

 $^{^{\}star}$ ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22CHO02 - WASTE TO ENERGY CONVERSION				
Programme& Branch	Sem. Category	L	Т	Р	Credit
Prerequisites	Nil V OE	3	1	0	4
Preamble	This course focuses on Waste to Energy Conversion, covering the principles, tec of various conversion processes. Students will learn how to design, optimize, and and economic impacts of waste-to-energy systems.				
Unit - I	Introduction to Waste Management and Energy Conversion				9 +
	ste management and the importance of waste-to-energy conversion; Types of wast rgy conversion technologies and their applications in waste-to-energy.	es an	d the	ir cha	racteristics
Unit - II	Waste Characterization and Analysis				9 +
waste reduction	te characterization and analysis; Techniques for determining waste composition and reuse, and recycling; Collection and transport systems for solid, liquid, and gase ues and hazards associated.				
Unit - III	Thermal and Biological Conversion Technologies				9 +
	pyrolysis processes; Gasification and plasma arc gasification; Anaerobic digestion vermiculture - Operation, and optimization of thermal and biological conversion system		biog	as pro	duction;
Unit - IV	Chemical Conversion Technologies				9 +
	ction from waste; Synthesis of fuels and chemicals from waste streams -Operation, a	ına op	otimiz	ation	or chemica
conversion syste	Environmental impact, case studies and applications				9 +
conversion system of the conversion system of the considerations for the considerations for the considerations for the conversion of the c	ems	alysis;	Ecc	nomic	9 +
conversion system of the conversion system of the considerations for the considerations for the considerations for the conversion of the c	Environmental impact, case studies and applications mpact of waste-to-energy conversion; Life cycle assessment and sustainability and or waste-to-energy systems; Case studies of successful waste-to-energy projects; Ap	alysis; olicati	Ecc ons (nomic of wast	9 + and polic e-to-energ
Conversion system Unit - V Environmental is considerations for technologies in v TEXTBOOK:	Environmental impact, case studies and applications mpact of waste-to-energy conversion; Life cycle assessment and sustainability an or waste-to-energy systems; Case studies of successful waste-to-energy projects; Apprairies	alysis; olicati	Eco ons o	nomic of wast	9 + and police-to-energes
Unit - V Environmental i considerations fi technologies in v TEXTBOOK:	Environmental impact, case studies and applications mpact of waste-to-energy conversion; Life cycle assessment and sustainability and or waste-to-energy systems; Case studies of successful waste-to-energy projects; Ap	alysis; olicati	Eco ons o	nomic of wast	9 + and polic e-to-energ =60 hour
Unit - V Environmental i considerations fi technologies in v TEXTBOOK:	Environmental impact, case studies and applications mpact of waste-to-energy conversion; Life cycle assessment and sustainability an or waste-to-energy systems; Case studies of successful waste-to-energy projects; Apprarious industries Rogoff, Francois Screve, "Waste-to-Energy: Technologies and Project Implementation, UK, 2011.	alysis; olicati	Eco ons o	nomic of wast	9 + and polic e-to-energ =60 hour
Conversion system Unit - V Environmental is considerations for technologies in v TEXTBOOK: 1. Marc J. Science REFERENCES:	Environmental impact, case studies and applications mpact of waste-to-energy conversion; Life cycle assessment and sustainability an or waste-to-energy systems; Case studies of successful waste-to-energy projects; Apprarious industries Rogoff, Francois Screve, "Waste-to-Energy: Technologies and Project Implementation, UK, 2011.	alysis; olicati To	Eccons o	nomic of wast 15 + 15 n, Else	9 + and policie-to-energ 5 =60 hour
Conversion system Unit - V Environmental i considerations for technologies in v TEXTBOOK: 1. Marc J. Science REFERENCES: 1. George	Environmental impact, case studies and applications mpact of waste-to-energy conversion; Life cycle assessment and sustainability an or waste-to-energy systems; Case studies of successful waste-to-energy projects; Apvarious industries Rogoff, Francois Screve, "Waste-to-Energy: Technologies and Project Implementation, UK, 2011.	alysis; olicati To " 2 nd E	Eccons ons on the constant of	nomic of wast 15 + 15 n, Else	9 + and policie-to-energ 5 =60 hour evier onal, 2002
Environmental is considerations for technologies in virologies in virologies. TEXTBOOK: Marc J. Science REFERENCES: George Naomi E	Environmental impact, case studies and applications mpact of waste-to-energy conversion; Life cycle assessment and sustainability and or waste-to-energy systems; Case studies of successful waste-to-energy projects; Applications industries Rogoff, Francois Screve, "Waste-to-Energy: Technologies and Project Implementation, UK, 2011. Tchobanoglous, Frank Kreith, "Handbook of Solid Waste Management" 2nd Edition, Mc Klinghoffer, Marco J Castaldi, "Waste to Energy Conversion Technology" Woodhead F	alysis; olicati To " 2 nd E	Eccons of the control	nomic of wast 15 + 15 n, Else rofessi .imited	9 + and policie-to-energe i =60 hour evier onal, 2002 , UK, 2013
Environmental is considerations for technologies in varied and technologies and technologies in varied and technologies	Environmental impact, case studies and applications mpact of waste-to-energy conversion; Life cycle assessment and sustainability and or waste-to-energy systems; Case studies of successful waste-to-energy projects; Applications industries Rogoff, Francois Screve, "Waste-to-Energy: Technologies and Project Implementation, UK, 2011. Tchobanoglous, Frank Kreith, "Handbook of Solid Waste Management" 2nd Edition, Mc Klinghoffer, Marco J Castaldi, "Waste to Energy Conversion Technology" Woodhead Foomers:	alysis; olicati To " 2 nd E	Eccons of the state of the stat	nomic of wast 15 + 15 n, Else rofessi imited BT Malighes	9 + and policie-to-energe i =60 hour evier onal, 2002 , UK, 2013
Environmental is considerations for technologies in virologies in virologies in virologies. TEXTBOOK: 1. Marc J. Science REFERENCES: 1. George 2. Naomi E COURSE OUTO On completion CO1 explain	Environmental impact, case studies and applications mpact of waste-to-energy conversion; Life cycle assessment and sustainability an or waste-to-energy systems; Case studies of successful waste-to-energy projects; Apparations industries Rogoff, Francois Screve, "Waste-to-Energy: Technologies and Project Implementation, UK, 2011. Tchobanoglous, Frank Kreith, "Handbook of Solid Waste Management" 2nd Edition, Mc Sklinghoffer, Marco J Castaldi, "Waste to Energy Conversion Technology" Woodhead Formula Company Conversion Technology (Company) and the course, the students will be able to the importance of waste-to-energy conversion and its role in sustainable development and methods for waste characterization and analysis to determine waste composition are	alysis; olicati To " 2 nd E	Eccons of the control	nomic of wast 15 + 15 n, Else rofessi imited BT Ma lighes lerstan	9 + and policie-to-energe 5 =60 hour evier onal, 2002 , UK, 2013
Environmental is considerations for technologies in varieties. TEXTBOOK: 1. Marc J. Science REFERENCES: 1. George 2. Naomi E COURSE OUTO On completion CO1 explain CO2 describe anaerob	Environmental impact, case studies and applications mpact of waste-to-energy conversion; Life cycle assessment and sustainability and or waste-to-energy systems; Case studies of successful waste-to-energy projects; Apparatious industries Rogoff, Francois Screve, "Waste-to-Energy: Technologies and Project Implementation, UK, 2011. Tchobanoglous, Frank Kreith, "Handbook of Solid Waste Management" 2nd Edition, Mc & Klinghoffer, Marco J Castaldi, "Waste to Energy Conversion Technology" Woodhead Form to the importance of waste-to-energy conversion and its role in sustainable development and methods for waste characterization and analysis to determine waste composition are ontent and methods for incineration, pyrolysis, gasification, plasma arc gasification, ic digestion, biogas production, composting, and vermiculture processes	alysis; olicati " 2 nd E Graw I	Eccons of the control	nomic of wast 15 + 15 n, Else rofessi imited BT Ma lighes lerstan	9 + and policie-to-energe i =60 hour evier onal, 2002 , UK, 2013 apped t Level)
Environmental is considerations for technologies in virologies in virolo	Environmental impact, case studies and applications mpact of waste-to-energy conversion; Life cycle assessment and sustainability and or waste-to-energy systems; Case studies of successful waste-to-energy projects; Apparatious industries Rogoff, Francois Screve, "Waste-to-Energy: Technologies and Project Implementation, UK, 2011. Tchobanoglous, Frank Kreith, "Handbook of Solid Waste Management" 2nd Edition, Mc & Klinghoffer, Marco J Castaldi, "Waste to Energy Conversion Technology" Woodhead For the course, the students will be able to the importance of waste-to-energy conversion and its role in sustainable development and methods for waste characterization and analysis to determine waste composition are content and methods for incineration, pyrolysis, gasification, plasma arc gasification, ic digestion, biogas production, composting, and vermiculture processes ize the principles of hydrogen production and synthesis of fuels and chemicals fro	To 2nd E	Eccons of the control	nomic of wast 15 + 15 n, Else rofessi .imited BT Ma lighes lerstan lerstan	9 + and police-to-energe 5 =60 hour evier conal, 2002 , UK, 2013 apped t Level) ading (K2)

					Mappi	ng of C	Os with	n POs a	nd PSC	Os				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2												
CO2	2	2												
CO3	2	2												
CO4	2	2												
CO5	2	2												

^{1 –} Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

		ASSESSMEN	T PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	70					100
CAT2	20	70					100
CAT3	20	70					100
ESE	20	70					100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

D						- APPLIED N			-					
Progra Branci	amme& h							Se	m.	Category	L	Т	Р	Credit
Prereq	quisites	Nil						\	/	OE	3	1	0	4
D	la La	This are		-1-1- 4- 1-	-1			- :	4:			.		
Preaml Unit - I			urse will a		•	ents to gain l	knowieag	e in prepara	ition	and applicat	ion o	if nan	omate	riais 9 + 3
						effects on p	roportion	Introductio	o to	Enhrication of	nd n	ropo	ration t	
Unit - I			terizatio				roperties.	Introductio	1 10	rabilication a	iiiu p	Гера	allon	9 +
Genera		tion of cha	racterizat	ion tech	niques, I	Usage of Mic	croscopy -	– SEM, TEI	И, S	TM & AFM, I	Jsag	e of (Crystal	
Unit - I	III	Key na	nostruct	ures an	d applic	ations								9 +
						Carbon base Nanomateria				y ball, CNT	, Gra	aphite	and	Graphene
Unit - I			iction to				<u> </u>	p o p d o o , _						9 +
	ion of comp					Key propert	ies of con	nposites. M	anuf	acturing prod	esse	es – N	/lolding	g, Forming
Unit - \			d compos											9 +
Nanoc	omposites					fshore instal					То	tal:4	5 + 15	=60 houi
TEXTE	BOOK:	elsall, Ian V ts I, II & III		and Ma	rk Geog	hegan, "Nan		sience and	Гесh	nology", 1st				
TEXTE 1.	BOOK: Robert Ke 2005.(Uni	ts I, II & III)				oscale Sc				Editio	on, W	/iley, U	JK,
1. 2.	Robert Ke 2005.(Uni Daniel Ga	ts I, II & III)			hegan, "Nan	oscale Sc				Editio	on, W	/iley, U	JK,
TEXTE 1. 2.	Robert Ke 2005.(Uni Daniel Ga	ts I, II & III y, "Compo) osite Mate	erials – D	esign aı	hegan, "Nan	oscale Sc	Press, Boo	a Ra	aton, USA, 20	Editio	on, W	/iley, U	JK, V)
TEXTE 1. 2. REFEF 1.	Robert Ke 2005.(Uni Daniel Ga RENCES:	ts I, II & III y, "Compo Goddard 2003.) osite Mate , "Hand b	erials – D	esign ai	hegan, "Nandapplication application ance, Engine	oscale Sc	Press, Boo	a Ra	aton, USA, 20	Editio	on, W (Units	/iley, U	V) ed State o
TEXTE 1. 2. REFEF 1.	Robert Ke 2005.(Uni Daniel Ga RENCES: William A America,	ts I, II & III y, "Compo Goddard 2003. MES: f the cour	osite Mate Thand b	erials – Dook of N	esign ar	hegan, "Nandapplication application ance, Engine	oscale Sons", CRC	Press, Boo	a Ra	aton, USA, 20	Edition 14.	On, W (Units Press	/iley, U s IV & ` s, Unite BT Ma ighest	V) ed State o
TEXTE 1. 2. REFEF 1. COUR:	Robert Ke 2005.(Uni Daniel Ga RENCES: William A America, SE OUTCO mpletion of describe to a second control of the control of t	ts I, II & III y, "Compo Goddard 2003. MES: f the cours	psite Mate Thand b se, the st	erials – Dook of Notes tudents	esign and lanoscies will be a and the	hegan, "Nandapplication ence, Enginedable to	oscale Sons", CRC ering and	Press, Boo	a Ra	aton, USA, 20	Edition 2014.	(Units	/iley, U s IV & ' s, Unite BT Ma ighest standir	Pped: Level)
TEXTE 1. 2. REFEF 1. COUR: On con CO1 CO2	Robert Ke 2005.(Uni Daniel Ga RENCES: William A America, :	ts I, II & III y, "Compo Goddard 2003. MES: f the cours he phenor e techniqu	osite Mate Thand b Se, the st nena of notes available	erials – Decorpools of Newscape tudents anosize ble for ch	esign and lanoscies will be a land the lanascteric	hegan, "Nandapplication ence, Enginedable to general synt	oscale Sons", CRC ering and thesis tech	Press, Boo	a Ra	aton, USA, 20	Edition D14.	Press (Hander	/iley, U s IV & ' s, Unite BT Ma ighest standir	pped Level)
TEXTE 1. 2. REFEF 1. COUR: On coi	Robert Ke 2005. (Uni Daniel Ga RENCES: William A America, SE OUTCO mpletion of describe the discuss the discuss the control of the control o	ts I, II & III y, "Compo Goddard 2003. MES: f the cours he phenor e techniqu e synthesi	psite Mate , "Hand b se, the st nena of notes availables charact	erials – Dook of Note tudents anosize ble for cherization	esign and applications and applications.	hegan, "Nandapplication application application of nar	oscale Sons", CRC ering and thesis technomateria	Press, Boo	a Ra	aton, USA, 20	Edition D14.	Press (Hander	/iley, U s IV & ' s, Unite BT Ma ighest standir standir	pped Level) ng (K2)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1				1	1	1				1		
CO2	3	1	1	1	2	1	1	1				1		
CO3	3	1	1	1	2	1	1	1				1		
CO4	3	2	1	1	2	1	1	1				1		
CO5	3	2	1	1	2	1	1	1				1		

		ASSESSMEN	T PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70					100
CAT2	30	70					100
CAT3	20	80					100
ESE	20	80					100
* ±3% may be varied (0	CAT 1,2,3 – 50 mar	ks & ESE – 100 ma	arks)	<u> </u>			

Programm	e&								Sem.	Category	L	Т	Р	Credit
Branch Prerequisi	tes	Nil							VI	OE	3	1	0	4
rerequisi		IVII							•••	- OL	•	•	•	
Preamble		This co		enable t	he students t	have a	compreh	ensive	understa	anding of po	owder t	techr	nology a	and its
Unit - I			uction to											9+3
					i, monitoring nework in Indi								ns of p	ollutants-
Unit - II					d Particulate			p. 0 1.0.0			, p	-		9+3
					s pollutants-			odels,	general	characterist	ics an	d typ	es. Pa	rticulates:
Collection r	nechanis	•			on- collection onitoring	emciency								9+3
		g Progra	m, Refer	ence Me	ethods and C ling Devices					ntal Survei	llance	and	Contro	l System,
Unit - IV	· · ·	Air Pol	lution C	ontrolli	ng Equipmer	t								9+3
Incinerators suggestions				idizers,	Gravity settlii	ig chamb	ers –cla	assificat	ions, op	eration, typ	ical ap	plica	ations a	and
Suggestions Unit - V	s ioi iiiip			s and A	ir Pollution S	urvev								9+3
Hybrid syst	tems -W				ors, Dry scru		ectrosta	tically a	augmente	ed fabric fil	ters. A	ir po	llution	surveying
guidelines														
1. Lor	uis Theo arl B. I dEdition,	Schnell		Russell	re, "Air Polluti F. Dunn,									
1. Loi 2. Ka 2ni REFEREN 1. Ra 2. C.	uis Theo arl B. (dEdition, CES: o M.N. a S. Rao,	Schnell CRC Pr and Rao I Environi	e, Jr., l ess, 201 ⁻ H.V.N, "A	Russell 7 .ir Polluti		Mary E	Ellen T	Ternes	"Air Po	llution Con	trol Te	nal, 2	ology F	Handbook
1. Lor 2. Ka 2nd REFERENC 1. Ra 2. C.	uis Theo arl B. (dEdition, CES: o M.N. a S. Rao,	Schnell CRC Pr and Rao I Environi	e, Jr., l ess, 201 H.V.N, "A mentalPo	Russell 7 .ir Polluti .llution C	F. Dunn,	Mary E	Ellen T	Ternes	"Air Po	llution Con	trol Te	nal, 2	ology F	Handbook
1. Lor 2. Ka 2no REFERENCE 1. Ra 2. C. COURSE COURSE CON comple	uis Theo arl B. dedition, CES: o M.N. a S. Rao,	Schnell CRC Prond Rao In Environment Checker C	e, Jr., less, 201	Russell 7 ir Polluti illution C	F. Dunn, on", 1stEdition	Mary F	Ellen T	Ternes ternatio	"Air Po	llution Con on, India, 20 ew Age Inte	001 ernatio	nal, 2	2007 BT Map	dandbook pped Level)
1. Lor Ka 2nd REFERENCE COURSE	uis Theo arl B. a dEdition, CES: o M.N. a S. Rao, OUTCOM etion of the	Schnell CRC Pr and Rao I Environi MES: the cour e evolution	e, Jr., less, 201 H.V.N, "AmentalPose, the son proced	Russell 7 .ir Polluti ollution C tudents	F. Dunn, on", 1stEdition controlEngine will be able malyzing the	Mary En, McGranering", Resto	Ellen T w Hill Invised se	Ternes ternatio	"Air Po	llution Con on, India, 20 ew Age Inte	001 ernatio	nal, 2	2007 BT Mapighest standin	pped Level)
1. Lor Ka 2nd REFERENCE COURSE	uis Theo arl B. a dEdition, CES: o M.N. a S. Rao, OUTCOM etion of the	Schnell CRC Pr and Rao I Environi MES: the cour e evolution	e, Jr., less, 201 H.V.N, "AmentalPose, the son proced	Russell 7 .ir Polluti ollution C tudents	F. Dunn, on", 1stEdition	Mary En, McGranering", Resto	Ellen T w Hill Invised se	Ternes ternatio	"Air Po	llution Con on, India, 20 ew Age Inte	001 ernatio	nal, 2	2007 BT Mapighest	pped Level)
1. Lor Ka 2nd REFERENCE 1. Ra 2. C. COURSE CO On comple CO 1 des CO 2 exp	uis Theo arl B. (dEdition, CES: o M.N. a S. Rao, DUTCOM etion of the control of	Schnell CRC Pr and Rao I "Environi MES: the cour e evolution	e, Jr., less, 201 H.V.N, "AmentalPose, the separate of processing and processing are separated by the separate of the separat	Russell 7 ir Polluti ollution C tudents dure in a	F. Dunn, on", 1stEdition controlEngine will be able malyzing the	Mary En, McGranering", Resto	Ellen T w Hill Invised se	Ternes ternatio	"Air Po	llution Con on, India, 20 ew Age Inte	001 ernatio	nal, 2	2007 BT Mapighest standin	oped Level) g (K2) g (K2)
2. Ka 2nd REFERENCE 1. Ra 2. C. COURSE COn complete CO1 des CO2 exp	uis Theo arl B. dedition, CES: o M.N. a S. Rao, DUTCON etion of the control of th	Schnell CRC Production CRC Productio	e, Jr., less, 201 H.V.N, "AmentalPose, the son proceduristics of quality m	Russell 7 ir Polluti illution C tudents dure in a gaseous	on", 1stEditions on the second of the second	Mary En, McGradering", Restoration	w Hill Invised se	ternes ternatio econd E	"Air Po	llution Con on, India, 20 ew Age Inte	001 ernatio	I (H)	2007 BT Mapighest standin	pped Level) g (K2) g (K2)
1. Loi 2. Ka 2nc REFERENC 1. Ra 2. C. COURSE CO On comple CO1 des CO2 exp CO3 des CO4 exe	uis Theo arl B. dedition, CES: o M.N. a S. Rao, CUTCON etion of the blain the monstrate	Schnell CRC Production CRC Productio	e, Jr., less, 201 H.V.N, "AmentalPose, the sen procederistics of quality mons, appli	Russell 7 ir Polluti illution C tudents dure in a gaseous	F. Dunn, on", 1stEdition controlEngine will be able nalyzing the s pollutants a	Mary En, McGravering", Resto	w Hill Invised se	ternes ternatio econd E	"Air Po	llution Con on, India, 20 ew Age Inte	001 Pernatio U U U A	nal, 2 (H (H nder	2007 3T Mapighest standin standin standin	pped Level) g (K2) g (K2)
1. Loi 2. Ka 2no REFERENC 1. Ra 2. C. COURSE COn comple CO1 des CO2 exp CO3 des CO4 exe	uis Theo arl B. dedition, CES: o M.N. a S. Rao, CUTCON etion of the blain the monstrate	Schnell CRC Production CRC Productio	e, Jr., less, 201 H.V.N, "AmentalPose, the sen procederistics of quality mons, appli	Russell 7 ir Polluti illution C tudents dure in a gaseous	F. Dunn, on", 1stEdition controlEngine will be able nalyzing the s pollutants a g techniques ofair pollution	Mary E	w Hill Invised se	ternes ternatio econd E ed on ai	"Air Po	llution Con on, India, 20 ew Age Inte	001 Pernatio U U U A	nal, 2 (H (H nder	2007 BT Mapighest standin standin standin ng (K3)	pped Level) g (K2) g (K2)
Loi Ka 2ni REFERENCE Ra C. C. C. C. C. C. C. C	uis Theo arl B. dedition, CES: o M.N. a S. Rao, CUTCON etion of the blain the monstrate	Schnell CRC Production CRC Productio	e, Jr., less, 201 H.V.N, "AmentalPose, the sen procederistics of quality mons, appli	Russell 7 ir Polluti illution C tudents dure in a gaseous	F. Dunn, on", 1stEdition controlEngine will be able nalyzing the s pollutants a g techniques ofair pollution id systems a	Mary En, McGranering", Restorational particular control econd air pollut	w Hill Invised se	ternes ternatio econd E ed on ai	"Air Po	llution Con on, India, 20 ew Age Inte	001 Pernatio U U U A	nal, 2 (H nder nder nder nder	2007 BT Mapighest standin standin standin ng (K3)	pped Level) g (K2) g (K2) g (K2)
1. Loi 2. Ka 2ni REFERENI 1. Ra 2. C. COURSE COn comple CO1 des CO2 exp CO3 des CO4 exe CO5 exp	uis Theo arl B. dedition, CES: o M.N. a S. Rao, DUTCON etion of the blain the monstrate cute the blain the	Schnell CRC Production of Rao In Tenvironing In Tenvironing Items: the course evolution characters the air evolution concepts Items	e, Jr., less, 201 H.V.N, "AmentalPose, the seristics of quality mons, applies involved PO3 2	Russell 7 ir Polluti illution C tudents dure in a gaseous conitoring cations d in hybr	on", 1stEdition on o	m, McGranering", Restorment pollutaring pollutaring control econd air pollutaring control econd air pollutaring po	w Hill Invised se	ternation ternat	"Air Po	on, India, 20 ew Age Inte	001 Prnatio U U U U U	nal, 2 (H nder nder nder nder	2007 BT Mapighest standin standin ng (K3) standin	pped Level) g (K2) g (K2) g (K2)
1. Loi 2. Ka 2ni REFERENC 1. Ra 2. C. COURSE CO COn comple CO1 des CO2 exp CO3 des CO4 exc CO5 exp CO5/POs CO1 CO2	uis Theo arl B. dedition, CES: o M.N. a S. Rao, DUTCOM etion of the control of th	Schnell CRC Production of the Court of the C	e, Jr., less, 201 H.V.N, "AmentalPose, the seristics of quality mons, applies involved PO3 2 2	Russell 7 ir Polluti illution C tudents dure in a gaseous conitoring cations d in hybr	on", 1stEdition on o	m, McGra ering", Re to air polluta control ed aid air pollut COs with FO7 2 2	w Hill Invised se	ternation ternat	"Air Po	on, India, 20 ew Age Inte	001 Prnatio U U U U U	nal, 2 (H nder nder nder nder	2007 BT Mapighest standin standin ng (K3) standin	pped Level) g (K2) g (K2) g (K2)
1. Loi 2. Ka 2ni REFERENI 1. Ra 2. C. COURSE CO On comple CO1 dei CO2 exp CO3 dei CO4 exc CO5 exp CO5/POs CO1/POs	uis Theo arl B. dedition, CES: o M.N. a S. Rao, DUTCON etion of the control of th	Schnell CRC Production of the court of the court of the court of the court of the concepts of	e, Jr., less, 201 H.V.N, "AmentalPortage se, the se on procedurality mans, applias involved PO3 2 2 2	Russell 7 ir Polluti illution C tudents dure in a gaseous conitoring cations d in hybr	on", 1stEdition on o	m, McGranering", Reserved to air pollutare control earlier con	w Hill Invised se	ternation ternat	"Air Po	on, India, 20 ew Age Inte	001 Prnatio U U U U U	nal, 2 (H nder nder nder nder	2007 BT Mapighest standin standin ng (K3) standin	pped Level) g (K2) g (K2) g (K2)
1. Lor Ka 2nd REFERENCE 1. Ra 2. C. COURSE CON COMPLEC CO1 dec CO2 exp CO3 dec CO4 exe CO5 exp CO5/POs CO1/CO2	uis Theo arl B. dedition, CES: o M.N. a S. Rao, DUTCOM etion of the control of th	Schnell CRC Production of the Court of the C	e, Jr., less, 201 H.V.N, "AmentalPose, the sen procederistics of quality mons, applies involved PO3 2 2	Russell 7 ir Polluti illution C tudents dure in a gaseous conitoring cations d in hybr	on", 1stEdition on o	m, McGra ering", Re to air polluta control ed aid air pollut COs with FO7 2 2	w Hill Invised se	ternation ternat	"Air Po	on, India, 20 ew Age Inte	001 Prnatio U U U U U	nal, 2 (H nder nder nder nder	2007 BT Mapighest standin standin (K3) standin standin	pped Level) g (K2) g (K2) g (K2)

1 - Slight, 2 - Moderate	e, 3 - Substant	ial, BT- Bloom's	Taxonomy
--------------------------	-----------------	------------------	----------

		ASSESSMEN	T PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70					100
CAT2	30	70					100
CAT3	20	60	20				100
ESE	20	60	20				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

					22CHO05 - P	AINTS AND C	DATING	S					
Programm Branch	e&							Sem.	Category	L	Т	Р	Credit
Prerequisi	tes	Nil						VI	OE	3	1	0	4
Preamble					rface enginee	ring, chemical ace coating	conversi	on, surfa	ace coating,	elect	ro-de	positio	n coating
Unit - I			e Engine										9+
ntroduction preparation nydro-blast	select	ace engi ive surfa	neering, ce harde	scope of ening, lase	surface engiler melting, she	neering, surfact ot peening, sh	e engin ot blastii	eering to	combat of blasting, v	orrosi apor	on ar phase	nd wea e degre	r, Surfacteasing an
Unit - II		Chemi	cal Conv	version C	oating:								9+
Phosphate anodizing. (and ch Oxidatio	romate on treatme	chemical ents, Diffi	conversion usion heat	on coating – t treatment co	types and appatings and pac	olications k-cemer	s. Alumi ntation d	nium, chro ffusion coa	mic, s tings.	ulfuri	c and	hard coa
Jnit - III		Surfac	e coatin	g method	ls:								9+
lining, high aluminium a	perform	ance cera e coating	amic coa s.	ting and lii	ning, Hot dipp	ass lining, pord ing – Batch and							galvanize
Unit - IV					ing methods								9+
	ctroless	plating, a				, continuous eleverlay coatings							
Jnit - V		Design	guideli	nes for su	urface coating	g:							9+
Surface Ro	oughnes					ng Thickness, urface prepara				coatir	ng an	d other	
Surface Roconsideration TEXTBOOI 1. J.R. cor	oughnessons. K: R. Davis	s and Fir	ociates, "	Design gu	idelines for su		tion, org	anic and	I inorganic	coatir	ng an	5 + 15	r importar =60 hour
Surface Roconsideration TEXTBOOI J.R	oughnessons. K: R. Davis	s and Fir	ociates, "	Design gu	idelines for su	urface prepara	tion, org	anic and	I inorganic	coatir	ng an	5 + 15	r importar =60 hour
TEXTBOOI 1. J.R cor REFERENCE 1. Ru	K: CES: dolf Stra	and Asso ations, 20	ociates, "and the second secon	Design gu Surface E	ngineering for ology", Butter	corrosion and	wear res	anic and	d inorganic , ASM inter	To nation	otal:4	5 + 15	=60 hour
TEXTBOOI 1. J.R cor REFERENCE 1. Ru Britannia	K: R. Davis mmunica CES: dolf Stra an Griffi	and Associations, 20	ociates, "and the second secon	Surface Elunt Techning Surface	ngineering for ology", Butter	urface prepara	wear res	anic and	d inorganic , ASM inter	To nation	otal:4	5 + 15	=60 hour
TEXTBOOI 1. J.R cor REFERENCE 1. Ru 2. Bright Processing Services Course Co	K: R. Davis mmunica CES: dolf Stra an Griffi pocesses	and Associations, 20 auss, "Suiths, "Mar Modular	ociates, " 01. rface Mo nufacturii S.) (Man	Surface El unt Techn ng Surface ufacturing	ngineering for ology", Butter	r corrosion and worth-Heineman Surface Integral of the Modular)", 2001	wear res	anic and	d inorganic , ASM inter	To nation	ng an otal:4 nals a (Mai	d other 5 + 15 Ind IOM Inufacture	=60 hour
TEXTBOOI 1. J.R cor REFERENCE 1. Ru 2. Brit. Pro COURSE Con comple	K: R. Davis mmunica CES: dolf Stra an Griffi ocesses DUTCOM	and Associations, 20 auss, "Surths, "Mar Modular MES: the cour	ociates, "on the second of the	Surface Elunt Techning Surfacturing	ngineering for ology", Butter e Technology Processes M	r corrosion and worth-Heineman Surface Integral of the Modular)", 2001	wear res	sistance	d inorganic , ASM inter	To nation	ng an otal:4 nals a (Mai	d other 5 + 15 Ind IOM Inufacture BT Mapighest	=60 hour
TEXTBOOI 1. J.R cor REFERENCE 1. Ru 2. Britan Pro COURSE COn comple	K: R. Davis mmunica CES: dolf Stra an Griffi ocesses DUTCOM blain the	and Associations, 20 auss, "Suiths, "Mar Modular basics of	ociates, "and oc	Surface Elunt Techning Surfacturing	ngineering for ology", Butter e Technology Processes Mull be able to ng and surfac	r corrosion and worth-Heinemar Surface Integrated Modular)", 2001	wear res	anic and	d inorganic ASM inter 994 Perforn	To nation	ng an otal:4 nals a (Mar (H	5 + 15 Ind IOM Inufacture BT Mapinghest erstand	=60 hour
TEXTBOOI 1. J.R cor REFERENCE 1. Ru 2. Britan Pro COURSE Of COURSE Of COURSE COUR	K: R. Davis mmunica CES: dolf Stra an Griffi ocesses DUTCON etion of olain the	and Associations, 20 auss, "Suiths, "Mar Modular MES: the cours basics of	ociates, "ociates, "ociate	Surface Elunt Techning Surfacturing	ngineering for ology", Butter e Technology Processes Mill be able to ng and surfaces of different of	corrosion and worth-Heinema Surface Integrated Integrat	wear res	sistance' isher, 19 I Function	d inorganic ASM inter 994 Perforn	To nation	otal:4 nals a (Mai	5 + 15 nd IOM nufactu BT Mapighest erstanderstan	=60 hour furing pped Level) ding (K2)
TEXTBOOI 1. J.R cor REFERENCE 1. Ru 2. Brit. Pro COURSE CO On comple CO1 exp CO2 illust CO3	K: R. Davis mmunica CES: dolf Stra an Griffi ocesses DUTCON etion of blain the scribe th	and Associations, 20 auss, "Surths, "Mar Modular MES: the course basics of the principal	ociates, "old. Inface Monufacturings.) (Manufacturings)	Surface Elunt Techning Surfacturing Students vengineeri	ngineering for ology", Butter e Technology Processes Mwill be able to ng and surfacts of different of sof different s	corrosion and worth-Heineman Surface Integrated Integra	wear res	sistance' isher, 19 I Function	d inorganic ASM inter 994 Perforn	To nation	otal:4 nals a (Man (H Und	d other 5 + 15 Ind IOM nufactu BT Mapighest erstand erstand	=60 hour end end end end end end end en
TEXTBOOI 1. J.R. cor REFERENCE 1. Ru 2. Brit. Pro COURSE COn complete CO1 exp CO2 illust CO3 exp	K: R. Davis mmunica CES: dolf Stra an Griffi ocesses DUTCOM blain the scribe th	and Associations, 20 auss, "Surths, "Mar Modular basics or e principle principle	ociates, "only ociate	Surface E unt Techn ng Surface unfacturing students v engineeri application	ngineering for ology", Butter e Technology Processes Mill be able to ng and surfacts of different of various sur	corrosion and worth-Heineman Surface Integrated Integra	wear resonann Publication, organn Publication and the control of t	anic and sistance lisher, 19 I Function ating means.	d inorganic d ASM inter 994 enal Perform	nation	ng an otal:4 nals a (Mar (H Und Und Und	d other 5 + 15 Ind IOM nufactu BT Mapighest erstanders	=60 hour =60 hour Iring Deed Level) ding (K2) ding (K2)
TEXTBOOI 1. J.R. cor REFERENCE 1. Ru 2. Brit. Pro COURSE CO On complete CO1 exp CO2 illust CO3 exp	K: R. Davis mmunica CES: dolf Stra an Griffi ocesses DUTCOM blain the scribe th	and Associations, 20 auss, "Surths, "Mar Modular basics or e principle principle	ociates, "only ociate	Surface Elunt Techning Surfacturing students verification in polications elines and	ngineering for ology", Butter e Technology Processes Mill be able to ng and surfacts of different of various surfacts of various surface prep	corrosion and co	wear reseann Publication, organn Publication and methods.	anic and sistance lisher, 19 I Function ating means.	d inorganic d ASM inter 994 enal Perform	nation	ng an otal:4 nals a (Mar (H Und Und Und	d other 5 + 15 Ind IOM nufactu BT Mapighest erstanders	=60 hour =60 hour furing pped Level) ding (K2) ding (K2) ding (K2)
TEXTBOOI 1. J.R cor REFERENCE 1. Ru 2. Britan Pro COURSE COn comple CO1 exp CO2 illus CO3 exp	K: R. Davis mmunica CES: dolf Stra an Griffi ocesses DUTCOM blain the scribe th	and Associations, 20 auss, "Surths, "Mar Modular basics or e principle principle	ociates, "only ociate	Surface Elunt Techning Surfacturing students verification in polications elines and	ngineering for ology", Butter e Technology Processes Mill be able to ng and surface s of different s of various surface prep	corrosion and worth-Heineman Surface Integration records a continuation of the continu	wear reseann Publication, organn Publication and methods.	anic and sistance lisher, 19 I Function ating means.	d inorganic d ASM inter 994 enal Perform	nation	ng an otal:4 nals a (Mai (Mai Und Und Und	d other 5 + 15 Ind IOM nufactu BT Mapighest erstanders	=60 hour =60 hour furing pped Level) ding (K2) ding (K2) ding (K2)
TEXTBOOI 1. J.R. cor REFERENCE 1. Ru 2. Brit. Pro COURSE CO On comple CO1 des CO2 illus CO3 exp CO4 der CO5 der	K: R. Davis mmunica CES: dolf Stra an Griffin ocesses DUTCOM etion of olain the scribe the strate the olain the monstrate the monstrate the olain the strate the olain the	and Associations, 20 auss, "Surths, "Mar Modular MES: the cour basics of e principle e principle te the des	ociates, "sociates, "s	Surface Elunt Techning Surfacturing students verification in polications elines and	ngineering for ology", Butter e Technology Processes Mill be able to ng and surfacts of different of various surfacts of various surface prep	corrosion and co	wear resonann Publication, organn Publication and Publication comethods. It is is a second or the second publication and publ	anic and sistance lisher, 19 I Function ating measures.	d inorganic d inorganic d ASM inter p94 nal Perform ethods.	To nation	ng an otal:4 nals a (Mai (Mai Und Und Und	d other 5 + 15 Ind IOM Inufactur BT Mapighest erstance erstance erstance erstance erstance	=60 hour
TEXTBOOI 1. J.R cor REFERENCE 1. Ru 2. Brit. Pro COURSE CO On comple CO1 exp CO2 illus CO3 exp CO4 der CO5 COS/POs	K: R. Davis mmunica CES: dolf Stra an Grifficocesses DUTCON etion of colain the scribe the strate the colain the monstra:	and Associations, 20 auss, "Suiths, "Mar Modular MES: the course basics of the principle principle te the des	pociates, "solution of the second of the sec	Surface Elunt Techning Surfacturing students verification in polications elines and	ngineering for ology", Butter e Technology Processes Mill be able to ng and surfacts of different of various surfacts of various surface prep	corrosion and worth-Heineman Surface Integration rechemical conversariation method of the properties o	wear resonann Publication, organn Publication and Publication comethods. It is is a second or the second publication and publ	anic and sistance lisher, 19 I Function ating measures.	d inorganic d inorganic d ASM inter p94 nal Perform ethods.	To nation	ng an otal:4 nals a (Mai (Mai Und Und Und	d other 5 + 15 Ind IOM Inufactur BT Mapighest erstance erstance erstance erstance erstance	=60 hour

CO4	3	2	1		1				
CO5	3	2	3		1				

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	50					100
CAT2	50	50					100
CAT3	30	70					100
ESE	30	70					100

 $^{^{\}star}$ ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Programr Branch	ne&							Sem.	Category	L	т	Р	Credit
Prerequis	ites	Nil						VI	OE	3	1	0	4
Preamble			ourse will e	enable the	students to	have a compi	ehensive	underst	anding of po	wder	techi	nology	and its
		rticle Si	ze Distrib	oution, Av	erage Parti	easurement cle Size, Siz am scanning r							
Unit - II		Partic	e shape C	Character	ization and	Measuremer	t						,
Particle Do	ensity, Me	easurem	ent Method	d for Parti	cle Density,	ve Size, Geo Hardness, Sti surement of T	ffness an	d Tough					
Unit - III		Funda	mental Pr	roperties	of Particles								
Sedimenta Electropho	ation, Set oresis, Pa	tling of T article De on, Solul	wo Spheri position a pility and D	ical Partic and Reent Dissolution	les, Rate of rainment, A	, Light Extinon Sedimentation gglomeration,	n in Cond	entrated	Suspension	, Par	ticle	Electrif	ication and
Surface M	odificatio	n, metho	ds, Microe	encapsula		eaction, Cryst nocoating, Po							
Unit - V	zation of			i tooonii ao									
Deposited Types of I	Particles Respirato	to Partic , Health rs, Air-P	le Matter, Effects of I urifying Re	Respirato Inhaled Pa espirators	tective devi ry System, F articles, Thre , Atmospher	ces Penetration are shold Limit Value of the control of the contro	lue, Res Respirato	piratory rs, Prote	Protective Dection	evices	for l	⊃articu	late Matte gnition and
Deposited Types of I Dust Explo TEXTBOO	Particles Respirato psion Med OK: roaki Mas	to Partic , Health rs, Air-P chanism	le Matter, Effects of I urifying Re and Preve	Respirato Inhaled Pa espirators ention, App	tective devi ry System, F articles, Thre , Atmospher olications to i	Penetration areshold Limit Value Fundation	alue, Res Respirato esses an	piratory rs, Prote d equipr	Protective De ction Factor nent.	evices Spo	for I	Particu eous Iç	act, Fate of late Matte gnition and Total:4
Deposited Types of I Dust Explo	Particles Respirato psion Med OK:	to Partic , Health rs, Air-P chanism	le Matter, Effects of I urifying Re and Preve	Respirato Inhaled Pa espirators ention, App	tective devi ry System, F articles, Thre , Atmospher olications to i	Penetration ar shold Limit Va e-Supplying F ndustrial prod	alue, Res Respirato esses an	piratory rs, Prote d equipr	Protective De ction Factor nent.	evices Spo	for I	Particu eous Iç	act, Fate of late Matte gnition and Total:4
TEXTBOC 1. Hi 20 REFEREN	Particles Respirato psion Med OK: roaki Mas 006.	to Partic , Health rs, Air-P chanism uda, KoH	le Matter, Effects of I urifying Re and Prever	Respirato Inhaled Pa espirators ention, App Hideto Yosl	tective devi ry System, F articles, Thre , Atmospher olications to i	Penetration ar shold Limit Va e-Supplying F ndustrial prod	Alue, Res Respirato esses an	piratory rs, Prote d equipr ok, 3 rd ec	Protective Decision Factor nent.	evices , Spo ress,	s for I	Particu eous Ig or Fran	act, Fate c late Matte gnition and Total:4
TEXTBOC 1. Hi 20 REFEREN 1. A 21 M	Particles Respirato psion Med OK: roaki Mas 006. ICES: gba D. Sa 006.	to Partic , Health rs, Air-P chanism uda, KoH	le Matter, Effects of I urifying Re and Prever igashitani, I	Respirato Inhaled Pa espirators, ention, App Hideto Yosl unslow, Jo	tective devi ry System, F articles, Thre Atmospher olications to i hida, Powder	Penetration are shold Limit Value-Supplying Food and strial process of Technology Seville, Hand	Alue, Res Respirato esses an Hand boo book of p	piratory rs, Prote d equipr ok, 3 rd ec	Protective Dection Factor nent.	ress,	Tayl	Particu eous Ig or Fran	act, Fate of late Matte gnition and Total:4 nois Group
TEXTBOO 1. Hi 20 REFEREN 1. A 20 2. M	Particles Respirato psion Med OK: roaki Mas 006. ICES: gba D. Sa 006. uhamma	to Partic , Health rs, Air-P chanism uda, KoH alman, M	le Matter, Effects of I urifying Re and Prever igashitani, I	Respirato Inhaled Pa espirators ention, App Hideto Yosl unslow, Jo	tective devi ry System, F articles, Thre Atmospher olications to i hida, Powder	Penetration ar shold Limit Va e-Supplying F ndustrial prod	Alue, Res Respirato esses an Hand boo book of p	piratory rs, Prote d equipr ok, 3 rd ec	Protective Dection Factor nent.	ress,	Tayl	Particu eous Ig or Fran	act, Fate clate Matte gnition and Total:4
TEXTBOO 1. Hi 20 REFEREN 1. A 20 2. M P COURSE	Particles Respirato psion Med OK: roaki Mas 006. ICES: gba D. Sa 006. uhamma ublishing,	to Partic , Health rs, Air-P chanism uda, KoH alman, M d E. Faye Chapma	le Matter, Effects of I urifying Re and Prever igashitani, F ichael Hou ed, Lambe an & Hall,	Respirato Inhaled Pa espirators ention, App Hideto Yosh unslow, Jo ert Otten, F 1997	tective devi ry System, F articles, Thre Atmospher olications to i hida, Powder	Penetration ar shold Limit Value-Supplying Findustrial production of Technology Seville, Hand findustrial production of Technology	Alue, Res Respirato esses an Hand boo book of p	piratory rs, Prote d equipr ok, 3 rd ec	Protective Dection Factor nent.	ress,	Tayl Gran	Particuleous Igeous Ige	act, Fate of late Matte gnition and Total:4
TEXTBOO 1. Hi 20 REFEREN 1. 20 2. M P COURSE On compl	Particles Respirato psion Med OK: roaki Mas 006. ICES: gba D. Sa 006. uhamma ublishing. OUTCOM etion of	to Partic , Health rs, Air-P chanism uda, KoH alman, M d E. Faye Chapma	le Matter, Effects of I urifying Re and Preven igashitani, I ichael Hou ed, Lambe an & Hall,	Respirato Inhaled Pa espirators ention, App Hideto Yosh unslow, Jo ert Otten, H 1997	tective devi ry System, F articles, Thre Atmospher plications to i hida, Powder nathan P.K. Hand book o	Penetration ar shold Limit Value-Supplying Findustrial production of Technology Seville, Hand findustrial production of Technology	Alue, Res Respirato esses an Hand boo book of p	piratory rs, Prote d equipr ok, 3 rd ec	Protective Dection Factor nent.	ress,	Gran	Particueous Igeous Igeo	act, Fate of late Matte gnition and Total:4 Total:4 nois Group n, Elsevier pmson
TEXTBOO 1. Hi 20 REFEREN 1. A 20 2. M P COURSE On compl	Particles Respirato psion Med OK: roaki Mas 006. ICES: gba D. Sa 006. uhamma ublishing, etion of escribe va	to Partic , Health rs, Air-P chanism uda, KoH alman, M d E. Faye Chapma MES: the cour	le Matter, Effects of I urifying Re and Prever igashitani, F ichael Hou ed, Lambe an & Hall,	Respirato Inhaled Pa espirators espirators ention, App Hideto Yosl unslow, Jo ert Otten, H 1997 udents w characteri	tective devi ry System, F articles, Three Atmospher Ilications to i hida, Powder nathan P.K. Hand book of ill be able to stics and its	Penetration are shold Limit Value-Supplying Findustrial process of Technology Seville, Hand findustrial process of the powder scies of the powder	Alue, Res Respirato esses an Hand boo book of p	piratory rs, Prote d equipr bk, 3 rd ecc cowder tecchnology	Protective Dection Factor nent.	ress,	Tayl Grainatio (H	Particuleous Igeous Ige	Total:4 Total:4 ncis Group n, Elsevier pmson pped Level)
TEXTBOO 1. Hi 20 REFEREN 1. A 20 2. M P COURSE On compl CO1 de CO2 ex	Particles Respirato psion Med OK: roaki Mas 206. ICES: gba D. Sa 206. uhamma ublishing, etion of escribe va cplain diff	to Partice, Health rs, Air-Pchanism uda, KoH alman, M chapma	le Matter, Effects of I urifying Re and Preven igashitani, I ichael Hou ed, Lambe an & Hall, rise, the str	Respirato Inhaled Pa espirators espirators ention, App Hideto Yosl unslow, Jo ert Otten, H 1997 udents w characteri e characteri	tective devi ry System, F articles, Three Atmospher Ilications to i hida, Powder nathan P.K. Hand book of ill be able to stics and its	Penetration are shold Limit Value-Supplying Findustrial production of Technology Seville, Hand findustrial production of Powder science of the powder sci	Alue, Res Respirato esses an Hand boo book of p	piratory rs, Prote d equipr bk, 3 rd ecc cowder tecchnology	Protective Dection Factor nent.	ress, U	Tayl Gran natio (H	Particuleous Igeous Ige	Total:4 Total:4 Total:4 Total:4 Total:4 Total:4 Total:4 Total:4 Total:4
Deposited Types of I Dust Explo 1. Hi 20 REFEREN 1. A 20 2. M P COURSE On compl CO1 de CO2 e) CO3 su	Particles Respirato psion Med OK: roaki Mas 206. ICES: gba D. Sa 206. uhamma ublishing. OUTCOM escribe va coplain diff ummarize	to Partice , Health rs, Air-P chanism uda, KoH alman, M d E. Faye Chapma fies: the cour arious pa erent par	le Matter, Effects of I urifying Re and Preven igashitani, I- ichael Hou ed, Lambe an & Hall, rticle size of	Respirato Inhaled Pa espirators ention, App Hideto Yosl unslow, Jo ert Otten, H 1997 cudents w characteri e characteri tal properi	ry System, Farticles, Three, Atmospher, Atmospher polications to in thick, Powder and book of the able to estics and its eristics and its ties of particles.	Penetration are shold Limit Value-Supplying Findustrial production of Technology Seville, Hand findustrial production of Powder science of the powder sci	Hand book of part techniquent metho	piratory rs, Prote d equipr bk, 3 rd ecc cowder tecchnology	Protective Dection Factor nent.	ress, bil 11, Intern U U	Tayl Gran natio (H nder	Particuleous Igeous Ige	Total:4 Tot
Deposited Types of I Dust Explo 1. Hi 20 REFEREN 1. 20 2. M P COURSE On compl CO1 de CO2 e3 CO3 su CO4 e3	Particles Respirato psion Med OK: roaki Mas 006. ICES: gba D. Sa 006. uhamma ublishing, OUTCOM escribe va cplain diff ummarize cplain the	to Partice, Health rs, Air-Pchanism uda, KoH alman, M d E. Faye Chapma described arious particus particus particus particus fundamental described arious particus fundamental described arious	le Matter, Effects of I urifying Re and Prevei igashitani, I ichael Hou ed, Lambe an & Hall, ricle size of ticle shape fundament entals of te	Respirato Inhaled Pa espirators espirators ention, App Hideto Yosl unslow, Jo ert Otten, H 1997 cudents w characteri e characte echniques	ry System, Farticles, Three, Atmospher, Ilications to inhida, Powder and hida, Powder and book of the able to stics and its eristics and its available for available for systems.	Penetration are shold Limit Value-Supplying Findustrial process of the short of the	alue, Res Respirato esses an Hand boo book of p nce & Teo	piratory rs, Prote d equipr ok, 3 rd ec	Protective Dection Factor nent.	ress, DI 11, Intern U U U	Tayl Gran matio (H nder	Particue eous Igeous Ig	Total:4 Tot
Deposited Types of I	Particles Respirato psion Med OK: roaki Mas 006. ICES: gba D. Sa 006. uhamma ublishing. OUTCOM etion of escribe va cplain diff ummarize cplain the escribe he	to Partice, Health rs, Health rs, Air-Pchanism uda, KoH alman, M d E. Faye Chapma field the court arious parent particular various fundame ealth haz	le Matter, Effects of I urifying Re and Prevel igashitani, I ichael Hou ed, Lambe an & Hall, rticle size of tricle shape fundament entals of te ards of por	Respirato Inhaled Pa espirators espirators ention, App Hideto Yosl unslow, Jo ert Otten, H 1997 udents w characteri e characteri echniques wders, its	ry System, Farticles, Three, Atmospher, Ilications to inhida, Powder mathan P.K. Hand book of the able to stics and its eristics and its available for health effect lapping of Carticles of Carticles and Its available for health effect lapping of Carticles and Its available for	Penetration are shold Limit Value-Supplying For ndustrial proof. Technology Seville, Hand for powder scie measurements measurements are surements and protects and protects.	Hand book of proce & Techniquent methodoxidation	piratory rs, Prote d equipr bk, 3 rd ec chnology ues ds	Protective Dection Factor nent.	ress, Interi	Tayl Grainatio (H nder nder	Particuleous Igeous Ige	act, Fate of late Matter gnition and Total:4 To
Deposited Types of I Dust Explo 1. Hi 20 REFEREN 1. 20 2. M P COURSE On compl CO1 de CO2 e3 CO3 su CO4 e3	Particles Respirato psion Med OK: roaki Mas 006. ICES: gba D. Sa 006. uhamma ublishing. OUTCOM etion of escribe va cplain diff ummarize cplain the escribe he	to Partice, Health rs, Air-Pchanism uda, KoH alman, M d E. Faye Chapma described arious particus particus particus particus fundamental described arious particus fundamental described arious	le Matter, Effects of I urifying Re and Prevei igashitani, I ichael Hou ed, Lambe an & Hall, ricle size of ticle shape fundament entals of te	Respirato Inhaled Pa espirators espirators ention, App Hideto Yosl unslow, Jo ert Otten, H 1997 udents w characteri e characteri echniques wders, its	ry System, Farticles, Three, Atmospher olications to in thick the street of particles and its eristics and its available for health effect.	Penetration are shold Limit Value-Supplying Findustrial process of the short of the	Hand book of proce & Techniquent methodoxidation	piratory rs, Prote d equipr ok, 3 rd ecc owder te chnology ues ds	Protective Dection Factor nent.	ress, DI 11, Intern U U U	Tayl Grainatio (H nder nder	Particue eous Igeous Ig	act, Fate of late Matte gnition and Total:4 Total:4 ncis Group n, Elsevier pmson pped Level) ng (K2) ng (K2) ng (K2)
Deposited Types of I	Particles Respirato psion Med OK: roaki Mas 006. ICES: gba D. Sa 006. uhamma ublishing. OUTCOM etion of escribe va cplain diff ummarize cplain the escribe he	to Partice, Health rs, Health rs, Air-Pchanism uda, KoH alman, M d E. Faye Chapma field the court arious parent particular various fundame ealth haz	le Matter, Effects of I urifying Re and Prevel igashitani, I ichael Hou ed, Lambe an & Hall, rticle size of tricle shape fundament entals of te ards of por	Respirato Inhaled Pa espirators espirators ention, App Hideto Yosl unslow, Jo ert Otten, H 1997 udents w characteri e characteri echniques wders, its	ry System, Farticles, Three, Atmospher, Ilications to inhida, Powder mathan P.K. Hand book of the able to stics and its eristics and its available for health effect lapping of Carticles of Carticles and Its available for health effect lapping of Carticles and Its available for	Penetration are shold Limit Value-Supplying For ndustrial proof. Technology Seville, Hand for powder scie measurements measurements are surements and protects and protects.	Hand book of proce & Techniquent methodoxidation	piratory rs, Prote d equipr bk, 3 rd ec chnology ues ds	Protective Dection Factor nent.	ress, Interi	Tayl Grainatio (H nder nder	Particuleous Igeous Ige	Total:4 Tot

CO3	3									
CO4	3	2			2				1	
CO5	3	1	3		3	3			2	

Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
30	70					100
30	70					100
30	70					100
30	70					100
	(K1) % 30 30 30	(K1) % (K2) % 30 70 30 70 30 70	(K1) % (K2) % (K3) % 30 70 30 70 30 70	(K1) % (K2) % (K3) % (K4) % 30 70 30 70 30 70	(K1) % (K2) % (K3) % (K4) % (K5) % 30 70 30 70 30 70	(K1) % (K2) % (K3) % (K4) % (K5) % (K6) % 30 70 30 70 30 70 30 70

 $^{^{\}star}$ ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

						,, 1001 – F	HYDROGE	LINENU	• •							
Progra Branc	amme& h								Sem.	Categor	y L	-	Т	Р	Credit	:
Prerec	quisites	Nil							7	PE	3	3	0	0	3	
Pream		utilizati	on, and sa	afety.				energy a	s energy	systems,	prod	duct	ion p	roce	sses, stora	
Unit -			uction of					information .		.:		م مرام				
	gen pathwa sing and uti							inirastruc	ture req	uirement i	or nyo	aro	gen p	roau	ction, stora	ge
Unit -			gen Prodi													
	al-Steam R															tio
	ds; Electroc organisms	nemical, E	ectrolysis	s, Photo	electro	chemical	I; Biologica	al, Photo E	Biological	; Anaerob	ic Dig	gest	ion, F	-erme	entative	
Unit -		Hydro	gen Stora	ige												
	al and cher								Compo	site cylinde	ers, G	3las	s mid	cro s	phere stora	ige
∠eolite Unit -	es, Metal hyd		ge, chemi gen Utiliz		ide stora	ige and c	ryogenic s	torage.								
	ew of Hydro				gas turb	oines, hvd	drogen buri	ners, powe	r plant. r	efineries, c	lomes	stic	and r	narin	e applicatio	ons
Hydrog	gen fuel qua	lity, perfor	mance, C	OV, em	ission ar	nd combu	ustion char	racteristics								
knocki Unit -	ng, volumet		cy, hydrog gen Safet		ifold and	d direct inj	jection, fur	nigation,								
				•	h a a dlin a	and rafu	alina atatia	n aafatui	o vobioul	ar and stat	ionor		anlina	tiono	fire detec	4i.c.
	barrier diag n, safety ma						eing static	m, salety i	n venicui	ar and star	lionar	y a _l	opiica	llions	s, lire detec	'III (
	<i>'</i>															
															Tota	1.4
TEVT	D001/														Tota	1:4
	воок:															
		all and Ma	rtin Wietso		ne Hydro	ogen Ecor	поту Орро	ortunities a	ınd Chall	enges", Ca	ambrio	dge	Univ	ersity	Tota / Press, 20	
1.		all and Ma	rtin Wietso		ne Hydro	ogen Ecor	nomy Oppo	ortunities a	ınd Chall	enges", Ca	ambrio	dge	Univ	ersity		
1. REFEI	Michael B			chel, "Tr							ambrio	dge	Univ	ersity		
1. REFEI 1.	Michael B RENCES: Bent Sore	nsen, Gius	seppe Spa	chel, "Th	o; "Hydro	ogen and	I Fuel Cells	s", 3 rd Editio	n, Elsev	ier, 2018					/ Press, 20	09
1. REFEI 1.	Michael B RENCES: Bent Sore	nsen, Gius	seppe Spa	chel, "Th	o; "Hydro	ogen and	I Fuel Cells	s", 3 rd Editio	n, Elsev	ier, 2018						09
1. REFEI 1.	Michael B RENCES: Bent Sore	nsen, Gius	seppe Spa	chel, "Th	o; "Hydro	ogen and	I Fuel Cells	s", 3 rd Editio	n, Elsev	ier, 2018					/ Press, 20	09
1. REFEI 1. 2. COUR	Michael B RENCES: Bent Sore Bockris. J	nsen, Gius O.M, "Ene MES:	seppe Spa	chel, "Tr azzafum ns: real e	o; "Hydro	ogen and	I Fuel Cells	s", 3 rd Editio	n, Elsev	ier, 2018			ndon	publi	y Press, 20 sher, 1980	09
1. REFEI 1. 2. COUR On co	Michael B RENCES: Bent Sore Bockris. J SE OUTCO	nsen, Gius O.M, "Ene MES: the cours	seppe Spa ergy option se, the stu	chel, "Thazzafum ns: real e	o; "Hydro economic will be a	ogen and	I Fuel Cells	s", 3 rd Editio	n, Elsev	ier, 2018			ndon (H	publi BT M ighe	/ Press, 20 sher, 1980 lapped st Level)	09
1. REFEI 1. 2. COUR On co	Michael B RENCES: Bent Sore Bockris. J	nsen, Gius O.M, "Ene MES: the cours	seppe Spa ergy option se, the stu	chel, "Thazzafum ns: real e	o; "Hydro economic will be a	ogen and	I Fuel Cells	s", 3 rd Editio	n, Elsev	ier, 2018			ndon (H	publi BT M ighe	y Press, 20 sher, 1980	09
1. REFEI 1. 2. COUR On co CO1	Michael B RENCES: Bent Sore Bockris. J SE OUTCO	O.M, "Ene	seppe Sparergy option se, the study of hydroger	chel, "The azzafum his: real equipments with the control of the co	o; "Hydro economic will be a	ogen and	I Fuel Cells	s", 3 rd Editio	n, Elsev	ier, 2018			ndon (H Und	publi BT M ighe	/ Press, 20 sher, 1980 lapped st Level)	09
1. REFEI 1. 2. COUR On co CO1 CO2	Michael B RENCES: Bent Sore Bockris. J SE OUTCO mpletion of explain th describe t	MES: the course basics of	seppe Spa ergy option se, the stu f hydroger	chel, "The azzafum ns: real e	o; "Hydro economic will be a ays	ogen and cs and the	l Fuel Cells e solar hyd	", 3 rd Editio	on, Elsev tem", Ha	ier, 2018 Isted Pres			ndon (H Und	publi BT M ighe	sher, 1980 lapped st Level) anding (K2)	09
1. REFEI 1. 2. COUR On co CO1 CO2	Michael B RENCES: Bent Sore Bockris. J SE OUTCO mpletion of explain th describe t	MES: the course basics of	seppe Spa ergy option se, the stu f hydroger	chel, "The azzafum ns: real e	o; "Hydro economic will be a ays	ogen and cs and the	I Fuel Cells	", 3 rd Editio	on, Elsev tem", Ha	ier, 2018 Isted Pres			ndon (H Und	publi BT M ighe	y Press, 20 sher, 1980 lapped st Level)	09
1. REFEI 1. 2. COUR On co CO1 CO2 CO3	Michael B RENCES: Bent Sore Bockris. J SE OUTCO mpletion of explain th describe t illustrate t	MES: the course basics of the difference chemic	seppe Spa ergy option se, the stu f hydrogen ut production	chel, "The azzafum hs: real equipments to pathwa on processical pr	o; "Hydro economic will be a ays esses	ogen and the shift of the shift	I Fuel Cells e solar hyd e required	", 3 rd Editio	on, Elsev tem", Ha	ier, 2018 Isted Pres			(H Und Und	publi BT M ighe lersta lersta	sher, 1980 lapped st Level) anding (K2) anding (K2)	09
1. REFEI 1. 2. COUR On co CO1 CO2 CO3 CO4	Michael B RENCES: Bent Sore Bockris. J SE OUTCO mpletion of explain th describe t illustrate t discuss m	MES: the course basics of the chemic ajor utiliza	seppe Spacergy option se, the str f hydroger at production al and phy tion of hydrogen	chel, "The azzafum his: real equipments on pathway con processical produced by the control of th	o; "Hydro economic will be a ays esses operties energy in	ogen and the able to which are	I Fuel Cells e solar hyd e required	", 3 rd Editio	on, Elsev tem", Ha	ier, 2018 Isted Pres			(H Und Und Und	publi BT M ighe ersta	sher, 1980 lapped st Level) anding (K2) anding (K2) anding (K2) anding (K2)	09
1. REFEI 1. 2. COUR On co CO1 CO2 CO3 CO4	Michael B RENCES: Bent Sore Bockris. J SE OUTCO mpletion of explain th describe t illustrate t	MES: the course basics of the chemic ajor utiliza	seppe Spacergy option se, the str f hydroger at production al and phy tion of hydrogen	chel, "The azzafum his: real equipments on pathway con processical produced by the control of th	o; "Hydro economic will be a ays esses eperties energy in	ogen and the able to which are various sols	I Fuel Cells e solar hyd e required sectors	s", 3 rd Edition drogen sys	e of Hydro	ier, 2018 Isted Pres			(H Und Und Und	publi BT M ighe ersta	sher, 1980 lapped st Level) anding (K2) anding (K2)	09
1. REFEI 1. 2. COUR On co CO1 CO2 CO3 CO4 CO5	Michael B RENCES: Bent Sore Bockris. J SE OUTCO mpletion or explain th describe t illustrate t discuss m explain va	MES: the course basics of the chemic ajor utiliza	seppe Spacergy option se, the stu f hydroger at production al and phy tion of hydrogen	chel, "The azzafum his: real example on processical produced rogen example on safet	o; "Hydro economic will be a ays esses eperties energy in y protoco Mapp	ogen and the shall be to which are various sols	e required sectors	os and Ps	on, Elsev tem", Ha	ier, 2018 Isted Press	s and	Loi	(H Und Und Und	publi BT M ighe ersta ersta ersta ersta	sher, 1980 lapped st Level) anding (K2) anding (K2) anding (K2) anding (K2)	09
1. REFEI 1. 2. COUR On co CO1 CO2 CO3 CO4	Michael B RENCES: Bent Sore Bockris. J SE OUTCO mpletion or explain th describe t illustrate t discuss m explain va	MES: the course basics of the chemic ajor utiliza	seppe Spacergy option se, the str f hydroger at production al and phy tion of hydrogen	chel, "The azzafum his: real equipments on pathway con processical produced by the control of th	o; "Hydro economic will be a ays esses eperties energy in	ogen and the shape of Colors of Colo	I Fuel Cells e solar hyd e required sectors	os and Ps	e of Hydro	ier, 2018 Isted Pres		Loi	(H Und Und Und	publi BT M ighe ersta	sher, 1980 lapped st Level) anding (K2) anding (K2) anding (K2) anding (K2)	09
1. REFEI 1. 2. COUR On co CO1 CO2 CO3 CO4 CO5	Michael B RENCES: Bent Sore Bockris. J SE OUTCO mpletion of explain th describe t illustrate t discuss m explain va	MES: the course basics of the chemic ajor utiliza	seppe Spacergy option se, the stu f hydroger at production al and phy tion of hydrogen	chel, "The azzafum his: real example on processical produced rogen example on safet	o; "Hydro economic will be a ays esses eperties energy in y protoco Mapp	ogen and the shall be to which are various sols	e required sectors	os and Ps	on, Elsev tem", Ha	ier, 2018 Isted Press	s and	1 Loi	(H Und Und Und	publi BT M ighe ersta ersta ersta ersta	sher, 1980 lapped st Level) anding (K2) anding (K2) anding (K2) anding (K2)	09
1. REFEI 1. 2. COUR On co CO1 CO2 CO3 CO4 CO5	Michael B RENCES: Bent Sore Bockris. J SE OUTCO mpletion of explain th describe t illustrate t discuss m explain va POS PO1 1 3	MES: the course basics of the chemic the chemic the chemic that is a property of the chemical that is a property of the chemic that is a property of the chemic that is a property of the chemical that is a property of	seppe Spacergy option se, the stu f hydroger at production al and phy tion of hydrogen	chel, "The azzafum his: real example on processical produced rogen example on safet	o; "Hydro economic will be a ays esses eperties energy in y protoco Mapp	ogen and the shall be to which are various sols	e required sectors	os and Ps	on, Elsev tem", Ha	ier, 2018 Isted Press	s and	1 Lor	(H Und Und Und	publi BT M ighe ersta ersta ersta ersta	sher, 1980 lapped st Level) anding (K2) anding (K2) anding (K2) anding (K2)	09
1. REFEI 1. 2. COUR On co CO1 CO2 CO3 CO4 CO5 COs/I	Michael B RENCES: Bent Sore Bockris. J SE OUTCO mpletion of explain th describe t discuss m explain va POS PO1 1 3 2 3	MES: the course basics of the chemic ajor utilizatious risk serious 2	seppe Spacergy option se, the stu f hydroger at production al and phy tion of hydrogen	chel, "The azzafum his: real example on processical produced rogen example on safet	o; "Hydro economic will be a ays esses eperties energy in y protoco Mapp	ogen and the shall be to which are various sols	e required sectors	os and Ps	on, Elsev tem", Ha	ier, 2018 Isted Press	s and	12	(H Und Und Und	publi BT M ighe ersta ersta ersta ersta	sher, 1980 lapped st Level) anding (K2) anding (K2) anding (K2) anding (K2)	09
1. REFEI 1. 2. COUR On co CO1 CO2 CO3 CO4 CO5 COs/F	Michael B RENCES: Bent Sore Bockris. J SE OUTCO mpletion of explain th describe t illustrate t discuss m explain va POS PO1 1 3 2 3 3 3	MES: the course basics of the chemic ajor utilizations risk at the course of the chemic ajor utilizations risk at the chemic alientations risk at the chemic ajor utilizations risk at the chemic alientations risk at the chemic	seppe Spacergy option se, the stu f hydroger at production al and phy tion of hydrogen	chel, "The azzafum his: real example on processical produced rogen example on safet	o; "Hydro economic will be a ays esses eperties energy in y protoco Mapp	ogen and the shall be to which are various sols	e required sectors	os and Ps	on, Elsev tem", Ha	ier, 2018 Isted Press	PO1	112	(H Und Und Und	publi BT M ighe ersta ersta ersta ersta	sher, 1980 lapped st Level) anding (K2) anding (K2) anding (K2) anding (K2)	09
1. REFEI 1. 2. COUR On co CO1 CO2 CO3 CO4 CO5 CO6/F CO CO	Michael B RENCES: Bent Sore Bockris. J SE OUTCO mpletion of explain th describe t discuss m explain va POS PO1 1 3 2 3 3 3 4 3	MES: the course basics of the chemic ajor utilizations risk at the course and the chemic ajor utilizations risk at the che	seppe Spacergy option se, the stu f hydroger at production al and phy tion of hydrogen	chel, "The azzafum his: real example on processical produced rogen example on safet	o; "Hydro economic will be a ays esses eperties energy in y protoco Mapp	ogen and the shall be to which are various sols	e required sectors	os and Ps	on, Elsev tem", Ha	ier, 2018 Isted Press	PO1 1 1	12	(H Und Und Und	publi BT M ighe ersta ersta ersta ersta	sher, 1980 lapped st Level) anding (K2) anding (K2) anding (K2) anding (K2)	09

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70					100
CAT2	30	70					100
CAT3	30	70					100
ESE	30	70					100

[%] may be varied (CAT 1,2,3 50 marks & ESE

					22CH0	008- RUBBE	R TECH	INOLO	GY						
Programm Branch	e&								Sem.	Categor	у	L 1	-	Р	Credit
Prerequisi	tes	Nil							VII	PE		3 ()	0	3
Preamble						mentary conc volved and m									
Unit – I			r – Basics		etrious irr	voiveu and m	anuiacii	ing pro	ocess III	specific ru	bbei	anu	nen	аррі	ications.
	nd Mond				nolecules	- addition po	lvmeriza	ation an	d conde	nsation po	lvme	erizati	on. F	hvsi	cal behavior
						cture and Beh									
and Synthe	tic, Elast													,	
Jnit - II			ounding a												
						nods, Finishin									
						lixing Steps, , Cold, High E					uries	s, Vl	ucan	ızatlı	on Condition
Jnit - III	on recili		for Rubb				noigy it	adidilol	i and will	JOWAVE					
	e and Gr					Compounding	with fo	ur Filler	s - Carbo	on Black.	Calci	um C	arbo	nate	, Clavs, Silica
and their ap						p o an anny	,		2010			J	20		,, .,
Jnit - IV			sing, Vul	canizati	ion, Prop	erties Tests									
rocessabi	lity Tests	– Plastic	ty, Comp	ression,	, Rotary S	Shear, Mixing,	Extrusi	on, Rela	axation, S	Scorch; Vu	ılcar	izatio	n Te	sts -	- Cruing, Effe
of Tempera	ture; Stre	ess-Strain	Tests – T	Tensile, H	Hardness	, Crystallization	n, Low t	tempera	ature stiff	ness, Low	tem	perati	ıre B	rittle	ness; Dynam
			, Free vib	ration, F	lex resista	ance, Crack ir	itiation a	and gro	wth; Agir	ıg Tests –	Oxy	gen a	ging,	Hea	at aging, Wate
Resistance Jnit - V	, rear re		octurina E	Process	of Speci	ific Rubbers									
	4									D t l		. - 4	.1		Nitarii - malala -
	iaciene i	ubber. Po		ene ano i	OOIVISOOLE			DIODVIE	ne rubbe						
											и па	alobut	yrruk	JUCI,	Nitrile rubbe
						bon elastome					и па	alobut	yrruk	JUCI,	
											и па	alobut	yrruk	JDEI,	Total:
Polyacrilic r	ubber, N										и па	110001	yrruk	, 	
Polyacrilic r	rubber, N	leoprene,	Silicone	rubber, f	Fluorocari	bon elastome	r, Polyu	rethane	elastom	er			yrruk	, 	
FEXT BOO	rubber, N PK: urice Mo	leoprene,	Silicone	rubber, f	Fluorocari		r, Polyu	rethane	elastom	er			yrruk		
FEXT BOO	rubber, N PK: urice Mo	leoprene,	Silicone	rubber, f	Fluorocari	bon elastome	r, Polyu	rethane	elastom	er			yrruk	, , , , , , , , , , , , , , , , , , ,	
TEXT BOO 1. Ma	rubber, No.	rton, "Ru	Silicone bber Tech	rubber, f	Fluorocarl	bon elastome	r, Polyu	rethane	elastom	er a Dordrec	ht, 1	999.			Total:
TEXT BOO 1. Ma REFERENCE 1. Ma	rubber, No.	rton, "Ru	Silicone bber Tech	nnology"	, 3 rd Edition	on, Springer S	Science	- Busine	elastom ess Media blishers	er a Dordrec & Distribu	ht, 19	999. New			Total:
TEXT BOO 1. Ma REFERENCE 1. Ma	rubber, No.	rton, "Ru	Silicone bber Tech	nnology"	, 3 rd Edition	bon elastome	Science	- Busine	elastom ess Media blishers	er a Dordrec & Distribu	ht, 19	999. New			Total:
FEXT BOO I. Ma REFERENCE I. Ma 2. Wh	oK: urice Mo CES: rtin.J.M a	rton, "Ru and Smith	bber Tech	nnology" andbook	, 3 rd Edition	on, Springer Ser Technology	r, Polyu Science+ , Vol.2, (les, Han	rethane - Busine - Busine - Busine	elastom ess Media blishers	er a Dordrec & Distribu New York	ht, 19	999. New			Total:
TEXT BOO 1. Ma REFERENCE 1. Ma 2. Wh	oK: urice Mo CES: rtin.J.M a	rton, "Ru and Smith	bber Tech	nnology" andbook	, 3 rd Edition	on, Springer S	r, Polyu Science+ , Vol.2, (les, Han	rethane - Busine - Busine - Busine	elastom ess Media blishers	er a Dordrec & Distribu New York	ht, 19	999. New			Total:
TEXT BOO 1. Ma REFERENCE 1. Ma 2. Wh	oK: urice Mo CES: rtin.J.M a	rton, "Ru and Smith	bber Tech	nnology" andbook	, 3 rd Edition	on, Springer Ser Technology	r, Polyu Science+ , Vol.2, (les, Han	rethane - Busine - Busine - Busine	elastom ess Media blishers	er a Dordrec & Distribu New York	ht, 19	999. New			Total:
TEXT BOO 1. Ma REFERENCE 1. Ma 2. Wh 3. Blo	CES: Inite.J.L., DW.C.M. &	erton, "Ru and Smith Rubber P and Hepb	bber Tech n.W.K, Ha rocessing urn.C. Ru	nnology" indbook g Techno	, 3 rd Edition of Rubbe blogy Mate	on, Springer Ser Technology erials, Princip	r, Polyu Science+ , Vol.2, (les, Han	rethane - Busine - Busine - Busine	elastom ess Media blishers	er a Dordrec & Distribu New York	ht, 19	999. New	Delh	i, 200	Total:
TEXT BOO 1. Ma REFERENCE 1. Ma 2. Wh 3. Blo COURSE COn comple	CES: Inite.J.L., DUTCONetion of t	erton, "Ru and Smitt Rubber P and Hepb IES: he cours	bber Techn.W.K, Harrocessing	nnology" Indbook Indbo	, 3 rd Edition of Rubbe blogy Mate	on, Springer Ser Technology erials, Princip and Manufac	r, Polyu Science+ , Vol.2, (les, Han	rethane - Busine - Busine - Busine	elastom ess Media blishers	er a Dordrec & Distribu New York	ht, 19	999. New	Delh E (Hi	i, 200	Total:
TEXT BOO 1. Ma REFERENCE 1. Ma 2. Wh 3. Blo COURSE COn comple	CES: Inite.J.L., DUTCONetion of t	erton, "Ru and Smitt Rubber P and Hepb IES: he cours	bber Tech n.W.K, Ha rocessing urn.C. Ru	nnology" Indbook Indbo	, 3 rd Edition of Rubbe blogy Mate	on, Springer Ser Technology erials, Princip and Manufac	r, Polyu Science+ , Vol.2, (les, Han	rethane - Busine - Busine - Busine	elastom ess Media blishers	er a Dordrec & Distribu New York	ht, 19	999. New	Delh E (Hi	i, 200	Total:
FEXT BOO I. Ma REFERENCE I. Wh B. Blo COURSE COn comple	CES: artin.J.M.anite.J.L., bw.C.M. according to blain the	erton, "Ru and Smith Rubber P and Hepb IES: he cours	bber Techn.W.K, Harrocessing urn.C. Ruse, the stuscience be	nnology" Indbook Techno	, 3 rd Edition of Rubbe blogy Mate chnology will be ab	on, Springer Ser Technology erials, Princip and Manuface ole to nology	r, Polyu Science+ , Vol.2, (les, Han	rethane - Busine - Busine - Busine	elastom ess Media blishers	er a Dordrec & Distribu New York	ht, 19	999. New	Delh E (Hi	i, 200	Total:
FEXT BOO I. Ma REFERENCE I. Wh B. Blo COURSE COn comple	CES: artin.J.M.anite.J.L., bw.C.M. according to blain the	erton, "Ru and Smith Rubber P and Hepb IES: he cours	bber Techn.W.K, Harrocessing urn.C. Ruse, the stuscience be	nnology" Indbook Techno	, 3 rd Edition of Rubbe blogy Mate chnology will be ab	on, Springer Ser Technology erials, Princip and Manufac	r, Polyu Science+ , Vol.2, (les, Han	rethane - Busine - Busine - Busine	elastom ess Media blishers	er a Dordrec & Distribu New York	ht, 19	999. New	Delh E (Hi	i, 200	Total:
FEXT BOO I. Ma REFERENCE I. Ma 2. Wr B. Blo COURSE COn comple CO1 exp	CES: urtin.J.M.a bite.J.L., bw.C.M. a courtcon etion of t blain the	e process	bber Tech n.W.K, Ha rocessing urn.C. Ru se, the stu science be es of com	nnology" Indbook Indbo	, 3 rd Edition of Rubbe blogy Mate chnology will be abober technology	on, Springer Ser Technology erials, Princip and Manuface ole to nology	r, Polyu Science+ , Vol.2, (les, Han	rethane - Busine - Busine - Busine	elastom ess Media blishers	er a Dordrec & Distribu New York	ht, 19	999. New 5	Delh E (Hi Unde	i, 200	Total:
FEXT BOO I. Ma REFERENCE I. Ma 2. Wr B. Blo COURSE COn comple CO1 exp	CES: urtin.J.M.a bite.J.L., bw.C.M. a courtcon etion of t blain the	e process	bber Techn.W.K, Harrocessing urn.C. Ruse, the stuscience be	nnology" Indbook Indbo	, 3 rd Edition of Rubbe blogy Mate chnology will be abober technology	on, Springer Ser Technology erials, Princip and Manuface ole to nology	r, Polyu Science+ , Vol.2, (les, Han	rethane - Busine - Busine - Busine	elastom ess Media blishers	er a Dordrec & Distribu New York	ht, 19	999. New 5	Delh E (Hi Unde	i, 200	Total:
FEXT BOO I. Ma REFERENCE I. Ma 2. Wh B. Blo COURSE COn complete CO1 exp CO2 des CO3 illustrates	CES: urtin.J.M.a nite.J.L., ow.C.M. a DUTCON etion of to blain the scribe the	e process	bber Techn.W.K, Harrocessing urn.C. Ruscience besof comes of fillers	nnology" Indbook Indbo	, 3 rd Edition of Rubbe blogy Mate chnology will be ab ober technology and vul	on, Springer Ser Technology erials, Princip and Manufactolle to nology	r, Polyu Science+ , Vol.2, (les, Han ture, Bu	- Busine CBS Pu ser Pub tterwort	elastom ess Media blishers blication,l hs, 1982	er a Dordrec & Distribu New York	ht, 19	999. New 5	Delh E (Hi Unde	i, 200	Total:
FEXT BOO I. Ma REFERENCE I. Ma 2. Wh 3. Blo COURSE CO On comple CO1 exp CO2 des CO3 illust CO4 dis	CES: urtin.J.M.a nite.J.L., ow.C.M. a DUTCOM etion of to blain the scribe the strate the cuss maj	epropertion testing	bber Tech n.W.K, Ha rocessing urn.C. Ru se, the stu science be es of com es of fillers	nnology" Indbook Techno Ibber T	, 3rd Edition of Rubbe blogy Mate chnology will be ab ober technology diditives	on, Springer Ser Technology erials, Princip and Manuface ble to nology Icanization	r, Polyu Science+ , Vol.2, (les, Han ture, Bu	- Busine CBS Pu ser Pub tterwort	elastom ess Media blishers blication,l hs, 1982	er a Dordrec & Distribu New York	ht, 19	999. New 5	Delh E (Hi Unde	i, 200 3T M ghe ersta ersta ersta	Total:- O4. lapped st Level) inding (K2) inding (K2) inding (K2) inding (K2)
FEXT BOO I. Ma REFERENCE I. Ma 2. Wh 3. Blo COURSE CO On comple CO1 exp CO2 des CO3 illust CO4 dis	CES: urtin.J.M.a nite.J.L., ow.C.M. a DUTCOM etion of to blain the scribe the strate the cuss maj	epropertion testing	bber Techn.W.K, Harrocessing urn.C. Ruscience besof comes of fillers	nnology" Indbook Techno Ibber T	, 3rd Edition of Rubbe blogy Mate chnology will be ab ober technology diditives	on, Springer Ser Technology erials, Princip and Manuface ble to nology Icanization	r, Polyu Science+ , Vol.2, (les, Han ture, Bu	- Busine CBS Pu ser Pub tterwort	elastom ess Media blishers blication,l hs, 1982	er a Dordrec & Distribu New York	ht, 19	999. New 5	Delh E (Hi Unde	i, 200 3T M ghe ersta ersta ersta	Total:
FEXT BOO I. Ma REFERENCE I. Ma 2. Wh 3. Blo COURSE CO On comple CO1 exp CO2 des CO3 illust CO4 dis	CES: urtin.J.M.a nite.J.L., ow.C.M. a DUTCOM etion of to blain the scribe the strate the cuss maj	epropertion testing	bber Tech n.W.K, Ha rocessing urn.C. Ru se, the stu science be es of com es of fillers	nnology" Indbook Techno Ibber T	, 3rd Edition of Rubbe ology Mate chnology will be abober technology and vul dditives ocesses in	on, Springer Ser Technology erials, Princip and Manuface ble to nology Icanization	r, Polyu Science+ Vol.2, (les, Han ture, Bu	- Busine - B	elastom ess Media blishers blication,l	er a Dordrec & Distribu New York	ht, 19	999. New 5	Delh E (Hi Unde	i, 200 3T M ghe ersta ersta ersta	Total:- O4. lapped st Level) inding (K2) inding (K2) inding (K2) inding (K2)
TEXT BOO 1. Ma REFERENCE 1. Ma 2. Wh 3. Blo COURSE CO On comple CO1 exp CO2 des CO3 illus CO4 dis CO5 Exp	CES: urtin.J.M.a nite.J.L., ow.C.M. a DUTCOM etion of to blain the scribe the strate the cuss maj	epropertion testing	bber Tech n.W.K, Ha rocessing urn.C. Ru se, the stu science be es of com es of filler: g methods turing productions	nnology" Indbook Techno Ibber T	Fluorocard , 3rd Edition of Rubbe plogy Mate chnology will be ab ober technology diditives pecases in specialty r Mappin	on, Springer Ser Technology erials, Princip and Manuface ble to nology lcanization nvolved in rub rubbers ng of COs wi	r, Polyu Science+ Vol.2, (les, Han ture, Bu	- Busine - B	elastom ess Media blishers blication, hs, 1982	a Dordrec & Distribu New York	ht, 19	999. New 5	Delh E (Hi Unde	i, 200 BT M gheersta ersta ersta ersta	Total:- O4. lapped st Level) inding (K2) inding (K2) inding (K2) inding (K2)
FEXT BOO I. Ma REFERENCE I. Ma 2. Wh 3. Blo COURSE COn comple CO1 exp CO2 des CO3 illus CO4 dis CO5 Exp	CES: Irtin.J.M. a DUTCOM etion of to blain the scribe the cuss maj	erton, "Ru and Smith Rubber P and Hepb IES: he cours polymer s e process e propertion for testing manufact	bber Tech n.W.K, Ha rocessing urn.C. Ru se, the stu science be es of com es of fillers	nnology" Indbook Techno Ibber T	Fluorocard , 3rd Edition of Rubbe plogy Mate chnology will be ab ober technology diditives pecases in specialty r Mappin	on, Springer Ser Technology erials, Princip and Manuface ble to nology Icanization nvolved in rub rubbers ng of COs wi	r, Polyu Science- Vol.2, (les, Han ture, Bu	- Busine - B	elastom ess Media blishers blication,l	er a Dordrec & Distribu New York	nt, 19	999. New 5	Delh E (Hi Unde	i, 200 BT M gheersta ersta ersta ersta	Total:- O4. O4. Iapped st Level) inding (K2) inding (K2) inding (K2) inding (K2) inding (K2) inding (K2)
TEXT BOO 1. Ma REFERENCE 1. Ma 2. Wr 3. Blo COURSE CO On comple CO1 exp CO2 des CO3 illus CO4 dis	DUTCOMetion of the strate the cuss majoration the	rton, "Ru and Smith Rubber P and Hepb IES: he cours polymer s e process e propertifior testing manufact	bber Tech n.W.K, Ha rocessing urn.C. Ru se, the stu science be es of com es of filler: g methods turing productions	nnology" Indbook Techno Ibber T	Fluorocard , 3rd Edition of Rubbe plogy Mate chnology will be ab ober technology diditives pecases in specialty r Mappin	on, Springer Ser Technology erials, Princip and Manuface ble to nology lcanization nvolved in rub rubbers ng of COs wi	r, Polyu Science- Vol.2, (les, Han ture, Bu	- Busine - B	elastom ess Media blishers blication, hs, 1982	a Dordrec & Distribu New York	ht, 19	999. New 5	Delh E (Hi Unde	i, 200 BT M gheersta ersta ersta ersta	Total:- O4. O4. Iapped st Level) inding (K2) inding (K2) inding (K2) inding (K2) inding (K2) inding (K2)

CO3	3	2					1	
CO4	3	2					1	
CO5	3	2					1	

		ACCECOME					
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70					100
CAT2	30	70					100
CAT3	30	70					100
ESE	30	70					100

 $^{^{\}star}$ ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Progra		Sem. Category	L	т	Р	Credit
Branch				_	_	0.00
Prereq	uisites	Nil VIII OE	3	0	0	3
Preaml	ole	This course deals with the fundamentals of electrochemical engineering and its app	licati	ons.		
Unit -	I	Introduction				9
Reporta supervi	able accide isors, work	Safety and productivity. Definitions: Accident, Injury, Unsafe act, UnsafeCondition ints. Theories of accident causation. Safetyorganization- objectives, types, function men, unions,government and voluntary agencies in safety. Safety policy. Safety Offormmittee-need, types, advantages.	ns, F	Role	of ma	anagement,
Unit -		Personal protection in work environment				,
system Unit - I Introdu fillingTemp safety. Disorde	- objectives II ction to cor Under-wate orary Struc Relevance ers	sponsibility of management and employees. Advantages of good housekeeping. 5 s oflowork and cold work permits. Typicalindustrial models and methodology. Entry into Safety issues in construction Instruction industry and safety issues in construction Safety in variousconstruction of the works — Under-pinning & Shoring — Ladders & Scaffolds — Tunneling — Blasting — Dutures. Familiarization with relevant Indian Standards and the National BuildingCode of ergonomics in construction safety. Ergonomics Hazards - Musculoskeletal Disorders.	o cor perati emoli prov	ons tion -	Exc - Exc - Con s on o	es. avation and space construction
Machin Weldin manua	ery safegua g and Cutti I andmec		cation ying,	n-safe pi	ety co ulling,	nsideration pushing
Welding manual palletizi slings,	ery safeguag g and Cutti l andmec ing and stoo hooks, clan	ard-Point-of-Operation, Principle of machine guarding -types of guards anddevices. Sa ng-Safety Precautions of Gas5welding and Arc Welding. Material Handling-Classifinanical handling. Handling assessments and techniques- lifting, carrocking. Material Handling equipment-operation & maintenance. Maintenanceof common aps. Hearing Conservation Program in Production industries	cation ying,	n-safe pi	ety co ulling,	nd grinding nsideration pushing ope, chains
Machin Welding manual palletizi slings, Unit - \	ery safeguage and Cutti andmecting and stooks, clam	ard-Point-of-Operation, Principle of machine guarding -types of guards anddevices. Saing-Safety Precautions of Gas5welding and Arc Welding. Material Handling-Classification handling. Handling assessments and techniques- lifting, carrocking. Material Handling equipment-operation & maintenance. Maintenanceof common	cation ying, elem	n-safe pi ents-	ety co ulling, wire re	nd grinding nsideration pushing ope, chains
Machin Welding manual palletiz slings, Unit - V Hazard of hazar plants-method	ery safegua g and Cutti I andmec ing and stoc hooks, clam / I and risk, T and identifica The Dow	and-Point-of-Operation, Principle of machine guarding -types of guards anddevices. Sa ng-Safety Precautions of Gas5welding and Arc Welding. Material Handling-Classification handling. Handling assessments and techniques- lifting, carrowing. Material Handling equipment-operation & maintenance. Maintenanceof common news. Hearing Conservation Program inProduction industries Hazard identification and analysis Hazards - Classification of Fire, Types of Fire extinguishers, fire explosion and and risk assessment. Identification of hazards: Inventory analysis, Fire and explosion Fire and Explosion Hazard Index, Preliminary hazard analysis, Hazard andOperality analysis, corrective action and follow-up. Control of Chemical Hazards, Hazardo	elem toxic ion h	n-safe prents- gas azarc	ety coulling, wire released rating	nd grinding nsideration pushing ope, chains e, Structure g of proces HAZOP))
Machin Welding manual palletiz slings, Unit - V Hazard of haza plants-method	ery safegua g and Cutti I andmec ing and stoc hooks, clam / I and risk, T ird identifica The Dow dology, critica	and-Point-of-Operation, Principle of machine guarding -types of guards anddevices. Sa ng-Safety Precautions of Gas5welding and Arc Welding. Material Handling-Classification handling. Handling assessments and techniques- lifting, carrowing. Material Handling equipment-operation & maintenance. Maintenanceof common news. Hearing Conservation Program inProduction industries Hazard identification and analysis Hazards - Classification of Fire, Types of Fire extinguishers, fire explosion and and risk assessment. Identification of hazards: Inventory analysis, Fire and explosion Fire and Explosion Hazard Index, Preliminary hazard analysis, Hazard andOperality analysis, corrective action and follow-up. Control of Chemical Hazards, Hazardo	elem toxic ion h	n-safe prents- gas azarc	ety coulling, wire released rating	nd grinding nsideration pushing ope, chains ee, Structure g of proces HAZOP)) chemicals
Machin Welding manual palletiz slings, Unit - V Hazard of hazar plants-method	ery safegua g and Cutti I andmec ing and stoc hooks, clam / I and risk, T ard identifica The Dow dology, critical Safety Da	and-Point-of-Operation, Principle of machine guarding -types of guards anddevices. Sa ng-Safety Precautions of Gas5welding and Arc Welding. Material Handling-Classification handling. Handling assessments and techniques- lifting, carrowing. Material Handling equipment-operation & maintenance. Maintenanceof common news. Hearing Conservation Program inProduction industries Hazard identification and analysis Hazards - Classification of Fire, Types of Fire extinguishers, fire explosion and and risk assessment. Identification of hazards: Inventory analysis, Fire and explosion Fire and Explosion Hazard Index, Preliminary hazard analysis, Hazard andOperality analysis, corrective action and follow-up. Control of Chemical Hazards, Hazardo	elem toxic ion h	n-safe prents- gas azarc	ety coulling, wire released rating	nd grinding nsideration pushing ope, chains e, Structure g of process HAZOP))
Machin Weldin manual palletiz slings, Unit - VH Hazard of haza plantsmethod Materia	ery safegua g and Cutti I andmec ing and stoc hooks, clam / I and risk, T and identifica The Dow dology, critical Safety Da	and-Point-of-Operation, Principle of machine guarding -types of guards anddevices. Sa ng-Safety Precautions of Gas5welding and Arc Welding. Material Handling-Classification handling. Handling assessments and techniques- lifting, carrowing. Material Handling equipment-operation & maintenance. Maintenanceof common news. Hearing Conservation Program inProduction industries Hazard identification and analysis Hazards - Classification of Fire, Types of Fire extinguishers, fire explosion and and risk assessment. Identification of hazards: Inventory analysis, Fire and explosion Fire and Explosion Hazard Index, Preliminary hazard analysis, Hazard andOperality analysis, corrective action and follow-up. Control of Chemical Hazards, Hazardo	toxic toxic ion h rabil us pr	gas azarcity st	ety co ulling, wire re release d rating udy (ties of	nd grinding nsideration pushing ope, chains e, Structur g of proces HAZOP)) chemicals
Machin Weldin manual palletiz slings, Unit - V Hazard of haza plantsmethod Materia	g and Cutti I andmec ing and stoc hooks, clam I and risk, T and risk, T ard identifica The Dow dology, critical Safety Da BOOK: Paul S V, RENCES:	ard-Point-of-Operation, Principle of machine guarding -types of guards anddevices. Sa ng-Safety Precautions of Gas5welding and Arc Welding. Material Handling-Classifinanical handling. Handling assessments and techniques- lifting, carricking. Material Handling equipment-operation & maintenance. Maintenanceof common hps. Hearing Conservation Program inProduction industries Hazard identification and analysis	cation ying, elem ttoxic ion h rrabil us pr	gas azaro iicatio	released rating udy (ies of	nd grinding nsideration pushing ope, chains ee, Structur g of proces HAZOP)) chemicals Total:4
Machin Welding manual palletiz slings, Unit - Vazard of hazard of hazard plants-method Materia	g and Cutti I andmec ing and stock hooks, clam I and risk, T and identifica The Dow dology, critical Safety Da GOOK: Paul S V, RENCES:	ard-Point-of-Operation, Principle of machine guarding -types of guards anddevices. Saing-Safety Precautions of Gas5welding and Arc Welding. Material Handling-Classifinanical handling. Handling assessments and techniques- lifting, carricking. Material Handling equipment-operation & maintenance. Maintenanceof common hips. Hearing Conservation Program inProduction industries Hazard identification and analysis Hazard identification and analysis Yes of hazards - Classification of Fire, Types of Fire extinguishers, fire explosion and and risk assessment. Identification of hazards: Inventory analysis, Fire and explosion Fire and Explosion Hazard Index, Preliminary hazard analysis, Hazard andOperality analysis, corrective action and follow-up. Control of Chemical Hazards, Hazardo ta Sheets	cation ying, elem ttoxic ion h rrabil us pr	gas azaro iicatio	released rating udy (ies of	nd grinding nsideration pushing ope, chains ee, Structur g of proces HAZOP)) chemicals Total:4
Machin Welding manual palletiz slings, Unit - Value of hazard of hazard plants-method Material TEXTB 1. REFER 1. COURS	g and Cutti I andmec ing and stoc hooks, clam I and risk, T and identifica The Dow dology, critical Safety Da BOOK: Paul S V, RENCES: AIChE/CO American	ard-Point-of-Operation, Principle of machine guarding -types of guards anddevices. Saing-Safety Precautions of Gas5welding and Arc Welding. Material Handling-Classifinanical handling. Handling assessments and techniques- lifting, carreling. Material Handling equipment-operation & maintenance. Maintenanceof common hips. Hearing Conservation Program inProduction industries Hazard identification and analysis	cation ying, elem ttoxic ion h rrabil us pr	gas azaro iicatio	released rating udy (cies of sess Sa	nd grinding nsideration pushing ope, chains ee, Structur g of proces HAZOP)) chemicals Total:4
Machin Weldin manual palletiz slings, Unit - \ Hazard of haza plantsmethoo Materia TEXTB 1. REFER 1. COURSON COUR	g and Cutti I andmed ing and stock hooks, clam I and risk, T and identificat The Dow dology, critical Safety Da BOOK: Paul S V, RENCES: AIChE/CO American SE OUTCO mpletion of	ard-Point-of-Operation, Principle of machine guarding -types of guards anddevices. Sang-Safety Precautions of Gas5welding and Arc Welding. Material Handling-Classifinanical handling. Handling assessments and techniques- lifting, carreling. Material Handling equipment-operation & maintenance. Maintenanceof common his. Hearing Conservation Program inProduction industries. Hazard identification and analysis	cation ying, elem ttoxic ion h rrabil us pr	gas azardity stication	released rating udy (cies of sess Sasses Sas	nd grinding nsideration pushing ope, chains e, Structur g of proces HAZOP)) chemicals Total:4 00.
Machin Welding manual palletiz slings, Unit - Value of hazard of hazard plants-method Material TEXTB 1. REFER 1. COURS	g and Cutti I andmec ing and stoc hooks, clam I and risk, T I and risk, T Ird identifica The Dow dology, critical Safety Da GOOK: Paul S V, RENCES: AIChE/CO American SE OUTCO mpletion of Describe t Explain at	ard-Point-of-Operation, Principle of machine guarding -types of guards anddevices. Saing-Safety Precautions of Gas5welding and Arc Welding. Material Handling-Classificational handling. Handling assessments and techniques- lifting, carrising. Material Handling equipment-operation & maintenance. Maintenanceof common hips. Hearing Conservation Program inProduction industries Hazard identification and analysis	cation ying, elem toxic ion h iorabil us pr	gas azarcity stoppertication	ety coulling, wire released rating udy (ies of ess Sa	nd grinding nsideration pushing ope, chains e, Structur g of proces HAZOP)) chemicals Total:4 O0. fety, apped t Level)

CO4	Desc	ribe va	rious ha	zards as	sociate	d with dif	ferent m	achine	s and m	echanio	calmateri	al handling	. Und	lerstandin	g (K2)
CO5			ent haza emical ha		fication	tools in	different	industr	es with	thekno	wledge o	f different	Unc	lerstandin	g (K2)
						Маррі	ng of C	Os with	POs a	nd PSC	Os				
COs/F	Os	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO.	1	2	1				3	3	3	2	1	1	3		
CO	2	2	1	2			3	3	3	2	1	1	3		
CO	3	2	2	2	2		3	3	3	2	1	1	3		
CO	4	2	2		2		3	3	3	2	1	1	3		
CO	5						3	3	3	2	1	1	3		
1 – Sli	ght, 2 –	Mode	rate, 3 -	- Substar	ntial, BT	- Bloom'	s Taxon	omy				1			
						ASSE	SSMEN	T PATI	ERN -	THEOR	Y				
Tes	t / Bloo	om's	Rei	member	ing l	Jndersta	anding	Apply	/ing	Analyzi	ing E	Evaluating	C	reating	Total %

		, 100200III211	,				
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	70	10				100
CAT2	20	70	10				100
CAT3	20	70	10				100
ESE	20	70	10				100
* ±3% may be varied (CAT 1,2,3 – 50 maı	rks & ESE – 100 ma	arks)				

	22CHO010 - ELECTROCHEMICAL EI	NGINEERING	;				
Programme& Branch		Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	VIII	OE	3	0	0	3
Preamble	This course deals with the fundamentals of electrochemic	cal engineerin	g and its app	licati	ons.		
Unit - I	Basics of Electrochemistry:	cai engineerin	g and its app	licati	ons.		

Importance of electrochemical systems: Faraday's law - Current density - Potential and Ohm's law. Cell potential. Electrochemical kinetics: Double layer - Butler-Volmer Kinetic Expression - Influence of Mass Transfer on the Reaction Rate - Current efficiency.

Unit - II Transport phenomena and Electrodes

9

Mobility of electrons in cells, Concentration over potential, Current distribution and membrane transport. Electrode configuration – Porous electrodes, characterization, current distribution, Three phase electrodes, Electrodes with flow

Unit - III Batteries and Fuel cells

9

Components of a cell - Classification of batteries and cell - Theoretical capacity and state of charge - Cell characteristics and electrochemical performance - Heat efficiency of secondary cells- Charge retention and self-discharge - capacity fade in secondary cells. Fuel cell fundamentals: Types of fuel cells- Current-voltage characteristics and polarizations - Electrode structure - Proton-Exchange Membrane (PEM) fuel cells - Solid Oxide Fuel cells.

Unit – IV Electrochemistry for e-vehicles

9

Introduction to fuel cell stack and super capacitors. Electric and Hybrid vehicles - Objectives, power demand determination, regenerative braking, Battery electric vehicle, Hybrid electric vehicle, Start-Stop hybrid, Fuel Cell Hybrid systems

Unit - V Electro-deposition and Corrosion

9

Electro-deposition: Fundamentals – Nucleation - Deposit morphology – Additives - Impact of side reactions and resistive substrates. Corrosion: Fundamentals - Thermodynamics of corrosion systems - Localized corrosion - Corrosion protection.

Total:45

TEXTBOOK:

1. Thomas F.Fuller and John N.Harb, "Electrochemical Engineering", 1st Edition, John Wiley & Sons, USA, 2018.

REFERENCES:

1. Allen J.Bard and Larry R. Faulkner, "Electrochemical Methods, Fundamentals and Applications", 2nd Edition, John Wiley & Sons Inc, United State of America, 2000.

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	explain the basics of electrochemical systems and electrochemical kinetics.	Understanding (K2)
CO2	describe the transport properties of electrochemical systems and electro analytical techniques.	Understanding (K2)
CO3	explain the fundamental properties and classification of batteries and fuel cells.	Understanding (K2)
CO4	describe the technology of electrochemical systems for electric vehicles	Understanding (K2)
CO5	illustrate the concepts of electro-deposition and corrosion prevention.	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	2	1											
CO3	3	2	1											
CO4	3	2	1											
CO5	3	2	1											

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	20	80					100
CAT3	20	80					100
ESE	20	80					100

* ±3% may be varied (CAT 1,2,3 - 50 marks & ESE - 100 marks)

	22CHO011 -SMART AND FUNCTIO	ONAL MATERIA	LS				
Programme& Branch		Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	VIII	OE	3	0	0	3
Preamble	To acquire knowledge on smart and intelligent material fields	als, their synthesi	s method and	d thei	r app	lication	ns in various
Unit – I	Smart Materials and Structures						9
	em intelligence- components and classification of smart str tion areas of smart systems	uctures, commor	smart materi	ials a	nd as	ssociat	ed stimulus-
Unit - II	Ferroelectric Materials						9
	pelectric materials- piezoelectric effect, Direct and converged as sensors, Actuators and bimorphs.	rse, parameter de	efinitions, Pie	zoce	ramio	s, Pie	zopolymers,
Unit - III	Shape Memory Materials						9
	e memory effect, Martensitic transformation, One way an al properties of SMAs	d two-way SME,	training of SN	//As,	binar	y and	ternary alloy
Unit – IV	Smart Hydrogels						9
	hesis, Fast responsive hydrogels, Molecular recognition Hydrogels in microfluidics	, Smart hydroge	ls as actuato	rs, C	ontro	olled d	rug release,
Unit – V	Smart systems for space applications						9
	ic memory composites, Smart corrosion protection coating nt devices, Molecular machines	s, Self-healing m	aterials, Sens	ors,	Actua	ators, T	ransducers,
							Total:45
TEXT BOOK:							
1. Schwartz	M, "New Materials, Processes, and Methods Technology	", CRC Press, 20	06.				
2. D.J. Leo.	D.J, "Engineering Analysis of Smart Material Systems", W	/iley 2007.					
REFERENCES:							
1. Yui. N, M CRC Pres	rsny. R.J, "Reflexive Polymers and Hydrogels: Understands, 2004.	ding and Designi	ng Fast Resp	onsi	ve Po	olymeri	c Systems",

2.	Ва	II. P, "M	ade to M	easure: N	faterials	for the 2	21stCen	tury", Pı	rinceto	n Univer	sity Pre	ss, 1997.			
		OUTCO etion of		rse, the s	tudents	will be	able to							BT Ma (Highest	
CO1	rec	all the	classifica	tion and a	pplication	ons of sn	nart mat	erials						Understan	ding (K2)
CO2	des	scribe th	ne variou	s ferroele	ctric ma	terials ar	nd its ap	plication	ns					Understan	ding (K2)
СОЗ	exp	olain the	e significa	ance of sh	ape me	mory ma	iterials a	and its fu	unction	al prope	rties			Understan	ding (K2)
CO4	ela	borate	the synth	esis of sn	nart hydi	ogels a	nd their	applicat	ions in	various	fields			Understan	ding (K2)
CO5	eni	umerate	the role	of smart	systems	in space	e applica	ations						Understan	ding (K2)
						Марр	oing of	COs wit	th POs	and PS	Os				
COs/P	os	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO	1	3	1					1	1	2			1		
CO2	2	3	1					1	1	2			1		
CO	3	3	1					1	1	2			1		
CO	4	3	1					1	1	2			1		
COS	5	3	1					1	1	2			1		
1 – Sli	ght, 2	2 – Mod	erate, 3	Substar	itial, BT-	Bloom's	Taxon	omy							
						ASSE	ESSMEI	NT PAT	TERN	- THEO	RY				
	t / Bl ateg	oom's ory*	Re	memberi (K1) %	ng U	Indersta (K2)	_	Apply (K3)		Analyz (K4)	_	Evaluating (K5) %		reating (K6) %	Total %
	CAT	Γ1		30		70									100
	CAT	Γ2		30		70									100
	CAT	Γ3		30		70									100
	ES	E		30		70									100
* ±3%	may	be vari	ed (CAT	1,2,3 - 50) marks	& ESE -	- 100 ma	arks)							

	(Computer Science ar	nd Design)					
Programme & Branch	BE - Computer Science and Design	Sem.	Category	L	Т	Р	Credit
Prerequisites	NIL	5	OE	3	1	0	4
Preamble	This subject will teach how to create amazing user of understand the importance of a good UX design and a UX and the application of various principles of psycand market research, which is crucial to creating a gr	the role of a UX designorhology in UX design.	ner. It deals d	iffere	nt stag	es of	designin
Unit – I	UX Design Process:						9+3
	User Research: asics – The Gestalt Theory – Psychology in UX – User Research: Getting to Know Your Users – Grouping Customer Inform					Bene	9+3 fits of
11							
User Personas: V	User Personas and Affinity Diagram: Vhat are User Personas? – Creating a Persona – Four Dif			Bene	fits of F	Persor	9+3 nas –
User Personas: V Affinity Diagrams Unit – IV Information Archi Colors – Font/Typ	Vhat are User Personas? – Creating a Persona – Four Dif: Affinity Diagram – Work Activity Affinity Diagram – Captu Information Architecture and Visual Design Princitecture: Navigation – Task Flow – Content Strategy – Site Dography – Textures – Forms – Design Principles – Alignn	re, Grouping and Lab ples: Map – Gestures – Ba	eling.	Desiç	gn – Li	nes –	9+3 Shapes
User Personas: V Affinity Diagrams Unit – IV Information Archi Colors – Font/Typ – Space – Visual	What are User Personas? – Creating a Persona – Four Dif: Affinity Diagram – Work Activity Affinity Diagram – Captu Information Architecture and Visual Design Princitecture: Navigation – Task Flow – Content Strategy – Site prography – Textures – Forms – Design Principles – Alignation Design Tools.	re, Grouping and Lab ples: Map – Gestures – Ba	eling.	Desiç	gn – Li	nes –	9+3 Shapes
Affinity Diagrams Unit – IV Information Archi Colors – Font/Typ – Space – Visual Unit – V What is Wirefram Paper cutouts – V	Vhat are User Personas? – Creating a Persona – Four Dif: Affinity Diagram – Work Activity Affinity Diagram – Captu Information Architecture and Visual Design Princitecture: Navigation – Task Flow – Content Strategy – Site Dography – Textures – Forms – Design Principles – Alignn	re, Grouping and Lab iples: Map – Gestures – Ba nent – Hierarchy – Co - Wireframing Tools: \$	eling. sics of Visual ntrast – Repet	Desiçition -	gn – Li – Proxi – Sten	nes – mity –	9+3 Shapes - Balance 9+3 and
User Personas: V Affinity Diagrams Unit – IV Information Archi Colors – Font/Typ – Space – Visual Unit – V What is Wirefram Paper cutouts – V	What are User Personas? – Creating a Persona – Four Dif: Affinity Diagram – Work Activity Affinity Diagram – Captu Information Architecture and Visual Design Princitecture: Navigation – Task Flow – Content Strategy – Site Dography – Textures – Forms – Design Principles – Alignm Design Tools. Wireframes and Prototyping 10e? – How to Create Wireframes? – Types of Wireframes – Wireframing Software – What is Prototyping – Prototyping	re, Grouping and Lab iples: Map – Gestures – Ba nent – Hierarchy – Co - Wireframing Tools: \$	eling. sics of Visual ntrast – Repet	Desigition -	gn – Li – Proxi – Sten ototype	nes – mity – ciling es – C	9+3 Shapes - Balance 9+3 and coding
User Personas: V Affinity Diagrams Unit – IV Information Archi Colors – Font/Typ – Space – Visual Unit – V What is Wirefram Paper cutouts – V Prototypes – The	What are User Personas? – Creating a Persona – Four Dif: Affinity Diagram – Work Activity Affinity Diagram – Captu Information Architecture and Visual Design Princitecture: Navigation – Task Flow – Content Strategy – Site Dography – Textures – Forms – Design Principles – Alignm Design Tools. Wireframes and Prototyping 10e? – How to Create Wireframes? – Types of Wireframes – Wireframing Software – What is Prototyping – Prototyping	re, Grouping and Lab iples: Map – Gestures – Ba nent – Hierarchy – Co - Wireframing Tools: \$	eling. usics of Visual ntrast – Repet Sketch Wirefra totypes – Digit	Desigition -	gn – Li – Proxi – Sten ototype	nes – mity – ciling es – C	9+3 Shapes - Balance 9+3 and coding
User Personas: V Affinity Diagrams Unit – IV Information Archi Colors – Font/Typ – Space – Visual Unit – V What is Wirefram Paper cutouts – V Prototypes – The TEXT BOOK: 1. Elvis Ca Scratch'	What are User Personas? – Creating a Persona – Four Dif: Affinity Diagram – Work Activity Affinity Diagram – Captu Information Architecture and Visual Design Princitecture: Navigation – Task Flow – Content Strategy – Site Dography – Textures – Forms – Design Principles – Alignm Design Tools. Wireframes and Prototyping 10e? – How to Create Wireframes? – Types of Wireframes – Wireframing Software – What is Prototyping – Prototyping process of Creating Prototypes – Prototyping Tools. 10ex Prototyping Tools.	re, Grouping and Lab iples: Map – Gestures – Ba nent – Hierarchy – Co - Wireframing Tools: S Methods – Paper Pro otype, and Implement	eling. sics of Visual ntrast – Repet Sketch Wirefra totypes – Digit Lecture: Compelling U	Designation -	gn – Li – Proxi – Sten ototype Futoria	nes – mity – ciling es – C	9+3 Shapes - Balance 9+3 and coding Total: 6
User Personas: V Affinity Diagrams Unit – IV Information Archi Colors – Font/Typ – Space – Visual Unit – V What is Wirefram Paper cutouts – V Prototypes – The TEXT BOOK: 1. Elvis Ca Scratch' 2. Rex Har	What are User Personas? – Creating a Persona – Four Dif: Affinity Diagram – Work Activity Affinity Diagram – Captu Information Architecture and Visual Design Princitecture: Navigation – Task Flow – Content Strategy – Site Dography – Textures – Forms – Design Principles – Alignm Design Tools. Wireframes and Prototyping 10e? – How to Create Wireframes? – Types of Wireframes – Wireframing Software – What is Prototyping – Prototyping process of Creating Prototypes – Prototyping Tools.	re, Grouping and Lab iples: Map – Gestures – Ba nent – Hierarchy – Co - Wireframing Tools: S Methods – Paper Pro otype, and Implement	eling. sics of Visual ntrast – Repet Sketch Wirefra totypes – Digit Lecture: Compelling U	Designation -	gn – Li – Proxi – Sten ototype Futoria	nes – mity – ciling es – C	9+3 Shapes - Balance 9+3 and coding Total: 6
User Personas: V Affinity Diagrams Unit – IV Information Archi Colors – Font/Typ – Space – Visual Unit – V What is Wirefram Paper cutouts – V Prototypes – The TEXT BOOK: 1. Elvis Ca Scratch' 2. Rex Har Morgan	What are User Personas? – Creating a Persona – Four Dif: Affinity Diagram – Work Activity Affinity Diagram – Captu Information Architecture and Visual Design Princitecture: Navigation – Task Flow – Content Strategy – Site Dography – Textures – Forms – Design Principles – Alignan Design Tools. Wireframes and Prototyping Mireframes and Prototyping Mireframing Software – What is Prototyping – Prototyping Process of Creating Prototypes – Prototyping Tools. Inziba "Hands-On UX Design for Developers: Design, Proto', First Edition, Packet Publishing, 2018 for units I - V tson, Pardha S. Pyla, "The UX Book Process and Guideling Process and Guideling Process of Creating Prototypes – Prototyping Tools."	re, Grouping and Lab iples: Map – Gestures – Ba nent – Hierarchy – Co - Wireframing Tools: S Methods – Paper Pro otype, and Implement	eling. sics of Visual ntrast – Repet Sketch Wirefra totypes – Digit Lecture: Compelling U	Designation -	gn – Li – Proxi – Sten ototype Futoria	nes – mity – ciling es – C	9+3 Shapes - Balance 9+3 and coding Total: 6
User Personas: V Affinity Diagrams Unit – IV Information Archi Colors – Font/Typ – Space – Visual Unit – V What is Wirefram Paper cutouts – V Prototypes – The TEXT BOOK: 1. Elvis Ca Scratch' 2. Rex Har Morgan REFERENCES:	What are User Personas? – Creating a Persona – Four Dif: Affinity Diagram – Work Activity Affinity Diagram – Captu Information Architecture and Visual Design Princitecture: Navigation – Task Flow – Content Strategy – Site Dography – Textures – Forms – Design Principles – Alignan Design Tools. Wireframes and Prototyping Mireframes and Prototyping Mireframing Software – What is Prototyping – Prototyping Process of Creating Prototypes – Prototyping Tools. Inziba "Hands-On UX Design for Developers: Design, Proto', First Edition, Packet Publishing, 2018 for units I - V tson, Pardha S. Pyla, "The UX Book Process and Guideling Process and Guideling Process of Creating Prototypes – Prototyping Tools."	re, Grouping and Lab iples: Map – Gestures – Ba nent – Hierarchy – Co - Wireframing Tools: \$ Methods – Paper Pro otype, and Implement nes for Ensuring a Qua	eling. sics of Visual ntrast – Repet Sketch Wirefra totypes – Digit Lecture: Compelling U	Designation -	gn – Li – Proxi – Sten ototype Futoria	nes – mity – ciling es – C	9+3 Shapes - Balance 9+3 and coding Total: 6
User Personas: V Affinity Diagrams Unit – IV Information Archi Colors – Font/Typ – Space – Visual Unit – V What is Wirefram Paper cutouts – V Prototypes – The TEXT BOOK: 1. Elvis Ca Scratch' 2. Rex Har Morgan REFERENCES: 1. https://w	What are User Personas? – Creating a Persona – Four Dif: Affinity Diagram – Work Activity Affinity Diagram – Captu Information Architecture and Visual Design Princitecture: Navigation – Task Flow – Content Strategy – Site Dography – Textures – Forms – Design Principles – Alignary Design Tools. Wireframes and Prototyping 10e? – How to Create Wireframes? – Types of Wireframes – Wireframing Software – What is Prototyping – Prototyping process of Creating Prototypes – Prototyping Tools. 10ex	re, Grouping and Lab iples: Map – Gestures – Ba nent – Hierarchy – Co - Wireframing Tools: \$ Methods – Paper Pro otype, and Implement nes for Ensuring a Qua	eling. sics of Visual ntrast – Repet Sketch Wirefra totypes – Digit Lecture: Compelling U	Designation -	gn – Li – Proxi – Sten ototype Futoria	nes – mity – ciling es – C	9+3 Shapes - Balance 9+3 and coding Total: 6

	SE OUTCOMES: upletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	Utilize the UX design process on product or service.	Applying (K3)
CO2	Apply principles and procedures to conduct user research.	Applying (K3)
CO3	Create user persona and construct affinity diagram for the product or service	Applying (K3)
CO4	Design information architecture based on various visual design principles.	Applying (K3)
CO5	Create wireframes and prototypes for the product or service by using various tools and software.	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1					3	2	1		3	1
CO2	3	3	3	1					3	2	1		3	1
CO3	3	3	3	1					3	2	1		3	1
CO4	3	3	3	1					3	2	1		3	1
CO5	3	3	3	1					3	2	1		3	1

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

		AUGEOGNIEN	III AII EINII -	IIILOINI			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	20	60	-	-	-	100
CAT2	10	20	70	-	-	-	100
CAT3	15	20	65	-	-	-	100
ESE	15	20	65	-	-	-	100
		-		_	-		İ

 $^{^*}$ ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22CDX01 - FUNDAMENTALS OF USEI (Computer Science and		SIGN				
Programme		Sem.	Category	L	т	Р	Credit
Branch Prerequisite		6	OE	3	0	2	4
rrerequisite	es IVIL	0	OL	3	U		-
Preamble	This course gives perfect introduction to user interface focusing on effective human communication.	design and explains	how to design	intui	tive us	er inte	rfaces by
Unit - I	Introduction						9
	nunication Concept - Communication Design Principles- UI Design tion - Intuitive UI- Necessary And Unnecessary Consistency - Ui				munic	ation	- Effective
Unit - II	Interaction and Visual Design						9
Notifications	-Controls - Commands - Labels And Instructions – Feedback - s - Dynamic Elements - Importance of Visual Design - Graphic Discount - Icons And Glyphs- Animations And Transitions - Demanding A	esigners - Layout					
Unit - III	Communication Design Process						9
Forgiveness	ting to People - Emotional Connection – Personality - Attributes - Building Trustworthiness - Courageous Design - commun Planning phase - Design phase -Refinement phase.						
Unit - IV	Material Design and Components						9
	sign: Introduction, Principles. Material Environment: Surfaces. Ele Top, Bottom Navigation, Buttons, Cards, Text Fields, Navigation		adows. Basic	Com	ponen	ts: Ap	p bars
Unit - V	Advanced Components						0
Advanced C	Components: Backdrop, Checkboxes, Chips, Date Pickers, Dialogns, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Ta		Pickers.				9 cators, , Total:75
Advanced C Radio Buttor TEXT BOOK	Components: Backdrop, Checkboxes, Chips, Date Pickers, Dialogns, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Take	ibs, Tool Tips, Time F	Pickers. Lecture:	45,	Praction		cators,
Advanced C Radio Buttor TEXT BOOK 1. McI con	Components: Backdrop, Checkboxes, Chips, Date Pickers, Dialogns, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takes, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takes, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takes, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takes, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takes, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takes, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takes, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takes, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takes, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takes, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takes, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takes, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takes, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takes, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takes, Sheets – Bottom and Side, Sheets – Bottom and Sheets – Bottom and Side, Sh	ibs, Tool Tips, Time F	Pickers. Lecture:	45,	Praction		cators,
Advanced C Radio Buttor TEXT BOOK 1. McI con List of Exer 1. Exp Vari Layer	Components: Backdrop, Checkboxes, Chips, Date Pickers, Dialogns, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takey, State of the State o	ibs, Tool Tips, Time F	Pickers. Lecture:	45,	Praction		cators,
Advanced C Radio Buttor TEXT BOOK 1. Mol con List of Exer 1. Exp Vari Laye Des	components: Backdrop, Checkboxes, Chips, Date Pickers, Dialogns, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takey, Everett N. UI is communication: How to design intuitive, use munication. Newnes, 2013. **Cises / Experiments:* **Diore Figma Interface in ious tools in toolbar yers, Assets, Pages sign Panel	ibs, Tool Tips, Time F	Pickers. Lecture:	45,	Praction		cators,
Advanced C Radio Buttor TEXT BOOK 1. Mcl con List of Exer 1. Exp Vari Lay Des 2. App	Components: Backdrop, Checkboxes, Chips, Date Pickers, Dialogns, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takey, Everett N. UI is communication: How to design intuitive, use munication. Newnes, 2013. **Cises / Experiments:* **Diore Figma Interface in ious tools in toolbar eers, Assets, Pages sign Panel **Dividesign constraints to objects in your workflow	ibs, Tool Tips, Time F	Pickers. Lecture:	45,	Praction		cators,
Advanced C Radio Buttor TEXT BOOK 1. McI con List of Exer 1. Exp Vari Lay Des 2. App 3. Cres	Components: Backdrop, Checkboxes, Chips, Date Pickers, Dialogns, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takey, Everett N. UI is communication: How to design intuitive, use munication. Newnes, 2013. **Cises / Experiments:* *Diore Figma Interface in ious tools in toolbar in toolbar in tools in toolbar in tools in toolbar in tools in toolbar in tools in toolbar in tools i	ibs, Tool Tips, Time F	Pickers. Lecture:	45,	Praction		cators,
Advanced C Radio Buttor TEXT BOOK 1. McI con List of Exer 1. Exp Vari Lay Des 2. App 3. Crei 4. App	Components: Backdrop, Checkboxes, Chips, Date Pickers, Dialogns, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takey, Everett N. UI is communication: How to design intuitive, use munication. Newnes, 2013. **Cises / Experiments:* Diore Figma Interface in ious tools in toolbar ivers, Assets, Pages sign Panel Diby design constraints to objects in your workflow water Frames and grids and add it in Figma ply Auto Layout to either frames or components in Figma	ibs, Tool Tips, Time F	Pickers. Lecture:	45,	Praction		cators,
Advanced C Radio Buttor TEXT BOOK 1. McI con List of Exer 1. Exp Vari Lay Des 2. App 3. Crea 4. App 5. Crea	Components: Backdrop, Checkboxes, Chips, Date Pickers, Dialogns, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takey, Everett N. UI is communication: How to design intuitive, use munication. Newnes, 2013. **Cises / Experiments:* *Diore Figma Interface in ious tools in toolbar in toolb	ibs, Tool Tips, Time F	Pickers. Lecture:	45,	Praction		cators,
Advanced C Radio Buttor TEXT BOOK 1. McI con List of Exer 1. Exp Vari Lay Des 2. App 3. Cre 4. App 5. Cre 6. Cre	Components: Backdrop, Checkboxes, Chips, Date Pickers, Dialogns, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takey, Everett N. UI is communication: How to design intuitive, use munication. Newnes, 2013. **Cises / Experiments:* *Diore Figma Interface in ious tools in toolbar vers, Assets, Pages sign Panel *Dividesign constraints to objects in your workflow vate Frames and grids and add it in Figma *Poly Auto Layout to either frames or components in Figma vate and use Figma components in Your Design vate a style guide for your mobile and web application.	ibs, Tool Tips, Time F	Pickers. Lecture:	45,	Praction		cators,
Advanced C Radio Buttor TEXT BOOK 1. Mcl con List of Exer 1. Exp Vari Lay Des 2. App 3. Crea 4. App 5. Cre 6. Cre 7. Cre	Components: Backdrop, Checkboxes, Chips, Date Pickers, Dialogns, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takey, Everett N. UI is communication: How to design intuitive, use munication. Newnes, 2013. **Cises / Experiments:* *Diore Figma Interface in ious tools in toolbar in toolb	ibs, Tool Tips, Time F	Pickers. Lecture:	45,	Praction		cators,
Advanced C Radio Buttor TEXT BOOK 1. McI con List of Exer 1. Exp Vari Lay Des 2. App 3. Cre 4. Apr 5. Cre 6. Cre 7. Cre 8. Cre 9. Cre Pro	components: Backdrop, Checkboxes, Chips, Date Pickers, Dialogns, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takey, Everett N. UI is communication: How to design intuitive, use munication. Newnes, 2013. **Cises / Experiments:* **Diore Figma Interface in ious tools in toolbar eers, Assets, Pages sign Panel **Diy design constraints to objects in your workflow eate Frames and grids and add it in Figma **Poly Auto Layout to either frames or components in Figma eate and use Figma components in Your Design eate a style guide for your mobile and web application. **Eate a mockup mobile UI screens for any mobile app.	ibs, Tool Tips, Time F	Pickers. Lecture:	45,	Praction		cators,
Advanced C Radio Buttor TEXT BOOK 1. Mcl con List of Exer 1. Exp Vari Lay Des 2. App 3. Cre 4. App 5. Cre 6. Cre 7. Cre 8. Cre 9. Cre Pro Ins	Components: Backdrop, Checkboxes, Chips, Date Pickers, Dialogns, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takey, Everett N. UI is communication: How to design intuitive, use munication. Newnes, 2013. **Cises / Experiments:* *Diore Figma Interface in ious tools in toolbar rers, Assets, Pages sign Panel *Dly design constraints to objects in your workflow rate Frames and grids and add it in Figma *Poly Auto Layout to either frames or components in Figma reate and use Figma components in Your Design reate a style guide for your mobile and web application. *Poly Reate a mockup mobile UI screens for any mobile app.* *Poly Reate a mockup web UI screens for any web application.* *Poly Reate Prototyping in Figma bototype Panel*	ibs, Tool Tips, Time F	Pickers. Lecture:	45,	Praction		cators,
Advanced C Radio Buttor TEXT BOOK 1. Molcon List of Exer 1. Exp Vari Lay Des 2. App 3. Crea 4. App 5. Cre 6. Cre 7. Cre 8. Cre 9. Cre Pro Ins 10. Cre 44	Components: Backdrop, Checkboxes, Chips, Date Pickers, Dialogns, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Takey, Everett N. UI is communication: How to design intuitive, use munication. Newnes, 2013. **Cises / Experiments:* **Diore Figma Interface in ious tools in toolbar eers, Assets, Pages sign Panel **Dividesign constraints to objects in your workflow eate Frames and grids and add it in Figma **Poly Auto Layout to either frames or components in Figma eate and use Figma components in Your Design **Poly Auto Layout to either frames for any mobile app.** **Poly Eate a mockup mobile UI screens for any mobile app.** **Poly Eate a mockup web UI screens for any web application.** **Poly Eate a mockup web UI screens for any web application.** **Poly Eate a mockup web UI screens for any web application.** **Poly Eate a mockup web UI screens for any web application.** **Poly Eate a mockup web UI screens for any web application.** **Poly Eate a mockup web UI screens for any web application.** **Poly Eate a mockup web UI screens for any web application.**	ibs, Tool Tips, Time F	Pickers. Lecture:	45,	Praction		cators,

REFERENCES: https://material.io/components **COURSE OUTCOMES:** BT Mapped On completion of the course, the students will be able to (Highest Level) Establish the baseline principles of UI design as a form of effective human communication Applying (K3) CO1 Make use of practical communication-based guide to interaction and visual design Applying (K3) CO2 Integrate the concepts of Communication-based design process from interaction to visual design Applying (K3) CO3 Apply the material design principles and its components used to create a user interface Applying (K3) CO₄ Design a simple user interface by applying the advanced material components Applying (K3) CO₅ Mapping of COs with POs and PSOs **PO7** COs/POs PO1 PO₂ PO₃ PO4 PO₅ **PO6 PO8** PO9 PO10 PO11 PO12 PSO₁ PSO₂ 3 2 1 2 1 CO1 2 CO₂ 3 2 1 1

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

1

1

1

CO3

CO₄

CO₅

3

3

3

2

2

2

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	5	20	75	-	-	-	100
CAT2	10	20	70	-	-	-	100
CAT3	10	20	70	-	-	-	100
ESE	10	20	70	-	-	-	100

2

2

2

1

1

1

	(Computer Science an	d Design)					
Programme & Branch	BE - Computer Science and Design	Sem.	Category	L	Т	Р	Credit
Prerequisites	NIL	7	OE	3	0	0	3
Preamble	This course helps the students to provide the basic kn prior knowledge or skills that are required to understar		al guide to dev	elop	mobile	game	es withou
Unit - I	Mobile Game Design Process						9
Unit - II Roles of UI – UI ii	user Interface Design for Mobile Games video games – Designing the UI: Aesthetics, vectors and on Size, Main Screen, Screen rotation, challenges – Mobile		cons – UI Desi	gn Pı	actices	s: Scr	9 een Flow
Unit - III	Graphics and Audio for Mobile	e Game Engines.					9
Graphics : Pixels	and Vectors - Graphic file formats - 2D & 3D Graphic Ass	sets – Character Desi	gning – Colors	s for r	nobile	– Auc	lio: Digita
Sound Technolog Unit - IV	and Vectors – Graphic file formats – 2D & 3D Graphic Ass y – Recording and Playback – Types of Game sounds – D Mobile Game Controls and Coding	esigning Audio – Pra	ctices for aud	io des	sign.		9
Sound Technolog Unit - IV Mobile Game con Future technologi	y – Recording and Playback – Types of Game sounds – D	Designing Audio – Pra	ctices for aud	io de: es – E	sign. Built-in	devic	9 es –
Sound Technolog Unit - IV Mobile Game con	y – Recording and Playback – Types of Game sounds – D Mobile Game Controls and Coding trols: Input Technology – Touchscreens – Keypads – Touch	Designing Audio – Pra	ctices for aud	io de: es – E	sign. Built-in	devic	9 es –
Sound Technolog Unit - IV Mobile Game con Future technologi Game program. Unit - V Prototyping proce Imagination – Per	y – Recording and Playback – Types of Game sounds – D Mobile Game Controls and Coding trols: Input Technology – Touchscreens – Keypads – Touches – Coding Games: Programming language features – Games	chscreen Gestures – ame programming: C	Input Interface ++, Java, HTN	es – E ML5, 2	sign. Built-in Xcode sposal	device – Stru	9 es – ucture of 9 de –
Sound Technolog Unit - IV Mobile Game con Future technologi Game program. Unit - V Prototyping proce Imagination – Per	Mobile Game Controls and Coding Itrols: Input Technology – Touchscreens – Keypads – Touches – Coding Games: Programming language features – Gerototyping Prototyping Iss: Defining – Building – Testing – Fixing – Styles: Horizonal and Paper – Visual prototypes – Interactive prototypes	chscreen Gestures – ame programming: C	Input Interface ++, Java, HTN	es – E ML5, 2	sign. Built-in Xcode sposal	device – Stru	9 es – icture of 9 de – ame
Sound Technolog Unit - IV Mobile Game con Future technologi Game program. Unit - V Prototyping proce Imagination – Per Mechanics – Con	Mobile Game Controls and Coding Itrols: Input Technology – Touchscreens – Keypads – Touches – Coding Games: Programming language features – Gerototyping Prototyping Iss: Defining – Building – Testing – Fixing – Styles: Horizonal and Paper – Visual prototypes – Interactive prototypes	chscreen Gestures – ame programming: C	Input Interface ++, Java, HTN	es – E ML5, 2	sign. Built-in Xcode sposal	device – Stru	9 es – icture of 9 de – ame
Sound Technolog Unit - IV Mobile Game con Future technologi Game program. Unit - V Prototyping proce Imagination – Per Mechanics – Con TEXT BOOK:	Mobile Game Controls and Coding Itrols: Input Technology – Touchscreens – Keypads – Touches – Coding Games: Programming language features – Gerototyping Prototyping Iss: Defining – Building – Testing – Fixing – Styles: Horizonal and Paper – Visual prototypes – Interactive prototypes	chscreen Gestures – ame programming: C ntal and Vertical – Pri – Tools for prototypi	Input Interface ++, Java, HTM ototyping Type ng – Pitching a	es – E ML5, 2	sign. Built-in Xcode sposal	device – Stru	9 es – ucture of 9 de –
Sound Technolog Unit - IV Mobile Game con Future technologi Game program. Unit - V Prototyping proce Imagination – Per Mechanics – Con TEXT BOOK: 1. Dr. Clau Manning	Mobile Game Controls and Coding Itrols: Input Technology – Touchscreens – Keypads – Touches – Coding Games: Programming language features – Gerototyping Iss: Defining – Building – Testing – Fixing – Styles: Horizon incil and Paper – Visual prototypes – Interactive prototypes trol scheme and Interface – Game Flow. Idio Scolastici, David Nolte, "Mobile Game Design Essential, J., & Buttfield-Addison, P. (2017). "Mobile Game Develop	chscreen Gestures – ame programming: C ntal and Vertical – Pro – Tools for prototypin	Input Interface ++, Java, HTM ototyping Type ng – Pitching a	es – E ML5, Z es: Di a mob	sign. Built-in Xcode sposal bile gar	device – Stru ole co me: G	9 es – icture of 9 de – ame Total: 4
Sound Technolog Unit - IV Mobile Game con Future technologi Game program. Unit - V Prototyping proce Imagination – Per Mechanics – Con TEXT BOOK: 1. Dr. Clau Manning	Mobile Game Controls and Coding Itrols: Input Technology – Touchscreens – Keypads – Touches – Coding Games: Programming language features – Gerototyping Iss: Defining – Building – Testing – Fixing – Styles: Horizon incil and Paper – Visual prototypes – Interactive prototypes trol scheme and Interface – Game Flow. Idio Scolastici, David Nolte, "Mobile Game Design Essential, J., & Buttfield-Addison, P. (2017). "Mobile Game Develop	chscreen Gestures – ame programming: C ntal and Vertical – Pro – Tools for prototypin	Input Interface ++, Java, HTM ototyping Type ng – Pitching a	es – E ML5, Z es: Di a mob	sign. Built-in Xcode sposal bile gar	device – Stru ole co me: G	9 es – ucture of 9 de – ame Total: 4

	SE OUTCOMES: upletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	describe the most important design process to develop game	Applying (K3)
CO2	built user interface design for mobile games	Applying (K3)
CO3	focus on the basic structure of game program and its controls along with the creation of user interface	Applying (K3)
CO4	Develop and design controls in mobile games using game programming .	Applying (K3)
CO5	model visual prototype for mobile gaming.	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1									3	2
CO2	3	2	2	1									3	2
CO3	3	2	2	1									3	2
CO4	3	2	2	1									3	2
CO5	3	2	2	1									3	2

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

	/		•			
Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
15	25	60				100
10	35	55				100
15	25	60				100
20	25	55				100
	(K1) % 15 10 15	Remembering (K1) % Understanding (K2) % 15 25 10 35 15 25	Remembering (K1) % Understanding (K2) % Applying (K3) % 15 25 60 10 35 55 15 25 60	Remembering (K1) % Understanding (K2) % Applying (K3) % Analyzing (K4) % 15 25 60 10 35 55 15 25 60	Remembering (K1) % Understanding (K2) % Applying (K3) % Analyzing (K4) % Evaluating (K5) % 15 25 60	(K1) % (K2) % (K3) % (K4) % (K5) % (K6) % 15 25 60 10 35 55 15 25 60

 $^{^{\}star}$ ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	(Computer Science and	Design)					
Programme & Branch	BE - Computer Science and Design	Sem.	Category	L	Т	Р	Credit
Prerequisites	NIL	8	OE	3	0	0	3
Preamble	This course provides knowledge of principles of design in- depth knowledge of major design formats and discip and package design. This course will benefit the student real world scenarios.	lines such as typog	raphy, interact	ive d	esign,	motio	n graphics
Unit - I	Fundamentals of Graphic Design						9
Spacing, Web Typ Craftsmanship.	ic shapes, HAUS, Laws of perceptual organization. Typogrape basics, Expressive typography. Design Process – Design						ith Type,
Unit - II	Concept Generation						
icons and color -	on and Creativity – Design concept, concept generation pro Image classifications and depictions, signs and symbols, Ic ipulating images, Basics of visualizing form, drawing, using	on design, Media, n	nethods and vi				
Unit - III	Proportional systems, Formats and Disciplines						9
							9
	ems, the grid and Brochure design – Mathematical ratios an ry. Book covers – purpose of cover design, designing a cov			ters -	Purpo	se of	
				ters -	Purpo	se of	
Social Commenta Unit - IV Branding and visu designing, fundam designing ads, Th	ry. Book covers – purpose of cover design, designing a cov Branding and Advertising ral identity – Branding, purpose and process of branding, vinentals of letterhead design. Advertisingpurpose, who cree Ad Campaign, Responsible advertising and being proactive.	er, designing for a s sual identity - purpo eates advertising?,	series. ose and design	ning, l	ogo - Į	ourpos	posters, 9 se and ailding,
Social Commenta Unit - IV Branding and visu designing, fundar designing ads, Th Unit - V	Branding and Advertising all identity – Branding, purpose and process of branding, vinentals of letterhead design. Advertisingpurpose, who cree Ad Campaign, Responsible advertising and being proactifully. Web, Mobile, Motion Design and Package Design	sual identity - purpo eates advertising?, ve.	series. ose and desigr Role of storyte	ning, l	ogo - μ and st	ourpos ory bu	posters, 9 se and ailding,
Social Commenta Unit - IV Branding and visu designing, fundar designing ads, Th Unit - V Web, Mobile and I and visual design,	ry. Book covers – purpose of cover design, designing a cov Branding and Advertising ral identity – Branding, purpose and process of branding, vinentals of letterhead design. Advertisingpurpose, who cree Ad Campaign, Responsible advertising and being proactive.	sual identity - purpo eates advertising? , ve.	series. ose and design Role of storyte Development,	ning, lelling	ogo - pand st	ourpos ory bu	posters, 9 se and uilding, 9 elopment
Social Commenta Unit - IV Branding and visu designing, fundar designing ads, Th Unit - V Web, Mobile and I and visual design,	Branding and Advertising all identity – Branding, purpose and process of branding, vinentals of letterhead design. Advertising - purpose, who cree Ad Campaign, Responsible advertising and being proactive. Web, Mobile, Motion Design and Package Design Motion design – expectations from interactive experiences, Engaging content, Mobile design, Motion design, and Visu	sual identity - purpo eates advertising? , ve.	series. ose and design Role of storyte Development,	ning, lelling	ogo - pand st	ourpos ory bu	posters, 9 se and uilding, 9 elopment
Social Commenta Unit - IV Branding and visu designing, fundam designing ads, Th Unit - V Web, Mobile and l and visual design, purpose, consider	Branding and Advertising all identity – Branding, purpose and process of branding, vinentals of letterhead design. Advertising - purpose, who cree Ad Campaign, Responsible advertising and being proactive. Web, Mobile, Motion Design and Package Design Motion design – expectations from interactive experiences, Engaging content, Mobile design, Motion design, and Visu	sual identity - purpo eates advertising? , ve.	series. ose and design Role of storyte Development,	ning, lelling	ogo - pand st	ourpos ory bu	posters, 9 se and uilding, 9 elopment
Social Commenta Unit - IV Branding and visu designing, fundam designing ads, Th Unit - V Web, Mobile and l and visual design, purpose, consider TEXT BOOK:	Branding and Advertising all identity – Branding, purpose and process of branding, vinentals of letterhead design. Advertising - purpose, who cree Ad Campaign, Responsible advertising and being proactive. Web, Mobile, Motion Design and Package Design Motion design – expectations from interactive experiences, Engaging content, Mobile design, Motion design, and Visu	sual identity - purpo eates advertising? , ve. Websites, Website al basics for screen	series. ose and design Role of storyte Development,	ning, lelling	ogo - pand st	ourpos ory bu	posters, 9 se and uilding, 9 elopment
Social Commenta Unit - IV Branding and visus designing, fundar designing ads, Th Unit - V Web, Mobile and land visual design, purpose, consider TEXT BOOK: 1. Robin La	Branding and Advertising Itali identity – Branding, purpose and process of branding, vincentals of letterhead design. Advertisingpurpose, who cree Ad Campaign, Responsible advertising and being proactive. Web, Mobile, Motion Design and Package Design Motion design – expectations from interactive experiences, Engaging content, Mobile design, Motion design, and Visuations, Audio CD package design.	sual identity - purpo eates advertising? , ve. Websites, Website al basics for screen	series. ose and design Role of storyte Development,	ning, lelling	ogo - pand st	ourpos ory bu	posters, 9 se and uilding, 9 elopment
Social Commenta Unit - IV Branding and visus designing, fundar designing ads, Th Unit - V Web, Mobile and land visual design, purpose, consider TEXT BOOK: 1. Robin La	Branding and Advertising all identity – Branding, purpose and process of branding, vinentals of letterhead design. Advertising - purpose, who cree Ad Campaign, Responsible advertising and being proactive. Web, Mobile, Motion Design and Package Design Motion design – expectations from interactive experiences, Engaging content, Mobile design, Motion design, and Visuations, Audio CD package design.	sual identity - purpo eates advertising? , ve. Websites, Website al basics for screen	series. ose and design Role of storyte Development,	ning, lelling	ogo - pand st	ourpos ory bu	posters, 9 se and uilding, 9 elopment

	SE OUTCOMES: upletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	Understand the formal elements, design principles and process.	Understand (K2)
CO2	Apply the concept generation process and creative thinking for real world design scenarios.	Apply (K3)
CO3	Utilize the formats, disciplines and proportional systems.	Apply (K3)
CO4	Apply branding and logos and identity to products and advertising.	Apply (K3)
CO5	Develop visual language in various projects and media channels including web, mobile and motion design and understand package design.	Apply (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1									3	2
CO2	3	2	2	1									3	2
CO3	3	2	2	1									3	2
CO4	3	2	2	1									3	2
CO5	3	2	2	1									3	2

 $1-Slight,\, 2-Moderate,\, 3-Substantial,\, BT\text{-}\,Bloom's\, Taxonomy$

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	60	25				100
CAT2	15	65	20				100
CAT3	15	65	20				100
ESE	10	70	20				100

 $^{^{\}star}$ ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

		(Computer Science an	d Design)					
_	ramme &	BE - Computer Science and Design	Sem.	Category	L	Т	Р	Credit
Brar Prer	equisites	NIL	8	PC	2	0	2	3
1 101	equisites	MIL		10				3
Prea	mble	This course introduces the fundamentals of the Virt user experience, identifying and resolving conflicts i architecture, gaming, entertainment etc.						
Unit	- I	Design ,Art Across Digital Realities and eXtende	d Reality					9
for S Reco	Spatial Compu ognition-Desig	act with Computers-Modalities Through the Ages-Types ting Devices - Current Controllers for Immersive Comning for Our Senses, Not Our Devices-Sensory Desduction-Draw Calls- Using VR Tools for Creating 3D Art	puting Systems-A I	Note on Hand Principles.Virt	l Tra ual f	cking Reality	and F	Hand Pose Art-3D Art
Unit		Hardware, SLAM, Tracking						9
Platf Pictu	orms- Apple's ıre—Privacy a	or Vision That Makes Augmented Reality Possible Works ARKit- Other Development Considerations –Lighting and AR Cloud Data.	g-The AR Cloud-T					The Bigge
Unit		Creating Cross-Platform Augmented Reality and						9
		A Augmented Reality: Cross-Platform Theory-The Role						
		o Game Design-Simplifying the Controller Input-Virtual lity and Augmented Reality Development Best Practices	•	n Source Fran	newc	rk tor	tne Co	ommunity-
		Enhancing Data Representation: Data Visualizati		telligence in	Snat	ial		
Unit	- IV	Computing		tomgenee m	Ора	ıuı		9
Data	and Machine	Learning Visualization Design and Development in	Spatial Computing-	Introduction-L	Jnde	rstand	ing D	ata
		iples for Data and Machine Learning Visualization-2D [ation-A	Animation-
		ons, Infographics, and Interactions-3D Reconstruction a		tion of Real-W	orld	Data.		
Unit		Character AI ,Behaviors and Use Cases in Embo						9
		aviors -Current Practice: Reactive AI-More Intelligence hnology Ecosystem-VR/AR Health Technology Applicati						
	tsXR.	milology Ecosystem-VN/AN Health Technology Applicati	on Design - Standa	IU UX ISII I IIII	JILIVE	-11161	all L	хрепенсе.
Орог	1071111							
List	of Exercises	s / Experiments :						
1.		out system for marker-less AR system.						
2.	<u> </u>	eraction for marker-less AR system.						
3.	•	bug and build marker-less AR application						
4.		out system for marker AR system.						
5.		eraction for marker AR system.						
6.	·	bug and build marker AR application						
о. 7.	•	odel for VR Environment						
7. 8.	Setup 3D mo							
9.		teraction system						
10.		bug and built VR education application						
				Lecture	:45,	Practi	cal:30), Total:75
TEV	T DOOK:							
		Augmented and Virtual Realities by Erin Pangilinan, St blisher(s): O'Reilly Media, Inc.,ISBN: 9781492044147	eve Lukas, Vasanth	Mohan Relea	sed	March)	
1.								
	ERENCES:							

	E OUTCOMES: upletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	understanding the fundamentals of Design ,Art Across Digital Realities and extended Reality	Applying (K3), Precision(S3)
CO2	explore the components of Hardware, SLAM, and Tracking	Applying (K3), Precision(S3)
CO3	apply the concept by creating Cross-Platform Augmented Reality and Virtual Reality	Applying (K3), Precision(S3)
CO4	Demonstrate the enhancing Data Representation of Data Visualization and Artificial Intelligence in Spatial Computing	Applying (K3), Precision(S3)
CO5	Demonstrate the character of AI ,behaviors and Use Cases in Embodied Reality	Applying (K3), Precision(S3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1									3	2
CO2	3	2	2	1									3	2
CO3	3	2	2	1									3	2
CO4	3	2	2	1									3	2
CO5	3	2	2	1									3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

	7.00-00									
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %			
CAT1	35	30	35				100			
CAT2	25	30	45				100			
CAT3	25	30	45				100			
ESE	20	50	30				100			

 $\pm 3\%$ may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	(Offered by Artificial Intelligence and I	Data Science)					
Programme	2	Sem.	Category		Т	Р	Credit
Branch	All BE/BTech Branches except AIDS and AIML			L		Г	Credit
Prerequisit	s Nil	5	OE	3	1	0	4
Preamble	This course provides a comprehensive knowledge about to operations.	ouilding a data wa	rehouse and	perf	ormir	ng dat	ta mining
Unit – I	Introduction:						9+3
	 Steps in Knowledge Discovery Process – Kinds of Data and Pa in Data Mining – Data objects and attribute types – Statistical 						
Unit – II	Data Preprocessing:						9+3
	n data preprocessing - Data Cleaning – Data Integration – Data R hierarchy generation.	eduction – Data	Transformation	on –	Data	Discr	etization
Unit – III	Data Warehousing:						9+3
	use architecture – Data warehouse modeling – Data cube – OLA use implementation – Data generalization by attribute oriented in		Data warehou	ise d	esigr	and	usage –
Unit – IV	Frequent Pattern Mining:						9+3
Pattern eval Unit – V Mining com	ots – Frequent itemset mining methods: Apriori algorithm – A paration methods – Multilevel – Multi dimensional frequent pattern notes and mining applications: Data Mining Applications:	nining.					9+3
mining trend	5		Lecture:4	5, Tı	ıtoria	al:15,	Total:60
TEXT BOO	:						
1. Har 201	Jiawei, and Kamber Micheline, "Data Mining: Concepts and Ted	chniques", 3 rd Ed	ition, Morgan	Kau	ıfmar	n Pu	blishers,
REFERENC	ES:						
1. Ber 200	on Alex, and Smith Stephen J, "Data Warehousing, Data Mining a	and OLAP", 1 st Eo	dition, Tata M	lcGra	aw- H	lill, Ne	ew Delhi,
COURSE O	JTCOMES: on of the course, the students will be able to					Γ Map	pped Level)
CO1 des	ribe the concepts of data mining and perform statistical analysis of	of data			Ар	plying	g (K3)
CO2 app	various preprocessing techniques				Ар	plying	g (K3)
CO3 perf	orm OLAP operations by constructing data warehouse				Ар	plying	g (K3)
	y association rule mining methods to solve the problem				Ap	plying	g (K3)
CO4 app	y association rule mining methods to solve the problem uss about data mining applications						g (K3) g (K3)

	Mapping of COs with POs and PSOs													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2											
CO2	3	2	2											
CO3	3	2	2											
CO4	3	2	2											
CO5	3	2	2											

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PA	TTERN - THEORY
---------------	----------------

nembering (K1) % 20	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
20	40	40				1
		40				100
20	40	40				100
20	40	40				100
20	40	40				100
	20	20 40 20 40	20 40 40 20 40 40 20 40 40	20 40 40 20 40 40 20 40 40	20 40 40 20 40 40 20 40 40	20 40 20 40 40 40

^{* ±3%} may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

		22ADX01 - DATA VISUALIZA (Offered by Artificial Intelligence and D						
	mme &	All BE/BTech Branches except AIDS and AIML	Sem.	Category	L	т	Р	Credit
Branch		Nil	6	OE		0	2	4
Prerequ	uisites	NII	0	OE	3	U		4
Preamb	ole	This course provides practical exposure to Python Progra	amming frame	works require	d for	visu	alizing	data.
Reshap Introdu	standing Da ping – Cond ction – UFu	Introduction to NumPy: Ita Types in Python – NumPy Arrays Basics: Array Atcatenation and Splitting – NumPy Arrays Computation: Inc. Exploring – Features – Aggregations						- UFunc
Unit – I		Computation on Arrays: rrays: Broadcasting – Introduction – Rules – Comparison	e Maeke an	d Boolean I o	aic -	_ 1 1f1 11	nce C	9 ompariso
Operate	ors – Boole	ean Arrays – Masks Boolean Arrays – Fancy Indexing – - Structured Data: NumPy's Structured Arrays						
Unit – I		Data Manipulation with Pandas:						9
Operat Rearra Unit – I Combin	tions betwe anging and l IV ning Datase	ntroduction – Data Indexing and Selection – Data Open DataFrame and Series – Handling missing data – Data Aggregations Advanced Operations with Pandas: ets: Concat and Append – Combining Datasets: Merge and Operations: Pandas String Operations Introduction – F	Hierarchical nd Join – Agg	Indexing: Cr	eatir	ng, Ir	ndexir	g, Slicing
– vecio		g Operations. Pandas String Operations Introduction – F Visualization with Matplotlib:	Pandas Sinng	ivietnous				9
		 Line Plots – Scatter Plots – Visualizing errors – Dens 	sity and Cont	our Plots – H	isto	gram	s. Bin	
Density	y – Custom	izing Plot Legends – Customizing Colorbars – Multiple S	Subplots					
3.	Combine	ata Manipulation using Pandas. datasets using concat, append, merge and join functions	;					
5. 6.	Visualize o	ggregation and grouping using Pandas vot Tables and vectorized String Operations data using line, scatter, density and contour plots.						
5.6.7.	Visualize d	vot Tables and vectorized String Operations data using line, scatter, density and contour plots. the Customizing Plot Legends						
5. 6. 7.	Visualize d	vot Tables and vectorized String Operations data using line, scatter, density and contour plots.						
5. 6. 7.	Visualize d	vot Tables and vectorized String Operations data using line, scatter, density and contour plots. the Customizing Plot Legends		Lecture	45, I	Pract	ical:3	0, Total:7
5. 6. 7. 8.	Visualize t Visualize t	vot Tables and vectorized String Operations data using line, scatter, density and contour plots. the Customizing Plot Legends		Lecture:	45, I	Pract	ical:3	0, Total:7
4. 5. 6. 7. 8. TEXT E	Visualize of Visualize to Implementation	vot Tables and vectorized String Operations data using line, scatter, density and contour plots. the Customizing Plot Legends	orking with dat					
5. 6. 7. 8. TEXT E	Visualize of Visualize of Implementation (No. 1) Visualize of Implementation (No. 1) Visualize of Visualize o	vot Tables and vectorized String Operations data using line, scatter, density and contour plots. the Customizing Plot Legends t Customizing Colorbars and Multiple Subplots	orking with dat					
5. 6. 7. 8. TEXT E	Visualize of Visualize of Implementation (Control of Control of Co	vot Tables and vectorized String Operations data using line, scatter, density and contour plots. the Customizing Plot Legends t Customizing Colorbars and Multiple Subplots s, J. "Python data science handbook: Essential tools for wo		a", 1 st Edition				
5. 6. 7. 8. TEXT E 1. REFER 1.	Visualize of Visualize of Visualize of Implementation (Control of Visualize of Visu	vot Tables and vectorized String Operations data using line, scatter, density and contour plots. the Customizing Plot Legends t Customizing Colorbars and Multiple Subplots s, J. "Python data science handbook: Essential tools for wo	n ", APress, 20	a", 1 st Edition				
5. 6. 7. 8. TEXT E 1. REFER 1. 2.	Visualize of Visualize of Visualize of Implementation (Control of the Control of	vot Tables and vectorized String Operations data using line, scatter, density and contour plots. the Customizing Plot Legends t Customizing Colorbars and Multiple Subplots s, J. "Python data science handbook: Essential tools for wo	n ", APress, 20	a", 1 st Edition				
5. 6. 7. 8. TEXT E	Visualize of Visualize of Visualize of Visualize of Implement Sook: VanderPlat 2016. EENCES/ MAD Dr. Ossam Wes McKill Operating	vot Tables and vectorized String Operations data using line, scatter, density and contour plots. the Customizing Plot Legends t Customizing Colorbars and Multiple Subplots s, J. "Python data science handbook: Essential tools for wo	n ", APress, 20	a", 1 st Edition				

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	perform array operations using Numpy	Applying (K3) Precision (S3)
CO2	manipulate the dense data arrays in python	Applying (K3) Precision (S3)
CO3	manipulate data using Pandas	Applying (K3) Precision (S3)
CO4	apply data transformations such as aggregation and grouping using Pandas	Applying (K3) Precision (S3)
CO5	use Matplotlib for visualizing the data in python	Applying (K3) Precision (S3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2											
CO2	3	2	2											
CO3	3	2	2											
CO4	3	2	2											
CO5	3	2	2											

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

Tank / Diagonia	Danis and and a	I I and a made an allower	A I	A I!	E. alas dia a	0	
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	40	50				100
CAT2	10	40	50				100
CAT3	10	40	50				100
ESE	5	45	50				100

^{* ±3%} may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

		22A[0002 – NEU	RAL NETWO	RKS AND DE	EP LEARI	NING				
					gence and Dat						
Progra Branci	imme &	All BE/BTech Brai	nches excep	ot AIDS and	AIML	Sem.	Category	L	Т	Р	Credit
Prereq	uisites	Nil				7	OE	3	0	0	3
Pream	hle	This course is design	aned to impa	ort the skills re	auired to build	different d	een neural n	atwor	k arc	hitactı	ıroc
Unit -		Neural Networks:	gried to impa	irt trie skills re	quirea to balla	dillerent d	eep nediai n	Stwoi	K alo	meett	9
Introdu Networ	ction – Basid	Architecture of Neu Power of Function C									s in Neural
Unit –		Training Deep Net									9
		propagation- Setup a Normalization - Pract								3radie	nt Descent
Unit –		Radial Basis Fund									9
		on : Introduction - Tra ons of Restricted Bo			Hopfield Netwo	ork – The E	soltzman Mac	hine	– Re	stricte	d Boltzman
Unit –	IV	Recurrent Neural	Networks:								9
Introdu Long S	ıction – Arch Short-Term M	tecture of Recurrent lemory (LSTM) – Gat	Neural Netw ted Recurren	orks – Challe nt Units (GRU	enges of trainin s) – Applicatio	g Recurreins of Recu	nt Networks - rrent Neural	- Ech Netw	o-Sta orks	te Net	works –
Unit -		Convolution Neur									9
		c Structure of Convilications of Convolut			ning a Convol	utional Ne	twork – Case	e Stu	dies	of Co	nvolutional
											Total:45
TEXT I	воок:										
1.	Aggarwal,	Charu C, "Neural Ne	tworks and D	Deep learning	", 1 st Edition, S	Springer, 20)18.				
REFER	RENCES:										
1.	Ian Goodfe	llow, YoshuaBengio,	and Aaron C	Courvill, "Deep	b Learning", MI	IT Press, U	ISA, 2016				
2.	Josh Patte	son and Adam Gibso	on, "Deep Le	arning – A Pr	actitioner's Ap	proach", 1 ^s	et Edition, O'R	eilly	Serie	s, Aug	ust 2017.
3.	Indra den E	Bakker, "Python Deep	Learning Co	ookbook", 1 st	Edition, Packt	Publishing	, October 20	7.			
	SE OUTCOM	MES: the course, the stud	dents will be	able to						BT Ma	pped Level)
CO1	use Artificia	al Neural Network .co	ncepts to so	lve real world	problems				А	pplyin	g (K3)
CO2	solve simpl	e real world problems							Α	pplyin	a (K3)
	use the cor		s using deep	o neurai netw	orks.						3 (- /
CO3		ncepts of RBF and Bo				blems			Α	pplyin	g (K3)
CO3	explicate th	ncepts of RBF and Bo	oltzman mac	hines to solve	real world pro		oblems.				

	Mapping of COs with POs and PSOs													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2										
CO2	3	2	3	2										
CO3	3	2	3	2										
CO4	3	2	3	2										
CO5	3	2	3	2										

^{1 -} Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEOR	ASSES	SSMFNT	PATTERN	N - THEORY
----------------------------	-------	--------	---------	------------

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	45	45				100
CAT2	10	45	45				100
CAT3	10	45	45				100
ESE	5	45	45				100
* . 20/	veried (CAT 4.2.2	E0	400	`			•

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

		YTICS					
	(Offered by Artificial Intelligence and D	ata Science)					
Programme & Branch	All BE/BTech Branches except AIDS and AIML	Sem.	Category	Credit			
Prerequisites	Python Programming	8	OE	3	0	0	3
Preamble	To impart knowledge on various analytical methods for a	chieving Busin	ess Intelligen	ice.			
Unit – I	Foundations of Business Analytics:						9
	 cs - Evaluation of Business analytics – scope of business a ata-Metrics and Data classification - Data reliability and validity 						
Unit – II	Business Analytics on spreadsheet and Visualizatio	n:					9
queries - spread Excel Data Visua							oft Exce
Unit – III	Descriptive Statistics:						9
	samples - Measures of location - Measures of dispersion - stic for grouped data - Descriptive statistic for Categorical dat sions						
Unit – IV	Statistical Inference and Regression models:						9
	<u> </u>						
Unit – V	Forecasting Techniques:						9
	judgemental Forecasting-statistical forecasting model - fore	casting model			maaa	riac_t	
models-regressi	series with linear trend – forecasting time series with seasonalit on forecasting with causal varialbles						orecastin
							orecastin
TEXT BOOK:							orecastin
TEXT BOOK: 1. James F	on forecasting with causal varialbles						
TEXT BOOK: 1. James F REFERENCES:	on forecasting with causal varialbles	y -selecting ap	propriate time	e seri	ies ba	ased f	orecastin
TEXT BOOK: 1. James F REFERENCES: 1. U Dines COURSE OUTC	con forecasting with causal varialbles R. Evans. Business Analytics, 2 nd Edition, Pearson, 2017. th Kumar. Business Analytics: The Science of Data - Driven D	y -selecting ap	propriate time	e seri	y, 201	17.	orecastir
TEXT BOOK: 1. James F REFERENCES: 1. U Dines COURSE OUTC On completion	on forecasting with causal varialbles R. Evans. Business Analytics, 2 nd Edition, Pearson, 2017. h Kumar. Business Analytics: The Science of Data - Driven D OMES:	y -selecting ap	propriate time	e seri	y, 20°	17. BT Maghest	Total:4
TEXT BOOK: 1. James F REFERENCES: 1. U Dines COURSE OUTC On completion CO1 perform	on forecasting with causal varialbles 2. Evans. Business Analytics, 2 nd Edition, Pearson, 2017. 3. Evans. Business Analytics: The Science of Data - Driven D OMES: of the course, the students will be able to	y -selecting ap	propriate time	e seri	y, 20° Bi	17. ST Maghest	Total:4
TEXT BOOK: 1. James F REFERENCES: 1. U Dines COURSE OUTC On completion CO1 perform CO2 perform	con forecasting with causal variables R. Evans. Business Analytics, 2 nd Edition, Pearson, 2017. The Kumar. Business Analytics: The Science of Data - Driven Domes: The Course, the students will be able to the business data modelling and its analytics	y -selecting ap	propriate time	e seri	y, 20° (Hit Ap	17. T Maghest oplyin	Total:4 pped : Level) g (K3)

	Mapping of COs with POs and PSOs													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1										
CO2	3	2	2	1										
CO3	3	2	2	1										

Applying (K3)

apply various Forecasting Techniques on time series data

CO5

CO4	3	2	2	1					
CO5	3	2	2	1					

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	50	35				100
CAT2	10	50	40				100
CAT3	10	50	40				100
ESE	5	50	45				100

 $^{^*}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

		(Offered by Artificial Intelligence and Mac	hine Learning	1)				
Program Branch		All BE/BTech Branches except AIDS and AIML	Sem.	Category	L	Т	Р	Credit
Prerequ	uisites	Nil	5	OE	3	1	0	4
Preamb	le	This course focuses on learners to apply the business applications for making better decisions.	intelligence o	concepts and	tec	hniqu	ies to	various
Unit – I		Business View of Information Technology Application	is:					9+3
Internet HealthC	-ready IT Care Group tured Data	ocesses – Baldrige Business Excellence Framework – Pu Applications – Enterprise Applications – Information user , Good Food Restaurants Inc, Ten To Ten Retail Stores. Typ – Semi-Structured Data – Difference between semi-structured Business Intelligence and Data Integration:	rs and their bes of Digital	requirements Data: Introdu	. Ca	ase S	Study:	GoodLif
Busines Applicat	s Intelliger tions – BI F	nce: Definition – Evolution – Need for BI – BI Value Chain – Roles and Responsibilities – Data Integration: Need for Data pal's Approach vs. W.H.Inmon's Approach – Goals of Data V	Warehouse	 Definition of 				Jsers – E
Unit – II	II	OLTP, OLAP and Multidimensional Data Modeling:						9+3
Types o	f Data Mod	DLAP Architectures – Data Models – Role of OLAP Tools in del – Data Modeling Techniques –Fact Table –Dimension Tab the Dimensional Model.						
Unit – ľ	V	Performance Management and Enterprise Reporting	ng:					9+3
Perspec	ctives – Re	easures and Performance – Measurement System – Role of eport Standardization and Presentation Practices – Enterprise ating Dashboards – Scorecards vs. Dashboards – Analysis.						
Unit – V	/	Role of Statistics in Analytics and BI Applications:						9+3
Hypothe	esis and t-1	atistics - Role of Statistics in Analytics –Data Description and Test - Correlation Analysis – Regression – ANOVA -The F-T Cloud Computing –Business Intelligence for ERP systems –	est - Time Se	eries Analysis and Business	- BI Inte	App Iliger	licatio ice.	
техт в	OOK:							
1.	Prasad R.	N. and SeemaAcharya, "Fundamentals of Business Analytics	s", 2 nd Edition,	Wiley-India F	Publi	cation	ո, 201	6.
REFER	ENCES:							
1.		Sharda, DursunDelen and Efraim Turban, "Business Intellive", 4 th Edition, Pearson Education, 2017.	gence, Analy	rtics, and Dat	a So	cienc	e: A M	lanageria
	E OUTCO	MES: the course, the students will be able to						pped Level)
CO1	demonstra	ate the enterprise view of IT applications and identify the diffe	rent types of	digital data		Αŗ	plyin	g (K3)

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	demonstrate the enterprise view of IT applications and identify the different types of digital data	Applying (K3)
CO2	make use of BI concepts and techniques to experiment ETL process	Applying (K3)
CO3	compare OLTP with OLAP systems and design dimensional model	Applying (K3)
CO4	apply different performance evaluation metrics for a given problem	Applying (K3)
CO5	Perform statistical analysis and apply BI to mobile, cloud, ERP and social CRM systems	Applying (K3)

	Mapping of COs with POs and PSOs													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	2	1											
CO3	3	2	1											
CO4	3	2	1											
CO5	3	2	1											

^{1 -} Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTE	RN - THEORY
------------------	-------------

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	50	40				100
CAT2	10	50	40				100
CAT3	10	50	40				100
ESE	10	50	40				100

 $^{^*}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

		(Offered by Artificial Intelligence and M	lachine Learnin	ng)						
Prograi Branch	mme &	All BE/BTech Branches except AIDS and AIML	Sem.	Category						
Prerequ	uisites	Python Programming	6	OE	3	0	2	4		
Preamb	ole	To provide practical exposure to Python Programming fr	ameworks requ	uired for visua	alizin	g vari	ous ty	pes of dat		
Unit – I		Data visualization in business intelligence:						9		
		ta visualization – need for data visualization – visualizat raries – Data gathering and cleaning: cleaning data – reac								
Unit – I	I	Data Exploring and Analysis:						9		
		uctures: series - data frames - panels - Series data str					- dat	ta analysis		
Statistic Unit – I		- Data grouping – Iterating through groups – Aggregation	ns – Transforma	ations – Filtra	ition.			9		
		Data visualization techniques: plot – bar plot – pie chart – box plot – histogram plot – sc	atter plot – sea	born plotting	svste	em:st	rip plo	9		
		t plot – Matplotlib plot: Line plot – bar chart - histogram plot								
Unit – ľ		Time series analysis:						9		
		a types and tools – time conversion - time series basics and period arithmetic – Resampling and frequency conver					ting -	time zon		
Unit – \		Categorical Data Analysis and Modeling Libraries:	31011 — MOVING	villaow lanc	tions	١.		9		
		advanced groupby - Techniques for method chaining - Ir	nterfacing betw	een pandas a	and r	node	l code	- Creatin		
model d	descriptions	s with Patsy – statsmodel.								
LIST OI	F EXPERIM	MENTS / EXERCISES:								
1.	Load data	in different formats and apply preprocessing								
2.	Perform g	rouping aggregating and transforming operations on data								
3.	Design dif	ferent types of using direct plotting methods								
4.	Create diff	ferent types of plots using Matplolib								
5.	Design dif	ferent types of plot using Seaborn								
6.	Demonstra	ate time series operations								
7.	Visualize o	categorical data and perform operations on it								
8.	Apply data	a transformations using Patsy								
				Lecture	:45,	Prac	tical:3	30, Total:7		
TEXT B	BOOK:									
1.	Dr. Ossam	na Embarak, " Data Analysis and Visualization using Pytho	on ", 1 st Edition,	APress, 201	8 fo	r Unit	s 1, 2	and 3		
2.		nney, "Python for Data Analysis", 3 rd Edition, Or'reilly, 202	2 for Units 4 ar	nd 5.						
REFER	ENCES:									
1.		son. Data Visualization in Python, 1st Edition, StackAbuse								
2.		ler Plas, "Python Data Science Handbook Essential Tools fo	or Working with	Data", 1 st Ed	lition,	O'Re	eilly M	edia, 2016		
		ANUAL / SOFTWARE:								
1.	-	atplotlib, Seaborn, Plotly								
	Linux / Wi	naows								
2.	ماما	-1								
2.	Lab manu						2T M-	nned		
2. 3. COURS	SE OUTCO							ipped t Level)		

CO2	make use of the features of data frames, panels and series data structure to analyze data	Applying (K3)
CO3	apply the plotting techniques for efficient data visualization	Applying (K3)
CO4	perform time series data analysis using appropriate methods	Applying (K3)
CO5	implement suitable techniques to analyze categorical data and use libraries for modeling the data	Applying (K3)
CO6	perform data preprocessing and transformation operations	Applying (K3) Precision (S3)
CO7	explore various plotting to interpret various visualizations	Applying (K3) Precision (S3)
CO8	demonstrate the use of Patsy for modeling and analyze categorical data.	Applying (K3) Precision (S3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	2	1											
CO3	3	2	1											
CO4	3	2	1											
CO5	3	2	1											

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Δ	SSESS	MENT	$D\Delta T$	TERN -	THEORY	
-	JOEJJ		FAI	I EVIN -	INEUNI	

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	40	50				100
CAT2	10	40	50				100
CAT3	10	40	50				100
ESE	5	45	50				100

^{* ±3%} may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

	22ALO02 - INDUSTRIA (Offered by Artificial Intellig)				
Programr Branch			Sem.	Category	L	Т	Р	Credit
Prerequis	ites Nil		7	OE	3	0	0	3
Preamble	The course helps the students to understa	and and apply vario	us mad	chine learning	g alg	orithi	ms in	industria
Unit – I	Introduction:							9
The Fourt Smart Ind Healthcar	n Industrial Revolution: Introduction – Industry Summa ustries – Applications: Energy Sector – Basic Mater Sector – Customer Goods Sector – Telecommunion Technology Sector	rials Sector – Indust	rials S	ector - Cust	ome	r Sei	vices	ties withir Sector -
Unit – II	Component-Level Case Study:							9
Signals – Degradati	n – Ball Bearing Prognostics: Data - Driven Techniq Hidden Markov Model-Based RUL Estimation: Hidden on model							ation of the
Unit – III	Machine-Level Case Study:		-			-	-	9
Consortiu	n – Performance of Industrial Motors as a Fingerprint: n Testbed – Testbed Dataset Description – Clustering <i>A</i> – K-means Clustering – Spectral Clustering – Affinity P	Algorithms for Fingerp	rint De	velopment: A	gglo	mera	tive H	lierarchica
Unit – IV	Production-Level Case Study:							9
System: /	n – Laser Surface Heat Treatment: Image Acquisition Anomaly Detection Algorithms in Image Processing ion of the Normality Model Distribution-Level Case Study:							
 Classific 	n – Air Freight Process: Data Preprocessing – Supervisation Trees – Rule Induction – Artificial Neural Network							
ClassificNetwork C	ation Trees – Rule Induction – Artificial Neural Network lassifiers – Meta classifiers – Implementation							Neighbors Bayesiar
– Classific Network C	ation Trees – Rule Induction – Artificial Neural Network lassifiers – Meta classifiers – Implementation OK:	rks – Support Vector	Machi	nes – Logisti	c Re	gress	sion –	Neighbors Bayesiar Total:4
- Classific Network C	ation Trees – Rule Induction – Artificial Neural Networklassifiers – Meta classifiers – Implementation OK: edro Larranaga, David Atienza, Javier Diaz-Rozo, Albe	rks – Support Vector	Machi	nes – Logisti	c Re	gress	sion –	Neighbors Bayesian Total:4
TEXT BO 1. P REFEREN	ation Trees – Rule Induction – Artificial Neural Networklassifiers – Meta classifiers – Implementation DK: edro Larranaga, David Atienza, Javier Diaz-Rozo, Albert and Strial Applications of Machine Learning", 1 St Edition	erto Ogbechie, Carlo, CRC Press, 2019.	Machi s Este	nes – Logisti	Santa	gress	Sion –	Neighbors - Bayesiar Total:4:
TEXT BO 1. P REFEREN 1. A E COURSE	ation Trees – Rule Induction – Artificial Neural Networklassifiers – Meta classifiers – Implementation OK: edro Larranaga, David Atienza, Javier Diaz-Rozo, Albert dustrial Applications of Machine Learning", 1 St Edition ICES: Indreas François Vermeulen," Industrial Machine Learning	erto Ogbechie, Carlo, CRC Press, 2019.	Machi s Este	nes – Logisti	Santa	ana, (Conch	Neighbors - Bayesiar Total:4
TEXT BO 1. P REFEREN 1. A COURSE On comp	Pation Trees – Rule Induction – Artificial Neural Networklassifiers – Meta classifiers – Implementation OK: Pedro Larranaga, David Atienza, Javier Diaz-Rozo, Albert and Applications of Machine Learning", 1 st Edition ICES: Indreas François Vermeulen," Industrial Machine Learning dition, Apress, 2020.	erto Ogbechie, Carlo , CRC Press, 2019 .	Machi s Este	nes – Logisti	Santa	gress ana, (ationa B (Hi	Conch I Disr T Ma	Neighbors - Bayesiar Total:4 na Bielza, uptor", 1 ^S
TEXT BO 1. P 1. A COURSE On comp	ation Trees – Rule Induction – Artificial Neural Networklassifiers – Meta classifiers – Implementation OK: edro Larranaga, David Atienza, Javier Diaz-Rozo, Albert dustrial Applications of Machine Learning", 1 St Edition ICES: Indreas François Vermeulen," Industrial Machine Learning dition, Apress, 2020. OUTCOMES: etion of the course, the students will be able to	erto Ogbechie, Carlo , CRC Press, 2019 .	Machi s Este	nes – Logisti	Santa	gress nna, (Bi (Hii	Conch I Disr T Ma ghest	Neighbors - Bayesiar Total:4 na Bielza, uptor", 1s pped t Level)
TEXT BO 1. P 1. A E COURSE On comp CO1 U CO2 U	ation Trees – Rule Induction – Artificial Neural Networklassifiers – Meta classifiers – Implementation OK: edro Larranaga, David Atienza, Javier Diaz-Rozo, Albert and Applications of Machine Learning", 1 st Edition ICES: Indreas François Vermeulen, "Industrial Machine Learning dition, Apress, 2020. OUTCOMES: etion of the course, the students will be able to inderstand and apply machine learning concepts in various distribution.	erto Ogbechie, Carlo, CRC Press, 2019.	Machi s Este	nes – Logisti	Santa	gress nna, (Bi (Hi Ap	Conch I Disr T Maghest pplyin	Neighbors - Bayesian Total:4 na Bielza, uptor", 1 ^S pped t Level) g (K3)
TEXT BO 1. P "I REFEREN 1. A E COURSE On comp CO1 U CO2 U CO3 A	ation Trees – Rule Induction – Artificial Neural Networklassifiers – Meta classifiers – Implementation OK: edro Larranaga, David Atienza, Javier Diaz-Rozo, Albert dustrial Applications of Machine Learning", 1 St Edition ICES: Indreas François Vermeulen, "Industrial Machine Learning dition, Apress, 2020. OUTCOMES: etion of the course, the students will be able to inderstand and apply machine learning concepts in various elidentes and markov models for handling industrial data	erto Ogbechie, Carlo, CRC Press, 2019. ng: Using Artificial Interpression of the control of the	Machi s Este	nes – Logisti	Santa	gress nna, (Hitiona Ap Ap	Conch T Ma ghest pplyin pplyin	Neighbors - Bayesial Total:4 na Bielza uptor", 1S pped t Level) g (K3) g (K3)

	Mapping of COs with POs and PSOs													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2											
CO2	3	2	2											
CO3	3	2	2											
CO4	3	2	2											
CO5	3	2	2											

^{1 -} Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
10	50	40				100
10	40	50				100
10	40	50				100
10	40	50				100
-	(K1) % 10 10 10	(K1) % (K2) % 10 50 10 40 10 40	(K1) % (K2) % (K3) % 10 50 40 10 40 50 10 40 50	(K1) % (K2) % (K3) % (K4) % 10 50 40 10 40 50 10 40 50	(K1) % (K2) % (K3) % (K4) % (K5) % 10 50 40 10 40 50 10 40 50	(K1) % (K2) % (K3) % (K4) % (K5) % (K6) % 10 50 40 10 40 50 10 40 50

^{* ±3%} may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

	(Offered by Artificial Intelligence and Ma	achine Learning	1)				
Programme & Branch	All BE/BTech Branches except AIDS and AIML	Sem.	Category	L	т	Р	Credit
Prerequisites	Nil	8	OE	3	0	0	3
		 		1			
Preamble	This course provides working principles of Sensors, Unapplying machine learning for Smart Cities.	AV's, Geriatric	Design and	IoT I	Enab	ed Ho	omes and
Unit – I	Machine Learning for Sustainable and Resilient Buil						9
and Resilience of	tainability and Resiliency Conditions – Paradigm and challe Engineered System – Structure Engineering Dilemmas RB) – Component of Smart Buildings – Machine Learning T	and Resilient	Epcot - Sma	art B	uildir	g Ap	pliances -
Unit – II	Sensors and UAV's						9
	sors – Unmanned Aerial Vehicle – Bluetooth – Problem De	scription – Univ	ariate Time s	erie	s – M	ultiva	riate Time
Unit – III	larkov Model – Fuzzy Logic Data Fusion Approaches						9
Architecture – Hie Management Cent	a Fusion – Types of Data Fusion Architecture – Centralized a erarchical Architecture – Case Study –Smart City Infrastru ters – Theory of Unified City Modeling – Smart City Operatio Analysis – Data Model for Group Construction in Student's I	ucture – IoT D onal Model- The	eployments - eories and Mo	- Sm	nart (City C	ontrol and
Unit – IV	Geriatric Design and IoT Enabled Smart Homes						9
	riatric Design – Background – Development of Smart Home						
	c Smart Home Requirements – Design – Framework for Sm for a Nesting Home – IoT Based Real Time Automation – 1						ase Study:
Unit – V	-	recrimed com		iaiti	101110	,	9
	Impact of IoT Enabled Smart Cities ent in IoT Application for Modern City – Classification of IoT	hased Smart	Pities – Impa	et of	5G T	echno	
Five Layer Archite	cture – IoT Computing Paradigm – Research Advancemer ications – System Security – Research Challenges and Gui	nt and Drawba					
							Total:45
TEXT BOOK:							
	ımar, Anand Nayyar, Arun Solanki, "Digital Cities Road ma , Wiley, 2021.	p IoT-Based A	rchitecture an	d Su	ıstain	able E	Buildings",
REFERENCES:							
	Thomas, Vasiliki Geropanta, Anna Karagianni, Vladimir Par	nchenko "Smar	Cities and M	achii	ne Le	arnin	g in Urban
	GIGlobal, 2021.						
On completion of						sı Ma ghest	pped
CO1 interpret th					(HI		Levely
	MES:	puildings			-		g (K3)
CO2 demonstra	MES: the course, the students will be able to	ouildings			A	oplyin	·
	MES: the course, the students will be able to ne machine learning concepts for sustainable and resilient b	ouildings			A	oplyin	g (K3)
CO3 explore da	MES: the course, the students will be able to ne machine learning concepts for sustainable and resilient b ate the concept of sensors and time series data	ouildings			A _l	oplyin oplyin	g (K3) g (K3)
CO3 explore da CO4 develop G	MES: the course, the students will be able to ne machine learning concepts for sustainable and resilient b ate the concept of sensors and time series data ata fusion approach	ouildings			A _l	oplyin oplyin oplyin	g (K3) g (K3) g (K3)

	Mapping of COs with POs and PSOs													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2										
CO2	3	2	2	2										
CO3	3	2	2	2										
CO4	3	2	2	2										
CO5	3	2	2	2										

^{1 -} Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSMENT I	PATTERN -	THEORY
--------------	-----------	--------

Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
20	40	40				100
20	40	40				100
20	40	40				100
20	40	50				100
	(K1) % 20 20 20	(K1) % (K2) % 20 40 20 40 20 40	(K1) % (K2) % (K3) % 20 40 40 20 40 40 20 40 40	(K1) % (K2) % (K3) % (K4) % 20 40 40 20 40 40 20 40 40	(K1) % (K2) % (K3) % (K4) % (K5) % 20 40 40 20 40 40 20 40 40	(K1) % (K2) % (K3) % (K4) % (K5) % (K6) % 20 40 40 20 40 40 20 40 40

^{* ±3%} may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

22MAO01 - MATHEMATICAL FOUNDATIONS FOR MACHINE LEARNING

Programme & Branch	All Engineering and Technology branches except AIDS & AIML	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	5	OE	3	1	0	4

Preamble	To impart the basic knowledge in linear algebra, decomposition of matrices, continuoptimization, linear regression and support vector machines which provide the foundation machine learning and deep learning.	
Unit - I	Vector Spaces:	9+3
	or spaces – Subspaces – Linear dependence and independence – Basis and dimension - lumn space and Null Space – Rank and nullity.	- Row
Unit - II	Linear Transformations:	9+3
Introduction	on – Kernel and range – Matrices of linear transformations – Change of basis – Rank and r	nullity.
Unit - III	Inner Product Spaces:	9+3
	nner products – Length and Distance – Angle and Orthogonality – Orthonormal Basis – Orthocess – QR-Decomposition – Orthogonal Projection.	Gram-
Unit - IV	Matrix Decomposition and Continuous Optimization:	9+3
Continuou	composition: Cholesky decomposition – Singular Value Decomposition. is Optimization: Introduction – Unconstrained Optimization – Gradient Descent metled Optimization – Lagrange Multipliers method – Convex Optimization.	nod –

Unit - V Linear regression and Support vector machines:

Linear Regression: Parameter Estimation – Maximum Likelihood estimation – Bayesian linear regression.

Support Vector Machines: Introduction – Linear and Non-linear Support vector machine – Margin and support vectors – Hard and Soft margins in Support vector machines – Kernels – Primal support vector machine – Dual support vector machine.

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

- 1. Howard Anton and Chris Rorres, "Elementary Linear Algebra", 11th Edition, John Wiley & Sons, New Delhi, 2014.**(Units I,II,III)**
- 2. M. P. Deisenroth, A. A. Faisal, and C. S. Ong, "Mathematics for Machine Learning", 1st Edition Cambridge University Press, 2019.(Units IV, V)

- 1. David C. Lay, Steven R. Lay, Judith McDonald, "Linear Algebra and its Applications", 5th Edition, Pearson Education, New Delhi, 2016.
- 2. Ethem Alpaydin, "Introduction to Machine Learning(Adaptive Computation and Machine Learning series)", 4th Edition, MIT Press, USA, 2020.
- 3. R. O. Duda, E. Hart, and D.G. Stork, "Pattern classification", 2nd Edition, John Wiley & Sons, 2012.

	SE OUTCOMES: upletion of the course, the students will be able to	BT Mapped (Highest Level)		
CO1	understand the concepts of vector spaces.	Understanding (K2)		
CO2	apply the concepts of linear mappings in machine learning.	Applying (K3)		
CO3	apply the concept of inner product space and decompose the given matrix by means of orthonormal vectors.	Applying (K3)		
CO4	apply the knowledge of factorisation of matrices and optimization techniques in clustering and classification of data.	Applying (K3)		

CO5	macnine.											Understanding (K2)		
	Mapping of COs with POs and PSOs													
COs/ POs												PSO2		
CO1	3	1												
CO2	3	1												
CO3	3	2												
CO4	3	3	3											
CO5	3	2	3											
1 – Slig	ht. 2 –	Mode	rate. 3	– Sub	stantia	al. BT-	Bloon	n's Tax	conom	V				

	ASSESSMENT PATTERN - THEORY												
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %						
CAT1	10	30	60				100						
CAT2	10	20	70				100						
CAT3	10	30	60				100						
ESE	10	20	70				100						

^{* ±3%} may be varied (CAT 1, 2, 3 – 50 marks & ESE – 100 marks)

22MAO02 - NUMERICAL COMPUTING

Programme & Branch	Common to CSE, CSD, IT, AIDS, AIML, ECE, EEE and EIE Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	5	OE	3	1	0	4

Preamble	To impart knowledge in interpolation, numerical differentiation and integration. Also develop
	skills to apply numerical algorithms to identify roots of algebraic and transcendental
	equations, finding eigen values and solve linear system of equations, ordinary differential
	equations.

Unit - I Solution to Algebraic and Transcendental Equations and Eigen value problems: 9+3

Solution to Algebraic and Transcendental Equations: Bisection method - Iteration method - Method of false position - Newton-Raphson method

Iterative method for Eigen values: Power method – Jacobi's method.

Unit - II Solution of Simultaneous Linear Algebraic equations:

9+3

Introduction - Direct methods: Gauss elimination method - Gauss - Jordan method - LU decomposition method - Crout's method - Iterative methods: Gauss Jacobi and Gauss - Seidel methods - Inverse of a matrix by Gauss Elimination method.

Unit - III Interpolation:

9+3

Interpolation with equal intervals: Newton's forward and backward difference formulae – Central difference interpolation formulae: Gauss forward and backward interpolation formulae – Interpolation with unequal intervals: Lagrange's interpolation formula – Newton's divided difference formula.

Unit - IV Numerical Differentiation and Integration:

9+3

Differentiation using Newton's forward, backward and divided difference formulae – Numerical integration: Trapezoidal rule – Simpsons 1/3rd rule – Simpsons 3/8th rule – Double integrals using Trapezoidal and Simpson's rules.

Unit - V Numerical Solution of First order Ordinary Differential Equations::

9+

Single step methods: Taylor series method – Euler method – Modified Euler method – Fourth order Runge-Kutta method – Multi step methods: Milne's predictor corrector method – Adam's Bashforth method.

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

1. Veerarajan T, Ramachandran T., "Numerical Methods", 1st Edition, Tata McGraw Hill Publishing Company, New Delhi, 2018.

- 1. Kandasamy, P., Thilakavathy, K. and Gunavathy, K., "Numerical Methods", Reprint Edition, S.Chand & Co, New Delhi, 2016.
- 2. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", 3rd Edition, Prentice Hall of India Pvt. Ltd, , New Delhi, 2007.
- 3. Steven C. Chapra, Raymond P. Canale., "Numerical Methods for Engineers", 7th Edition, McGraw-Hill Education, 2014.
- 4. Sastry, S.S, "Introductory Methods of Numerical Analysis", 5th Edition, PHI Learning Pvt. Ltd, 2015.

	E OUTCOMES: bletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	apply various numerical techniques to solve algebraic and transcendental equations.	Applying (K3)

CO2	solve s	simulta	aneou	s linea	ar equa	ations	by nu	merica	al meth	nods.			Applying (K3)					
CO3	compu	ıte inte	ermed	iate va	alues d	of give	n evei	nly (or) unev	enly sp	aced da	ata.	Applying (K3)					
		apply the concepts of numerical differentiation and integration in real timapplications.												ng (K3)				
CO5 obtain the solution of first ordinary differential equations by numerical methods.													Applying (K3)					
Mapping of COs with POs and PSOs																		
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2				
CO1	3	2	1															
CO2	3	2	2															
CO3	3	3	2															
CO4	3	2	1															
CO5	3	3	3															
1 – Slight,	2 – M	odera	te, 3 –	Subs	tantial	, BT- E	3loom	's Tax	onom	y	Л							

	ASSESSMENT PATTERN - THEORY												
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %						
CAT1	10	15	75	-	-	-	100						
CAT2	10	15	75	-	-	-	100						
CAT3	10	15	75	-	-	-	100						
ESE	10	15	75	-	-	-	100						

^{* ±3%} may be varied (CAT 1, 2, 3 – 50 marks & ESE – 100 marks)

22MAO03 STOCHASTIC PROCESSES AND QUEUING THEORY

Programme & Branch	Common to CSE, IT, CSD, AIDS, AIML, EEE, EIE and MTS Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	5	OE	3	1	0	4

Preamble	To provide an in-depth knowledge in random variables, random process, correlation promote the ability to apply suitable queuing models to real time applications.	n and								
Unit - I	Random Variables:	9+3								
	and Continuous random variables – Probability Mass and Probability density functional expectation and Variance – Moments – Moment generating functions.	ons –								
Unit - II	Random processes:	9+3								
	oncepts and definitions – Classification – Stationary process – Markov chains – Trares – Poisson process.	nsition								
Unit - III	II Correlation and Spectral densities: 9									
spectral de	elation – Cross Correlation – Properties (Without Proof) – Power spectral density – ensity – Properties (Without Proof) – Wiener- Khintchine relation – Relationship between ectrum and cross correlation function.									
Unit - IV	Queuing Theory:	9+3								
server Poi multiple se Poisson q	istics of a queueing system – Kendall's notation – Queuing model I (Infinite capacity sson queue model) (M/M/1): (∞ /FIFO) – Little's formulae – Queuing model II (Infinite caproer Poisson queue model (M/M/C): (∞ /FIFO) – Queuing model III (Finite capacity single ueue model) (M/M/1): (N/FIFO) – Queueing model IV (Finite capacity multiple server Po/M/C): (N/ FIFO).	apacity server								
Unit - V	Non-Markovian Queues and Queue Networks:	9+3								
	on to Non-Markovian queues – M/G/1 queue – Pollaczek-Khintchine formula – Series que d Closed queuing networks.	ueues								

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

1. Veerarajan, T, "Probability and Statistics, Random Processes and Queuing Theory", 1st edition, McGraw-Hill Education, Chennai, 2019.

- 1. Athanasios Papoulis, S. Unnikrishna Pillai., "Probability, Random Variables and Stochastic Processes", 4th edition, McGraw Hill, New Delhi, 2017.
- 2. Allen A.O., "Probability, Statistics and Queuing Theory", 2nd Edition, Academic Press, New Delhi, 1990.
- 3. Roy D. Yates and David J. Goodman, "Probability and Stochastic Processes A friendly Introduction for Electrical and Computer Engineers", 3rd edition, John Wiley & Sons, 2014.
- 4. John F. Shortle, James M. Thompson, Donald Gross and Carl M. Harris, "Fundamentals of Queuing Theory", 5th edition, John Wiley and Sons, New York, 2018.

	SE OUTCOMES: upletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	classify random variables and apply suitably in practical problems.	Applying (K3)
CO2	apply the concept of random process in communication problems.	Applying (K3)
CO3	understand the concepts and properties of Spectral Density Function and Cross Correlation function.	Understanding (K2)
CO4	use the appropriate queuing model for a given practical application.	Applying (K3)

CO5	identify the real time queue in computer networks and take decision accordingly.										ĮΑ	Applying (K3)		
				N	Mappin	g of C	Os w	ith PO	s and	PSOs		•		
COs/ POs	PO1	PO2	РО3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1												
CO2	3	2												
CO3	3	2												
CO4	3	3	3										2	
CO5	3	3	3										3	
1 – Slig	ht, 2 –	Modera	ate, 3 -	- Subs	tantial,	вт-в	loom's	Taxo	nomy					

		ASSESSMENT	PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	70				100
CAT2	10	30	60				100
CAT3	10	20	70				100
ESE	10	20	70				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22MAO04 STATISTICS FOR ENGINEERS AND DATA SCIENTISTS

Programme & Branch	All Engineering and Technology Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	5	OE	3	1	0	4

Unit - I	Organization and Presentation of Data:	9+3
	the variations in real time applications.	
	provide skills to apply correlation, suitable non-parametric tests and control charts to	control
Preamble	To impart the basic knowledge in presentation of data, descriptive statistical measure	

Introduction to Statistics – Collection of data – Classification and tabulation of data – Types of data: primary, secondary, quantitative and qualitative data – Types of Measurements: nominal, ordinal, discrete and continuous data – Presentation of data – Diagrammatic and Graphical Representation: Histogram - Frequency curve - Frequency polygon - Cumulative frequency distributions – Ogive curves – Stem and leaf chart.

Unit - II Descriptive Statistics:

9+3

Measures of location or central tendency: Arithmetic mean – Median – Mode – Geometric mean – Harmonic mean – Partition values: Quartiles – Deciles and percentiles – Measures of dispersion: Mean deviation – Quartile deviation – Standard deviation – Coefficient of variation – Measures of skewness – Kurtosis.

Unit - III | Correlation and Regression:

9+3

Correlation and Regression: Scatter Diagram – Karl Pearson's Correlation Coefficient – Rank Correlation - Regression Coefficients – Fitting of Regression Lines.

Multiple Correlation and Regression: Multiple and partial correlation – Method of least squares – Plane of regression – Properties of residuals – Coefficient of multiple correlation – Coefficient of partial correlation – Multiple correlation with total and partial correlations – Regression and partial correlations in terms of lower order coefficient..

Unit - IV Non-parametric tests:

9+3

Introduction – Sign test: One sample sign test – Sign test for paired samples – Signed rank test – Rank Sum test: Mann Whitney U test – Kruskal-Wallis test – One sample run test – Tests of randomness.

Unit - V Statistical Quality Control:

9+3

Introduction to Statistical quality control – Control charts – Control chart for variables: \overline{X} -chart – s-chart – Charts for attributes: np-chart – p-chart – c-chart.

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

- 1. S.P.Gupta, "Statistical Methods", 44th Revised Edition, Sultan Chand & Sons, New Delhi, 2011 (Units I,II, V)
- 2. S.C.Gupta, V.K.Kapoor, "Fundamentals of Mathematical Statistics", 12th Edition, Sultan Chand & Sons, New Delhi, 2022. (Units III, IV)

- 1. Jay L. Devore., "Probability and Statistics for Engineering and the Sciences", 9th Edition, Cengage Learning, USA, 2016.
- 2. G.C.Beri, "Business Statistics", 3rd Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2011.
- 3. Johnson. R.A., Miller. I and Freund. J., "Miller and Freund's Probability and Statistics for Engineers", 9th Edition, Pearson Education, India, 2018.
- 4. Anthony Hayter, "Probability and Statistics for Engineers and Scientists", 4th Edition, Cengage Learning, USA, 2012.
- 5. J. K. Sharma, "Business Statistics", 5th Edition, Vikas Publishing House Pvt Ltd, Noida, 2020.

	SE OUTCO	-		he stu	dents	will be	able t	Ю.					T Mappo Jhest Le	
CO1	demons forms.	trate t	he cla	ssifica	tion of	f data	and p	resen	t the o	data in	various	Unde	rstandin	g (K2)
CO2	compute and gra				scriptiv	e stat	istical	meas	ures u	sing nu	merical	Ар	plying (ł	(3)
CO3	apply s analysir							regr	ession	analy	sis in	Ар	plying (ł	(3)
CO4	use app	ropriat	e non-	param	etric te	est to a	analyz	e expe	erimen	tal data	•	Ар	plying (ł	〈 3)
CO5	identify	suitable	e conti	rol cha	rts for	monite	oring p	roces	ses			Ар	plying (ł	(3)
				Ма	pping	of CC	s with	n POs	and P	SOs				
COs/ POs	PO1	PO2	РО3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	3	2												
CO2	3	2												
CO3	3	3	2											
CO4	3	3	1											
CO5	3	3	3											
1 – Slig	ht, 2 – Mc	derate	, 3 – S	Substa	ntial, E	BT- Blo	om's	Taxon	omy					

		ASSESSMENT	PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	40	50				100
CAT2	10	20	70				100
CAT3	10	20	70				100
ESE	10	20	70				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22MAO05 - GRAPH THEORY AND ITS APPLICATIONS

Programme & Branch	All Engineering and Technology branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	6	OE	3	1	0	4

	To develop rigorous logical thinking and analytical skills by graph theoretic concepts helps for solving real time engineering problems in networks, computer archite compiling techniques, model checking, artificial intelligence, software engineering, esystems, software/hardware correctness problem.	cture, expert
Unit - I	Graphs:	9+3

Introduction – Definition – Types of graphs – Degree of vertex – Walk, path and cycle – Isomorphism – Connected graph – Hamiltonian graph – Euler graph – Digraph – Representations of graphs: Adjacency matrix – Incidence matrix.

Unit - II Trees: 9+3

Introduction – Properties of trees – Pendant vertices in a tree – Distances and centers in a tree – Rooted and binary trees – Spanning tree – Construction of spanning tree: BFS algorithm – DFS algorithm – Finding all spanning trees of a graph – Fundamental circuits.

Unit - III Graph Coloring:

9+3

Vertex coloring – Chromatic number – Chromatic partitioning – Independent sets – Chromatic polynomial – Matching – Covering – Four color problem (statement only) – Simple applications.

Unit - IV Network Flows and Applications:

9+3

Flows and cuts in networks - Max-flow Min-cut Theorem - Transport networks - Residual capacity and Residual network - Ford-Fulkerson Algorithm - Edmonds-Karp Algorithm - Maximal Flow Applications: Multiple sources and sinks - Maximum Bipartite matching.

Unit - V Graph Theoretic Algorithms:

9+3

Shortest paths – Shortest path algorithms: Dijkstra's algorithm – Warshall's algorithm – The Chinese Postman Problem – Fleury's Algorithm – Travelling salesman problem – Minimum Spanning tree – Minimal spanning tree algorithms: Prim's algorithm – Kruskal's algorithm.

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

- 1. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", 1st Edition, Dover Publications, New York, 2016.(Units I,II,III)
- 2. S. Saha Ray, "Graph Theory with Algorithms and Its Applications in Applied Science and Technology", 1st Edition, Springer, London, 2013.(Units IV,V)

- 1. Douglas B West, "Introduction to Graph Theory", 2nd Edition, Pearson Education, New Delhi, 2002.
- 2. Jonathan L. Gross and Jay Yellen, "Graph Theory and its Applications", 2nd Edition, CRC Press, New York, 2006.
- 3. J.A.Bondy and U.S.R. Murty ,Graph Theory and Applications , 5th Edition, Elsevier Science Publishing Co., Inc., New York,1982.

	SE OUTCOMES: pletion of the course, the students will be able to	BT Mapped (Highest Level)
	,	
CO1	understand basic graph theoretic concepts.	Understanding (K2)
CO2	intrepret the concepts the concepts of tress and its types.	Applying (K3)
CO3	compute the Chromatic partition, Chromatic polynomial and Matching of a given graph.	Applying (K3)
CO4	identify the maximal flow in network by means of algorithms.	Applying (K3)

CO5	apply proble		s grap	h theo	retic a	gorith	ms to	comm	unicati	on and	network		Applying	(K3)
				N	lappir	g of C	COs w	ith PC	s and	I PSOs				
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	1												
CO3	3	1												
CO4	3	2	2											
CO5	3	2	3											
1 – Slight,	2 – M	oderat	e, 3 –	Subst	antial,	BT- B	loom'	s Taxo	nomy					

		ASSESSMENT	PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	40	50				100
CAT2	10	20	70				100
CAT3	10	20	70				100
ESE	10	20	70				100

^{* ±3%} may be varied (CAT 1, 2, 3 – 50 marks & ESE – 100 marks)

22MAX01 - DATA ANALYTICS USING R PROGRAMMING

Programme & Branch	All Engineering and Technology branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	6	OE	3	0	2	4

Preamble To impart the basic knowledge in R and develop skills to apply the knowledge of R programming to statistical measures, data handling, probability, testing of hypothesis and design of experiments.

Overview of R programming – Need for R – Installing R – Environment setup with R Studio – Packages: Installing packages – Running and manipulating packages – Basic objects: Vectors – Matrix – Array – Lists – Factors – Data frames.

Unit - II R Programming Structures and Functions:

9+3

Basic expressions: Arithmetic expressions – Control Statements: if and if-else statements — switch statement – Loops: for loop – while loop – Function: Creating a function – calling a function – Default value for function arguments – Logical functions – Math functions – Statistical functions – Apply-family functions – Getting started with strings – Formatting data and time.

Unit - III Descriptive Statistics:

9+3

Summary command – Summarizing samples – cumulative statistics – summary statistics for data frames – summary tables – Linear Modeling: Simple linear regression – Multiple regression – Curvilinear regression – Plotting linear models and curve fitting.

Unit - IV Working with data:

9+3

Reading and writing data: Text-format in a file – Excel worksheets – Native data files – built-in datasets. Visualizing data: Scatter plots – line plots – bar charts – pie charts – Cleveland dot charts – Histogram and density plots – Box-whisker plots.

Unit - V Probability Distributions, Testing of hypothesis and ANOVA:

9+3

Probability Distributions: Binomial Distribution – Poisson Distribution – Normal Distribution.

Testing of Hypothesis and ANOVA: Student's t-test – Non-Parametric tests: Wilcoxon U-test – Paired t and U-tests – Correlation and covariance – Tests for association – Analysis of variance: One-way ANOVA – Two-way ANOVA.

List of Exercises / Experiments:

- 1. Implementation of operations of data objects such as vector, list and matrix.
- 2. Implementation and use of array, factors and data frames in R.
- 3. Programs using decision making statements and looping structures.
- 4. Programs to demonstrate programming concepts using functions (Using built-in and user-defined functions)
- 5. Performing various basic statistical measures for the given data.
- 6. Calculate the regression coefficient and obtain the lines of regression for the given data.
- 7. Creating and reading various types of data files.
- 8. Create different charts for visualization of given set of data.
- 9. Computation of probability using Binomial, Poisson and Normal distributions.
- 10. Perform the t-test for testing significance of mean.
- 11. Perform various non-parametric tests for the given sample data.
- 12. Perform One way and two way ANOVA.

Lecture: 45, Practical: 15, Total: 60

TEXT BOOK:

- 1. Kun Ren, "Learning R Programming", 1st Edition, Packt Publishing Ltd, UK, 2016. (Units I, II)
- 2. Mark Gardener, "Beginning R-The Statistical Programming Language",1st Edition, John Wiley & Sons,Inc, USA, 2012. (Units III,IV, V)

- 1. Seema Acharya, "Data Analytics using R", 1st Edition, McGraw Hill Education, Chennai, 2018.
- 2. Norman Matloff, "The Art of R Programming", 1st Edition, No Starch Press, San Francisco, 2011.
- 3. Paul Teetor, "R Cookbook", 1st Edition, O'Reilly Media, USA, 2011.

COUI On co	BT Mapped (Highest Level)		
CO1	understand the basics of fundamentals of R.	Understanding (K2)	
CO2	apply the concepts of decision, looping structures and functions in real time problems.	Applying (K3)	
CO3	apply R programming to descriptive statistics.	Applying (K3)	
CO4	apply the libraries for data manipulation and data visualization in R.	Applying (K3)	
CO5	use R studio to identify the probability and test statistical hypothesis.	Applying (K3)	

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1											
CO2	3	1	1		2									
CO3	3	2	2	2	2									
CO4	3	3	2	3	2									
CO5	3	2	2	3	2									

ASSESSMENT PATTERN - THEORY									
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %		
CAT1	10	30	60				100		
CAT2	10	20	70				100		
CAT3	10	20	70				100		
ESE	10	20	70				100		

^{* ±3%} may be varied (CAT 1, 2, 3 – 50 marks & ESE – 100 marks)

22MAO06 OPERATIONS RESEARCH

Programme & Branch	All Engineering and Technology Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	6	OE	3	1	0	4

functions, transportation models and also impart knowledge in finding optimal solution problems involving limited resources, project management techniques and game the	he skills for solving the real tim	engineering problems involving line	ar objective
problems involving limited resources, project management techniques and game the	ansportation models and also	npart knowledge in finding optimal	solutions to
probleme inverting innited recogness, project management teeriniques and game tree	volving limited resources, proje	t management techniques and gar	ne theoretic
concepts.			

Unit - I Linear Programming:

9+3

Introduction to Operations research – Applications of OR – Linear Programming – Formation of Linear Programming Problem – Solution of LPP: Basic concepts – Graphical Solution – Simplex method – Artificial techniques: Big M method.

Unit - II Transportation and Assignment Problems:

9+3

Transportation Problem: Introduction – Mathematical formulation – Solution of transportation problem: Initial basic feasible solution: North-West Corner Rule – Vogel's Approximation Method – Optimal Solution: MODI method.

Assignment Problems: Introduction – Mathematical Formulation – Hungarian Algorithm.

Unit - III Games Theory:

9+3

Theory of Games: Introduction – Basic Terminology – Two-Person zero sum games – Pure strategies (Games with saddle point) – Mixed Strategies (Games without saddle points) – Rule of Dominance – Solution of Mixed Strategy games: Algebraic method – Arithmetic method – Graphical method.

Unit - IV Sequencing models:

9+3

Sequencing problems: Introduction – Johnson's algorithm – Processing of n jobs through two machines – Processing of n jobs through three machines – Processing of 'n' jobs through 'm' machines - Processing of two jobs through 'm' machines.

Unit - V Network and Project Management:

9+3

Introduction – Basic terminology – Rules of Network construction – Fulkerson's Rule for numbering of events – Construction of network – Critical Path Method (CPM) – Programme Evaluation and Review Technique (PERT).

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

 Sharma J.K, "Operations Research – Theory and Applications", 6th Edition, Trinity Press, India, New Delhi, 2017.

- 1. Taha, Hamdy A., "Operation Research: An introduction", 9th edition, Pearson Education, 2010.
- 2. Hiller, Frederick. S. and Lieberman, Gerald. J., "An introduction to Operations research- concepts and cases", Tata McGraw Hill (SIE) 8th edition, 2005.
- 3. Ravindran, A., Phillips, D.J., and Solberg, J.J., "Operations Research- Principles and Practice", John Wiley & Sons, 2005.
- 4. Kanti Swarup, P.K. Gupta, Man Mohan, "Operations Research", 15th revised Edition, S. Chand & Sons Education Publications, New Delhi, 2017.
- 5. Gupta P.K. and Hira D.S., "Operations Research: An Introduction", 7th Revised Edition, S.Chand and Co. Ltd., New Delhi, 2014.

	SE OUTCO		-	the stu	udents	will be	e able	to					T Mapp jhest Le		
CO1	formulate	e and s	solve I	inear p	orogra	mming	g probl	ems.				Applying (K3			
CO2	apply tra	nsport	ation a	and as	signm	ent alg	gorithn	ns in e	nginee	ering pro	blems.	s. Applying (K3)			
CO3	use game theory concepts in practical situations.											Ap	plying (K3)	
CO4	identify the minimum processing times for sequencing problems											Applying (K3)			
CO5	apply the concepts of CPM and PERT in scheduling the project netwo									tworks.	Ap	plying (K3)		
				Ма	pping	of CC)s wit	h POs	and F	PSOs					
COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	
CO1	3	2	3												
CO2	3	2	1												
CO3	3	2	1												
CO4	3	2	1												
CO5	3 2 3														
1 – Slig	ht, 2 – Mo	derate	e, 3 – S	Substa	ntial, l	BT- BI	oom's	Taxor	nomy				II.	II.	

	ASSESSMENT PATTERN - THEORY											
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %					
CAT1	10	20	70				100					
CAT2	10	20	70				100					
CAT3	10	20	70				100					
ESE	10	20	70				100					

^{* ±3%} may be varied (CAT 1, 2, 3 – 50 marks & ESE – 100 marks)

22MAO07 - NUMBER THEORY AND CRYPTOGRAPHY

Programme & Branch	All Engineering and Technology branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	6	OE	3	1	0	4

11	D. C. West Theorem	
	tests in cryptography and network security and impart knowledge of basic cryptography techniques.	
Preamble	To provide the skills for applying various number theoretic algorithms, congruences, prin	nality

Unit - I Divisibility Theory:

9+3

Division algorithm – Base-b representations – Number patterns – Prime and composite numbers – Fibonacci and Lucas numbers – Fermat numbers – GCD – Euclidean Algorithm – Fundamental theorem of Arithmetic – LCM.

Unit - II Theory of Congruences:

9+3

Basic concepts – Properties of congruences – Linear congruences – Solution of linear congruences – Fermat's Little theorem – Chinese remainder theorem.

Unit - III Number Theoretic Functions:

9+3

Introduction – Functions τ and σ – Mobius function – Greatest integer function – Euler's Phi function – Euler's theorem – Properties of Euler's function – Applications to Cryptography.

Unit - IV Primality testing and Factorization:

9+3

Primality testing: Fermat's pseudo primality test – Solvay-Strassen test – Miller-Rabin test – Fibonacci test – Lucas test – Integer factorization: Trial division – Pollard's Rho method – Quadratic sieve method.

Unit - V Classical Cryptographic Techniques:

9+3

Introduction – Substitution techniques – Transposition techniques – Encryption and decryption – Symmetric and asymmetric key cryptography – Steganography.

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

- 1. Thomas Koshy, "Elementary Number Theory with Applications", 2nd Edition, Academic Press, Elsevier, USA, 2007.(Units I,II,III)
- 2. William Stallings, "Cryptography and Network Security: Principles and Practice", 7th Edition, Pearson Education, New Delhi, 2019.(Units IV,V)

REFERENCES:

- 1. Ivan Niven, Herbert S. Zukerman, Hugh L. Montgomery, "An Introduction to the Theory of Numbers", Reprint Edition, John Wiley & Sons, New Delhi, 2008.
- 2. Bernard Menezes, "Cryptography and Network Security", Cengage Learning India, 1st Edition, New Delhi, 2010.

	RSE OUTCOMES: ompletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	understand the concepts of divisibility and canonical decompositions.	Understanding (K2)
CO2	obtain the knowledge in theory of congruences and solution of linear congruences.	Understanding (K2)
CO3	use different number theoretic function suitably in cryptography.	Applying (K3)
CO4	apply Primality test and factorisation algorithms to network security problems.	Applying (K3)
CO5	apply the suitable cryptographic techniques to handle real time security issues.	Applying (K3)

	Mapping of COs with POs and PSOs													
COs/POs PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12 PS01 PS0														PSO2
CO1	3	2												
CO2	3	1												
CO3	3	1												
CO4	3	2	1		2									
CO5	3	2	1		2									
1 Slight 3	_ Slight 2 _ Moderate 3 _ Substantial RT- Rloom's Tayonomy													

	ASSESSMENT PATTERN - THEORY												
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %						
CAT1	10	30	60				100						
CAT2	10	20	70				100						
CAT3	10	20	70				100						
ESE	10	20	70				100						

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22MAO08 NON-LINEAR OPTIMIZATION

Preamble	The course focuses on the basic concepts, various techniques and applications of engi optimization.	neering
Unit - I	Classical Optimization Techniques:	9
variable of	on to Optimization – Statement of an Optimization problem – Mathematical formulation otimization with equality constraints – Lagrange multipliers method – Multi variable optimality constraint – Kuhn Tucker conditions.	
Unit - II	Non-Linear Programming: One-Dimensional Minimization Method:	9
Dichotomo	on – Unimodal function – Elimination Methods: Unrestricted search – Exhaustive sous search – Interval halving method – Fibonacci method – Golden section method – Dinewton method – Secant method.	
Unit - III	Non-Linear Programming: Unconstrained Optimization Techniques:	9
	on to Unconstrained optimization – Direct Search Methods: Grid search method – Un Hookes and Jeeve's method – Powell's method.	ivariate
Unit - IV	Unconstrained Optimization Techniques (Indirect Methods):	9
	of a Function – Indirect Search Methods: Steepest descent method – Fletcher-Reeves s method – Marquardt method.	method
Unit - V	Non-Linear Programming: Constrained Optimization Techniques:	9
Sequentia	on – Characteristics of a Constrained Problem – Direct Methods: Random search m I linear programming – Indirect methods: Transformation techniques – Exterior penalty Interior penalty function method.	
	Total	: 45

TEXT BOOK:

1. S.S.Rao, Engineering Optimization Theory and Practice, 1st Edition, John Wiley & Sons Ltd, USA, 2020.

REFERENCES:

- 1. David Luenberger and Yinyu Ye, Linear and Nonlinear Programming, 4th edition, Springer-Verlag, 2015
- 2. A.Ravindran, K.M.Ragsdell, G.V.Reklaitis, Engineering Optimization: Methods and applications, 2nd Edition, Wiley India Pvt. Ltd., 2006.
- 3. Yang, Xin-She. Optimization Techniques and Applications with Examples. 1st Edition, John Wiley & Sons, United Kingdom, 2018.

	RSE OUTCOMES: empletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	solve problems with equality and inequality constraints.	Applying (K3)
CO2	solve nonlinear programming problems of functions of single variable.	Applying (K3)
CO3	use methods of unconstrained optimization to solve non linear problems	Applying (K3)
CO4	solve nonlinear optimization problems in the presence of inequality and equality constraints.	Applying (K3)
CO5	apply several modern methods of optimization for solving engineering problems	Applying (K3)

	Mapping of COs with POs and PSOs													
COs/POs PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12 PSO1 PS													PSO2	
CO1	3	3	2											
CO2	3	2												
CO3	3	3	1											
CO4	3	3	3											
CO5	3	2	3											
1 – Slight, 2	I – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy													

	ASSESSMENT PATTERN - THEORY											
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %					
CAT1	10	10	80				100					
CAT2	10	10	80				100					
CAT3	10	10	80				100					
ESE	10	10	80				100					

^{* ±3%} may be varied (CAT 1, 2, 3 – 50 marks & ESE – 100 marks)

22MAO09 OPTIMIZATION FOR ENGINEERS

Programme & Branch	All Engineering and Technology Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	7	OE	3	0	0	3

To provide the skills for solving the real time engineering problems involving linear an linear objective functions and also impart knowledge in finding optimal solutions to pro involving multi-level decision making and analyzing queuing models.	

Unit - I Linear Programming:

9

Introduction to Operations research – Applications of OR – Linear Programming – Formation of Linear Programming Problem – Solution of LPP: Basic concepts – Graphical Solution – Simplex method – Artificial techniques: Big M method.

Unit - II Integer Programming:

9

Introduction – Types of Integer Programming Problems – Solution of Integer programming problems – Gomory's all integer cutting plane method - Gomory's Mixed-Integer Cutting Plane Method – Branch and Bound method.

Unit - III Dynamic programming:

9

Introduction – Characteristics – Formulation of Dynamic programming problems –Dynamic programming Algorithm – Solution of Discrete Dynamic programming problem – Solution of LPP by Dynamic programming.

Unit - IV Queueing Theory:

9

Characteristics of a queueing system – Kendall's notation – Queuing model I (Infinite capacity single server Poisson queue model) (M/M/1): (∞/FIFO) – Little's formulae – Queuing model II (Infinite capacity multiple server Poisson queue model (M/M/C): (∞/FIFO) – Queuing model III (Finite capacity single server Poisson queue model) (M/M/1): (N/FIFO) – Queueing model IV (Finite capacity multiple server Poisson model) (M/M/C): (N/FIFO)..

Unit - V Non-Linear Programming:

9

Introduction – Mathematical formulation of Non-linear programing problems – Non-linear programing problem with equality constraints – Lagrange multipliers method – Non-linear programing problem with inequality constraint – Kuhn Tucker conditions.

Total: 45

TEXT BOOK:

1. Sharma J.K, "Operations Research – Theory and Applications", 6th Edition, Trinity Press, India, New Delhi, 2017.

REFERENCES:

- 1. Taha, Hamdy A., "Operation Research: An introduction", 9th edition, Pearson Education, 2010.
- 2. Hiller, Frederick. S. and Lieberman, Gerald. J., "An introduction to Operations research- conceptsand cases", Tata McGraw Hill (SIE) 8th edition, 2005.
- 3. Ravindran, A., Phillips, D.J., and Solberg, J.J., "Operations Research- Principles and Practice", John Wiley & Sons, 2005.
- 4. Kanti Swarup, P.K. Gupta, Man Mohan, "Operations Research", 15th revised Edition, S. Chand & Sons Education Publications, New Delhi, 2017.
- 5. Gupta P.K. and Hira D.S., "Operations Research: An Introduction", 7th Revised Edition, S.Chand and Co. Ltd., New Delhi, 2014.

COURSE OUTCOMES:	BT Mapped
On completion of the course, the students will be able to	(Highest Level)

CO1	formulate	e and s		Ар	plying (ł	(3)								
CO2	solve Inte	eger P	rograr	nming	probl	ems th	nat exis	st in re	al time	applica	ations.	Applying (K3)		
CO3	demons find sho		ethod to	O Applying (K3)										
CO4	use the a	use the appropriate queuing model for a given practical application.												(3)
CO5	apply th		•					_	solving	the pr	oblems	Ар	plying (ł	(3)
				Ма	pping	of CC	s with	n POs	and P	SOs				
COs/ POs	PO1	PO2	РО3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	3	2	3											
CO2	3	2	1											
CO3	3	2	1											
	3 2 1													
CO4	3	2	1											
CO4 CO5	3	2	3											

	ASSESSMENT PATTERN - THEORY													
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %							
CAT1	10	20	70				100							
CAT2	10	20	70				100							
CAT3	10	20	70				100							
ESE	10	20	70				100							

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22PHO01 - THIN FIL	LM TECHNOLOGY					
Programme & Branch	All BE/BTech Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	5	OE	3	1	0	4
Preamble	This course aims to impart the essential knowle various engineering fields, and also provides m			d app	licatio	n of t	hin films in
Unit – I	Theories and models of thin film growth:						9+3
	Theories of thin film nucleation: Impingement, Adsorpels – Structural consequences of thin film nucleation – T						
Unit – II	Vacuum technology:						9+3
lon pump, Ti-s	working of vacuum pumps: Roots vacuum pump, Rotar sublimation pump – Measurement of Pressure: Bayet- ation gauges – Pressure controlling system (qualitative).	Albert gauge, Pirani and					
Unit – III	Deposition of thin films - Physical methods:						9+3
	oration – Electron beam evaporation – Pulsed laser dep eactive sputtering – Molecular beam epitaxy - Demonst					ng –	Magnetron
Unit – IV	Deposition of thin films – Chemical methods	s:					9+3
	or deposition – Sol-gel method – Chemical bath dep position – Spray Pyrolysis - Spin coating.	position – Hydro thermal	methods - E	Electro	oplati	ng de	position -
	Characterization and Applications of thin file						
Unit – V	Characterization and Applications of thin his	ms:					9+3
Photoemission	on: X-ray diffraction, Energy dispersive X-ray analysis, a Spectroscopy, UV-vis spectroscopy and Four probe reprint films for information storage and Optical coatings.	Atomic probe microscopy					cope, X-ray
Characterization Photoemission	on: X-ray diffraction, Energy dispersive X-ray analysis, a Spectroscopy, UV-vis spectroscopy and Four probe re	Atomic probe microscopy	qualitative): Th	in filn	n sola	ar cell	cope, X-ray
Characterization Photoemission	on: X-ray diffraction, Energy dispersive X-ray analysis, a Spectroscopy, UV-vis spectroscopy and Four probe re	Atomic probe microscopy	qualitative): Th	in filn	n sola	ar cell	cope, X-ray s, Thin film
Characterization Photoemission gas sensors, TEXT BOOK:	on: X-ray diffraction, Energy dispersive X-ray analysis, a Spectroscopy, UV-vis spectroscopy and Four probe re	Atomic probe microscopy esistivity – Applications (d	qualitative): Th	45, 1	n sola	ar cell	cope, X-ray s, Thin film
Characterization Photoemission gas sensors, T TEXT BOOK: 1. Main San	on: X-ray diffraction, Energy dispersive X-ray analysis, in Spectroscopy, UV-vis spectroscopy and Four probe rethin films for information storage and Optical coatings. Seel L.I. and Glang R, Hand book of Thin Film Technology and Four English Technology.	Atomic probe microscopy esistivity – Applications (o	Lecture:	45, T k, 197	n sola Tutori	ar cell ial: 15	cope, X-ray s, Thin film 5, Total: 60
Characterization Photoemission gas sensors, T TEXT BOOK: 1. Main 2 San	on: X-ray diffraction, Energy dispersive X-ray analysis, in Spectroscopy, UV-vis spectroscopy and Four probe rethin films for information storage and Optical coatings. Ssel L.I. and Glang R, Hand book of Thin Film Technological Technological Coating R, Hand book of Thin Film Technological Characterization (Characterization)	Atomic probe microscopy esistivity – Applications (o	Lecture:	45, T k, 197	n sola Tutori	ar cell ial: 15	cope, X-rays, Thin film 5, Total: 60
Characterization Photoemission gas sensors, T TEXT BOOK: 1. Mai: 2. San (Un REFERENCE:	on: X-ray diffraction, Energy dispersive X-ray analysis, in Spectroscopy, UV-vis spectroscopy and Four probe rethin films for information storage and Optical coatings. Ssel L.I. and Glang R, Hand book of Thin Film Technological Technological Coating R, Hand book of Thin Film Technological Characterization (Characterization)	Atomic probe microscopy resistivity – Applications (compared to the second to the seco	Lecture: Inc., New York tion, CRC Pre	45, T k, 197	n sola Tutori	ar cell ial: 15	cope, X-ray s, Thin film 5, Total: 60
Characterizatic Photoemission gas sensors, 1 TEXT BOOK: 1. Mai: 2. San (Un) REFERENCE: 1. Ohr	on: X-ray diffraction, Energy dispersive X-ray analysis, in Spectroscopy, UV-vis spectroscopy and Four probe rethin films for information storage and Optical coatings. See L.I. and Glang R, Hand book of Thin Film Technology and Four Li and Ashok Kumar, Materials Characterization of the Charac	Atomic probe microscopy resistivity – Applications (of pogy, Reprint, McGraw Hill zation Techniques, 1st edidemic Press, New Jersey,	Lecture: Inc., New York tion, CRC Pre	45, T k, 197	n sola Tutori	ar cell ial: 15	cope, X-rays, Thin film 5, Total: 60

	COURSE OUTCOMES: On completion of the course, the students will be able to						
CO1	utilize the appropriate theory and models to comprehend the thin film growth process.	Applying (K3)					
CO2	apply the principle of vacuum pump to explain select methods to create vacuum and to make use of the principle of vacuum gauge to explain the measurement of vacuum by select methods.	Applying (K3)					
CO3	describe the deposition of thin films by select physical methods using the principle of working of respective methods.	Applying (K3)					
CO4	explain the deposition of thin films by select chemical methods using the principle of working of respective methods.	Applying (K3)					
CO5	make use of select characterization techniques to comprehend the properties of thin films and also to illustrate the various device applications of thin films.	Applying (K3)					

COs/POs	PO1	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2						2	2		2		
CO2	3	2	2						2	2		2		
CO3	3	2	2						2	2		2		
CO4	3	2	2						2	2		2		
CO5	3	2	2						2	2		2		

^{1 -} Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

 $^{^{\}star}$ ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

						-	
Programme& Branch	All BE/BTech Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	5	OE	3	1	0	4
Preamble	This course aims to impart the essential knowledge on technologies and materials for energy storage solutions engineering field.						
Unit – I	Introduction to Energy Storage:						9+3
electrical energy storage – Gener	energy storage systems (qualitative): Thermal energy storage storage, electrochemical energy storage, electrostatic energical criteria of energy storage systems – Conventional batteries uge systems and requirements.	rgy storage, mag	netic energy s	storag	je an	d opti	cal energ
Unit – II	Thermal storage and Mechanical Storage:						9+3
Merits and dem	Thermal properties of materials, principle of operations, efficients of thermal storage system – Recent development in age systems, principle of operations, emerging advances and	thermal storage	systems. Med	hanic	al St	orage	: Types of
Unit – III	Magnetic storage, Electro-optic, Optical and Chemic	cal Storage:					9+3
Magnetic storage	e: Principle of operation, emerging challenges and a review or	n devices and tecl	nnology, Electr	o-opt	ic and	d optio	al storage
	s and upcoming technologies (qualitative). Chemical storage inum-Boron, silicon, and zinc.	: Power to gas –	Hydrogen and	Meth	ane.	Powe	r to liquid
		: Power to gas –	Hydrogen and	Meth	ane.	Powe	r to liquid
Bio fuels – Alum Unit – IV Materials, Princi operation, batter	inum-Boron, silicon, and zinc.	ctrode materials,	Hydrogen and electrolytes. L	Meth i-ion attery	ane. batte	Poweries: I	9+3 Principle ond packs
Bio fuels – Alum Unit – IV Materials, Princi operation, batter	Electrochemical Storage: ple of operation, positive electrode materials, negative electrode y components, design of electrodes, cell and battery fabricat	etrode materials, tions – Building b nagnesium batter	Hydrogen and electrolytes. L	Meth i-ion attery	batte	Poweries: I	9+3 Principle ond packs
Bio fuels – Alum Unit – IV Materials, Princi operation, batter Li-polymer batter Unit – V Fuel Cells: Introfuel cells and so cryogenic hydro	Electrochemical Storage: ple of operation, positive electrode materials, negative electrodes, cell and battery fabricatives – Applications – Future developments: Sodium-battery, materials, materials, negative electrodes, cell and battery fabrications – Future developments: Sodium-battery, materials, materi	etrode materials, tions – Building b nagnesium batter : Hydrogen PEM fu rdrogen storage t	electrolytes. L lock cells – Ba y, aluminum ba uel cell, direct anks, gas phas	i-ion attery attery methase hyd	batte modu and s	ries: I les a silicor uel cen stoi	9+3 Principle ond packs battery. 9+3 ell, alkaling age tanks
Bio fuels – Alum Unit – IV Materials, Princi operation, batter Li-polymer batte Unit – V Fuel Cells: Intro fuel cells and so cryogenic hydro principle of operation	Electrochemical Storage: ple of operation, positive electrode materials, negative electrodes, cell and battery fabricatives – Applications – Future developments: Sodium-battery, materials, Hydrogen storage and Super capacitors: duction to fuel cells, PEM (polymer electrolyte membrane), hid oxide fuel cells. Hydrogen storage systems: Solid state hygen storage tanks and liquid phase hydrogen storage tanks	etrode materials, tions – Building b nagnesium batter : Hydrogen PEM fu rdrogen storage t	electrolytes. L lock cells – Ba y, aluminum ba uel cell, direct anks, gas phas ors: Features	i-ion attery attery methase hydrof su	batte modu and s	ries: I ules a silicor uel ce n stor	9+3 Principle ond packs battery. 9+3 ell, alkaling age tanks
Bio fuels – Alum Unit – IV Materials, Princi operation, batter Li-polymer batter Unit – V Fuel Cells: Introfuel cells and so cryogenic hydroprinciple of operations.	Electrochemical Storage: ple of operation, positive electrode materials, negative electrodes, cell and battery fabricatives – Applications – Future developments: Sodium-battery, materials, Hydrogen storage and Super capacitors: Eduction to fuel cells, PEM (polymer electrolyte membrane), hid oxide fuel cells. Hydrogen storage systems: Solid state hydrogen storage tanks and liquid phase hydrogen storage tanks attain, performance and technologies of super capacitors.	etrode materials, tions – Building b nagnesium batter : Hydrogen PEM fu rdrogen storage t	electrolytes. L lock cells – Ba y, aluminum ba uel cell, direct anks, gas phas ors: Features	i-ion attery attery methase hydrof su	batte modu and s	ries: I ules a silicor uel ce n stor	9+3 Principle ond packs battery. 9+3 ell, alkalingage tankstors, basi
Bio fuels – Alum Unit – IV Materials, Princi operation, batter Li-polymer batte Unit – V Fuel Cells: Intro fuel cells and so cryogenic hydro principle of operation. TEXT BOOK: 1. Rober	Electrochemical Storage: ple of operation, positive electrode materials, negative electrodes, cell and battery fabricatives – Applications – Future developments: Sodium-battery, materials, negative electrodes, cell and battery fabricatives – Applications – Future developments: Sodium-battery, materials, Hydrogen storage and Super capacitors: duction to fuel cells, PEM (polymer electrolyte membrane), hid oxide fuel cells. Hydrogen storage systems: Solid state hydrogen storage tanks and liquid phase hydrogen storage tank attion, performance and technologies of super capacitors.	ctrode materials, tions – Building b nagnesium batter : Hydrogen PEM fu rdrogen storage tr ss. Super capacit	electrolytes. L lock cells – Ba y, aluminum ba uel cell, direct anks, gas phas ors: Features Lecture:	i-ion attery attery methase hydrof su	batte modu and s anol f droge per c	ries: I	9+3 Principle on packs battery. 9+3 Pll, alkalin age tank tors, bas
Bio fuels – Alum Unit – IV Materials, Princi operation, batter Li-polymer batte Unit – V Fuel Cells: Intro fuel cells and so cryogenic hydro principle of operation TEXT BOOK: 1. Rober	Electrochemical Storage: ple of operation, positive electrode materials, negative electrodes, cell and battery fabricatives – Applications – Future developments: Sodium-battery, m Fuel Cells, Hydrogen storage and Super capacitors: duction to fuel cells, PEM (polymer electrolyte membrane), hid oxide fuel cells. Hydrogen storage systems: Solid state hygen storage tanks and liquid phase hydrogen storage tank ation, performance and technologies of super capacitors. It A. Huggins, Energy Storage, Springer, 2010, (Unit I – V) it, Y. Gao, S. Gay, A. Emadi, Modern Electric, Hybrid Electric	ctrode materials, tions – Building b nagnesium batter : Hydrogen PEM fu rdrogen storage tr ss. Super capacit	electrolytes. L lock cells – Ba y, aluminum ba uel cell, direct anks, gas phas ors: Features Lecture:	i-ion attery attery methase hydrof su	batte modu and s anol f droge per c	ries: I	9+3 Principle on packs a battery. 9+3 Pll, alkalinage tank tors, bas
Bio fuels – Alum Unit – IV Materials, Princi operation, batter Li-polymer batte Unit – V Fuel Cells: Intro fuel cells and so cryogenic hydro principle of operation TEXT BOOK: 1. Rober 2. Ehsar (Unit I	Electrochemical Storage: ple of operation, positive electrode materials, negative electrodes, cell and battery fabricatives – Applications – Future developments: Sodium-battery, m Fuel Cells, Hydrogen storage and Super capacitors: duction to fuel cells, PEM (polymer electrolyte membrane), hid oxide fuel cells. Hydrogen storage systems: Solid state hygen storage tanks and liquid phase hydrogen storage tank ation, performance and technologies of super capacitors. It A. Huggins, Energy Storage, Springer, 2010, (Unit I – V) it, Y. Gao, S. Gay, A. Emadi, Modern Electric, Hybrid Electric	ctrode materials, tions – Building b nagnesium batter : Hydrogen PEM fu rdrogen storage tr ss. Super capacit	electrolytes. L lock cells – Ba y, aluminum ba uel cell, direct anks, gas phas ors: Features Lecture:	i-ion attery attery methase hydrof su	batte modu and s anol f droge per c	ries: I	9+3 Principle on packs battery. 9+3 Pll, alkalin age tank tors, bas
Bio fuels – Alum Unit – IV Materials, Princi operation, batter Li-polymer batte Unit – V Fuel Cells: Intro fuel cells and so cryogenic hydro principle of operation of the cells and so cryogenic hydro principle of the cells and the cells a	Electrochemical Storage: ple of operation, positive electrode materials, negative electrodes, cell and battery fabricatives – Applications – Future developments: Sodium-battery, m Fuel Cells, Hydrogen storage and Super capacitors: duction to fuel cells, PEM (polymer electrolyte membrane), hid oxide fuel cells. Hydrogen storage systems: Solid state hygen storage tanks and liquid phase hydrogen storage tank ation, performance and technologies of super capacitors. It A. Huggins, Energy Storage, Springer, 2010, (Unit I – V) it, Y. Gao, S. Gay, A. Emadi, Modern Electric, Hybrid Electric	etrode materials, tions – Building b nagnesium batter : Hydrogen PEM fu rdrogen storage t ss. Super capacit	electrolytes. L lock cells – Ba y, aluminum ba uel cell, direct anks, gas phas ors: Features Lecture:	i-ion attery attery of su	batte modu and s anol f droge per c	ries: I ules a silicor uel ce n stor apaci	9+3 Principle and packs battery. 9+3 Pll, alkaling tank tors, bas
Bio fuels – Alum Unit – IV Materials, Princi operation, batter Li-polymer batte Unit – V Fuel Cells: Intro fuel cells and so cryogenic hydro principle of operation. TEXT BOOK: 1. Rober 2. Ehsar (Unit I REFERENCES: 1. Yupin Press	Electrochemical Storage: ple of operation, positive electrode materials, negative electrodes, cell and battery fabricatives – Applications – Future developments: Sodium-battery, magnetic fies – Applications – Future developments: Sodium-battery, magnetic fies – Applications – Future developments: Sodium-battery, magnetic fies – Applications – Future developments: Sodium-battery, magnetic field cells, Hydrogen storage and Super capacitors: duction to fuel cells, PEM (polymer electrolyte membrane), hid oxide fuel cells. Hydrogen storage systems: Solid state hygren storage tanks and liquid phase hydrogen storage tank ation, performance and technologies of super capacitors. It A. Huggins, Energy Storage, Springer, 2010, (Unit I – V) it, Y. Gao, S. Gay, A. Emadi, Modern Electric, Hybrid Electric – V) g Wu, Lithium-Ion Batteries: Fundamentals and Applications	ctrode materials, tions – Building b nagnesium batter: Hydrogen PEM fudrogen storage trusts. Super capacit	electrolytes. L lock cells – Ba y, aluminum ba uel cell, direct anks, gas phas ors: Features Lecture:	i-ion attery attery of su	batte moduland sand sand sand sand sand sand sand s	ries: I sulles a silicor can stor capaci	9+3 Principle and packs a battery. 9+3 Pell, alkaling age tank age

	E OUTCOMES: upletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	utilize the appropriate concepts and models to comprehend the basics of energy storage systems.	Applying (K3)
CO2	apply the principle of thermal and mechanical storage systems to explain the working and the recent advancements in thermal and mechanical storage systems.	Applying (K3)
CO3	ultilize the principle of operation of magnetic storage systems, electro-optic, optical and chemical storage systems to illustrate the respective process under gone in these techniques.	Applying (K3)
CO4	explain the principle of operation of electrochemical storage device and materials used and to elucidate the construction and working of various types of high energy storage batteries.	Applying (K3)
CO5	make use of various techniques to construct different types of fuel cells and to explain the advanced techniques involved in hydrogen storage systems and also to explain the principle and working of super capacitors.	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2						2	2		2		
CO2	3	2	2						2	2		2		
CO3	3	2	2						2	2		2		
CO4	3	2	2						2	2		2		
CO5	3	2	2						2	2		2		

^{1 –} Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 - 50 marks & ESE - 100 marks)

Programr Branch	ne&	All BE/BTech Branches	Sem.	Category	L	Т	P	Credit
Prerequis	ites	Nil	5	OE	3	1	0	4
Preamble		This course aims to impart the essential knowl Raman spectroscopy, UV-visible spectroscopy, application in various engineering fields, and als	Electron microscopy and	Scanning tun	neling			
Unit – I		Introduction to Characterization Techniques	and X-Ray Diffraction:					9+3
Theory of	X-ray diffra	rials characterization – Classification of characte action – Powder and Single crystal X-ray diffraction nation (qualitative), crystallite size determination (: Instrumentation (quality	ative), XRD pa	ttern,	syste	ematio	
Unit – II		Electron Microscopy:						9+3
X-rays, tra	ansmitted e: Schem	croscopy – Electron specimen interaction: Emissic electrons, specimen interaction volume – Resoluatic diagram and working – Different types of filamolysis – Three parameter equation for quantitative of	ution – Scanning electro ents – Field emission sc	n microscope	and	trans	missi	on electro
Unit – III		Scanning Tunneling Microscopy:						9+3
		tum mechanical tunneling – Basic principles of scinstant voltage mode – Instrumentation and workin		copy – Two mo	odes	of sca	annin	g: constar
Unit – IV		Raman Spectroscopy:						9+3
		rotational Raman spectra – Vibrational Raman rumentation and working – Near-Infra-Red Raman			Rama	an ef	fect -	- Structur
Unit – V		Ultra Violet &Visible Spectroscopy:						9+3
		ole radiation – Colour and light absorption – Chi – Frank-Condon principle – Instrumentation and w						heory of
TEXT BO	OK:			Lecture.	43,	utor	iai. i	o, rotai. u
1.	Cullity B.	D. and Stock S. R, Elements of X-ray diffraction, 3	B rd Edition, Pearson Educ	cation, India, 2	003 (Unit I)	
2.		C. N, McCash E. M, Choudhury H. K, Fundamental i, 2013 (Unit II-V)	s of Molecular Spectroso	copy, 5 th Editio	n, Ta	ta Mo	Graw	-Hill Publ
REFEREN	ICES:							
1.	Holt D. B.	and Joy D. C, SEM micro characterization of sem	niconductors, 1st Edition,	Academic Pre	ss, N	ew D	elhi, 1	1989
2		H., Merritt L. L., John A Dean, and Settle Jr. F. A,	Instrumental methods o	f Analysis 7 th E	Editio	n, Wa	dswo	rth
2.	Publishing	g Company, United States, 1988						

	SE OUTCOMES: upletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	apply the concept of X-ray diffraction to determine the crystal structure and related structural parameters of materials.	Applying (K3)
CO2	determine the micro-structural parameters of materials and to perform surface analysis of materials using the concept of matter waves and electron microscopy.	Applying (K3)
CO3	utilize the concept and phenomenon of quantum mechanical tunneling to interpret the surface image recorded at atomic level using scanning tunneling microscopy.	Applying (K3)
CO4	make use of the concept of Raman effect and Raman spectroscopy to determine the crystal structure and related structural parameters of materials.	Applying (K3)
CO5	apply the theory of UV-Vis spectroscopy to comprehend the working of UV-Vis spectrophotometer.	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2						2	2		2		
CO2	3	2	2						2	2		2		
CO3	3	2	2						2	2		2		
CO4	3	2	2						2	2		2		
CO5	3	2	2						2	2		2		

^{1 -} Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	25	35	40				100
CAT3	30	30	40				100
ESE	20	40	40				100

 $^{^{\}star}$ ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

2	2PHO04 – SYNTHESIS, CHARACTERIZATION AND BIOL	LOGICAL APPLICA	TIONS OF NA	NOM	ATEF	RIALS	3			
Programme & Branch All BE/BTech Branches Preequisites Nil All BE/BTech Branches Sem. Category L T P G G G G G G G G G G G G										
Prerequisit	es Nil	6	OE	3	1	0	4			
Preamble				ynthe	sis of	nand	omaterials,			
Unit – I	Introduction to nanomaterials						9+3			
confinement	t effect - Classification of nanomaterials based on dimension -									
Unit – II	Synthesis of nanomaterials						9+3			
Deposition i	method - Colloidal precipitation method - Sol-Gel method -									
Unit – III	Characterization of nanomaterials									
							9+3			
analysis - L	IV visible spectroscopy analysis – Bandgap estimation – HRTI						ssion peak			
analysis - L	IV visible spectroscopy analysis – Bandgap estimation – HRTI						ssion peak			
analysis – L (qualitative) Unit – IV Allotropes o	V visible spectroscopy analysis – Bandgap estimation – HRTI	EM & AFM analysis of the EM & AFM analysis of the EM & AFM analysis of E	(qualitative) – p	oartic	le size	e ana	ssion peak lysis – BET 9+3			
analysis – L (qualitative) Unit – IV Allotropes o	V visible spectroscopy analysis – Bandgap estimation – HRTI Carbon nanotubes f carbon – Diamond – Graphite – Graphene – Fullerenes – Car	EM & AFM analysis of the EM & AFM analysis of the EM & AFM analysis of E	(qualitative) – p	oartic	le size	e ana	ssion peak lysis – BET 9+3			
analysis – L (qualitative) Unit – IV Allotropes o of Carbon n Unit – V Antibacteria	Carbon nanotubes f carbon – Diamond – Graphite – Graphene – Fullerenes – Calanotubes – Preparation: Laser ablation method – CVD – Appli	EM & AFM analysis of the second secon	qualitative) – poperties – SW0	CNT -	- MW	CNT -	ssion peak lysis – BET 9+3 - Structure 9+3 eria – Disc			
analysis – L (qualitative) Unit – IV Allotropes o of Carbon n Unit – V Antibacteria	Carbon nanotubes f carbon – Diamond – Graphite – Graphene – Fullerenes – Carbon bianotubes – Preparation: Laser ablation method – CVD – Applianotubes – Biological applications I activity – Mechanism – Antifungal activity – Microorganism	EM & AFM analysis of the second secon	qualitative) – p operties – SW0 acteria – Gram Γ method –Tox	CNT -	- MW	CNT -	ssion peak lysis – BET 9+3 - Structure 9+3 eria – Disc			
analysis – L (qualitative) Unit – IV Allotropes o of Carbon n Unit – V Antibacteria	Carbon nanotubes f carbon – Diamond – Graphite – Graphene – Fullerenes – Carbon beserved anotubes – Preparation: Laser ablation method – CVD – Applianotubes – Preparation: Laser ablation method – CVD – Applianotubes – Biological applications I activity – Mechanism – Antifungal activity – Microorganism thod – Antioxidant activity – DPPH method – Anticancer activity	EM & AFM analysis of the second secon	qualitative) – p operties – SW0 acteria – Gram Γ method –Tox	CNT -	- MW	CNT -	9+3 - Structure 9+3 eria – Disc			
analysis – L (qualitative) Unit – IV Allotropes o of Carbon n Unit – V Antibacteria diffusion me	Carbon nanotubes f carbon – Diamond – Graphite – Graphene – Fullerenes – Carbon beserved anotubes – Preparation: Laser ablation method – CVD – Applianotubes – Preparation: Laser ablation method – CVD – Applianotubes – Biological applications I activity – Mechanism – Antifungal activity – Microorganism thod – Antioxidant activity – DPPH method – Anticancer activity	rbon nanotubes – Proications. n – Gram positive batty – Cytotoxity – MT	qualitative) – poperties – SW0 acteria – Gram r method –Tox Lecture:	CNT - n neg	ative	CNT - bacter	9+3 - Structure 9+3 - Discticles. 5, Total: 60			
analysis – L (qualitative) Unit – IV Allotropes o of Carbon n Unit – V Antibacteria diffusion me TEXT BOO	Carbon nanotubes f carbon – Diamond – Graphite – Graphene – Fullerenes – Carbanotubes – Preparation: Laser ablation method – CVD – Appli Biological applications I activity – Mechanism – Antifungal activity – Microorganism thod – Antioxidant activity – DPPH method – Anticancer activity K: harles P Poole Jr., and Frank J. Ownes ,. "Introduction to Nan	rbon nanotubes – Proications. n – Gram positive batty – Cytotoxity – MT	qualitative) – poperties – SW0 acteria – Gram r method –Tox Lecture:	CNT - n neg	ative	CNT - bacter	9+3 - Structure 9+3 - Discticles. 5, Total: 60			
analysis – L (qualitative) Unit – IV Allotropes o of Carbon n Unit – V Antibacteria diffusion me TEXT BOO 1. C REFERENC	Carbon nanotubes f carbon – Diamond – Graphite – Graphene – Fullerenes – Carbanotubes – Preparation: Laser ablation method – CVD – Appli Biological applications I activity – Mechanism – Antifungal activity – Microorganism thod – Antioxidant activity – DPPH method – Anticancer activity K: harles P Poole Jr., and Frank J. Ownes ,. "Introduction to Nan	rbon nanotubes – Proications. n – Gram positive baity – Cytotoxity – MT	qualitative) – poperties – SW0 acteria – Gram r method –Tox Lecture:	CNT - n neg	ative	CNT - bacter	9+3 - Structure 9+3 - in a Discriticles. 5, Total: 60			

	E OUTCOMES: pletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	describe the properties of nanomaterials using concepts such as surface to volume ratio and quantum confinement and also able to classify nanomaterials.	Applying (K3)
CO2	explain the synthesis of nanomaterials using select physical and chemical methods.	Applying (K3)
CO3	explain the characterization of nanomaterials using XRD, UV-vis, HRTEM & AFM and BET.	Applying (K3)
CO4	Illustrate the preparation of CNT and their applications.	Applying (K3)
CO5	explore the biological applications of nanomaterials such as antibacterial activity, antifungal activity, antioxidant activity and anticancer activity.	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2						2	2		2		
CO2	3	2	2						2	2		2		
CO3	3	2	2						2	2		2		
CO4	3	2	2						2	2		2		
CO5	3	2	2						2	2		2		

^{1 -} Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	20	50	30				100
CAT3	20	50	30				100
ESE	20	50	30				100

^{* ±3%} may be varied (CAT 1,2,3 - 50 marks & ESE - 100 marks)

	22PHO05 - TECHNIQUES OF	CRYSTAL GROWTH												
Prerequisites Nil Category L T P General Sem. Category Categ														
Prerequisites	Nil	6	6 OE 3 1 0											
Droomble	This source sime to import the knowledge on	amentals, physics of ame	tal arouth and	O 871 / O	lal ar	th	mathada							
		crystais, physics of crys	iai growin and	crys	iai gro)WIII I	9+3							
		talling materials Case	alattica Drav	oio lo	t tioo	l otti								
						- Lalli	ce piane:							
Unit – II		•	•				9+3							
solution (eutectic) – Invheterogeneous nucleation.	variant reactions – Eutectic, peritectic and pe on – Classical theory – Energy of formation of nu	ritectoid (qualitative) -	Nucleation co	once	ot —	Homo	geneous nospheri							
Unit – III	Melt growth						9+3							
	ods – Melt growth methods – Bridgman (vertical			ods –	Liqui	d enc	apsulated							
technique (LEC) for sem	iconductors – Vermeil growth technique for grov Solution growth	ving gem crystals – Zor	e melting.				9+3							
	growth – High temperature solution growth – Ele	octro crystallization C	vetal growth in	gol	Grov	uth of								
crystals – Hydrothermal		ectio crystallization – Of	y star growth in	gei	GIOV	viii Oi	biologica							
Unit – V	Vapour growth						9+3							
	ort – chemical vapour transport. Epitaxial growth organic – Molecular beam epitaxy – Chemical be		ohase epitaxy	– Va	pour	phas	e epitaxy							
			Lecture:	45, T	utoria	al: 15	, Total: 6							
TEXT BOOK:														
1. Boardman A. D., – V)	O'Conner D. E. and Young D. A., Symmetry and	d its Applications in Scie	ence, London N	/IcGr	aw Hi	II, 197	73. (Unit I							
2. Introduction to C	rystallography Philips, Read Books (9 June 2011	1), India. (Unit I – V)												
REFERENCES:														
1. B. D. Cullity Addi	son, Elements of X-ray diffraction, Wesley Publi	shers, 1977.												
2. Santhana Ragha	van and Dr. P. Ramasamy, Crystal growth proce	esses and methods, KR	U publications	, 199	9.									
3. Leonid V. Azarof	f, Introduction to Solids, Tata McGraw Hill Publis	shing Company.												
4. C. Kittel Wiley, In	troduction to Solid State Physics, Eastern Unive	ersity Edition.												

	SE OUTCOMES:	BT Mapped
On co	mpletion of the course, the students will be able to	(Highest Level)
CO1	describe the physical properties of crystals using the concepts of crystalline materials, amorphous material, space lattice, unit cell, Miller indices and crystal symmetry.	Applying (K3)
CO2	explain nucleation in crystal growth using the concepts of phase diagrams and formation energy.	Applying (K3)
CO3	demonstrate the growth of bulk crystals using melt growth techniques.	Applying (K3)
CO4	demonstrate the growth of crystals using solution growth techniques.	Applying (K3)
CO5	comprehend the growth of epitaxy crystal using vapour growth techniques.	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2						2	2		2		
CO2	3	2	2						2	2		2		
CO3	3	2	2						2	2		2		
CO4	3	2	2						2	2		2		
CO5	3	2	2						2	2	·	2		

^{1 –} Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	20	50	30				100
CAT3	20	50	30				100
ESE	20	50	30				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Programme	All BE / BTech Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	5	OE	3	1	0	4
reamble	Instrumental methods of analysis aim to prepare the stumethods in order to identify the molecules and reaction towards the industries.						
Jnit – I	Absorption and Emission Spectroscopy						9+3
signal to noise	s of Absorption and Emission Spectroscopy – representation a ratio - techniques for signal to noise enhancement – resolvingsic principles, instrumentation and applications of Atomic A	ng power – Fou	rier transform	spe	ctros	copy -	evaluatio
Init – II	IR, Raman and NMR Spectroscopy						9+3
nalysis. Raman Spect Nuclear Magn	roscopy – correlation of IR Spectra with molecular structure, oscopy – Classical and Quantum theory instrumentation, Struetic resonance Spectroscopy – basic principles – pulsed Fouring NMR spectra and quantitative analysis.	ctural analysis	and quantitat	ive a	nalys	sis.	
Jnit – III	Surface Studies						9+3
AES) - Trans	 X-Ray Emission Spectroscopy (XES), X- Ray Photo Electronission Electron Microscopy (TEM) - Scanning Electron Microscopy (AFM). 						
Jnit – IV	Mass Spectroscopy						9+3
	Thermal Analysis sis: principles and instrumentations and applications of Therm	nogravimetry (T	GA), Differer	ntial T	herm	nal Ana	9+3 alvsis
hermal Analy	Thermal Analysis sis: principles and instrumentations and applications of Thermatial Scanning Calorimetry (DSC), evolved gas detection, Thermatial Scanning Calorimetry (DSC), evolved gas detection, Thermatian Scanning Calorimetry (DSC), evolved gas detection, Thermatian Scanning Calorimetry (DSC), evolved gas detection, Thermatian Scanning Calorimetry (DSC), evolved gas detection, Thermatian Scanning Calorimetry (DSC), evolved gas detection, Thermatian Scanning Calorimetry (DSC), evolved gas detection, Thermatian Scanning Calorimetry (DSC), evolved gas detection, Thermatian Scanning Calorimetry (DSC), evolved gas detection, Thermatian Scanning Calorimetry (DSC), evolved gas detection, Thermatian Scanning Calorimetry (DSC), evolved gas detection, Thermatian Scanning Calorimetry (DSC), evolved gas detection, Thermatian Scanning Calorimetry (DSC), evolved gas detection, Thermatian Scanning Calorimetry (DSC), evolved gas detection, Thermatian Scanning Calorimetry (DSC), evolved gas detection, Thermatian Scanning Calorimetry (DSC), evolved gas detection, Thermatian Scanning Calorimetry (DSC), evolved gas detection, Thermatian Scanning Calorimetry (DSC), evolved gas detection, Evolved Gas detection, Thermatian Scanning Calorimetry (DSC), evolved gas detection, Evolved Gas		Analysis and	d The	rmor	metric [*]	alysis Titration.
Thermal AnalyDTA), Differe	sis: principles and instrumentations and applications of Therm	mo Mechanica	Analysis and	d The	ermor Tuto	metric	alysis Titration.
Text Book: Chatv. 2019.	sis: principles and instrumentations and applications of Therm tial Scanning Calorimetry (DSC), evolved gas detection, the scanning Calorimetry (DSC), evolved gas detection, the scanning Calorimetry (DSC), evolved gas detection, the scanning Calorimetry (DSC), evolved gas detection, the scanning Calorimetry (DSC), evolved gas detection, the scanning Calorimetry (DSC), evolved gas detection, the scanning Calorimetry (DSC), evolved gas detection, evolved gas	mo Mechanica	Analysis and	d The	ermor Tuto	metric	alysis Titration.
TEXT BOOK: Chatve 2019. CEFERENCE	sis: principles and instrumentations and applications of Thermatial Scanning Calorimetry (DSC), evolved gas detection, Evolved gas dete	mo Mechanica	Lecture:	d The	ermor Tuto	metric	alysis Titration.
TEXT BOOK: Chatv. 2019. REFERENCE	sis: principles and instrumentations and applications of Therm tial Scanning Calorimetry (DSC), evolved gas detection, the scanning Calorimetry (DSC), evolved gas detection, the scanning Calorimetry (DSC), evolved gas detection, the scanning Calorimetry (DSC), evolved gas detection, the scanning Calorimetry (DSC), evolved gas detection, the scanning Calorimetry (DSC), evolved gas detection, the scanning Calorimetry (DSC), evolved gas detection, evolved gas	mo Mechanica	Lecture:	d The	ermor Tuto	metric	alysis Titration.
TEXT BOOK: Chatve 2019. REFERENCE B.K. S Willar	sis: principles and instrumentations and applications of Thermatial Scanning Calorimetry (DSC), evolved gas detection, Evolved gas dete	mo Mechanica al Analysis" 5th rakashan Media	Lecture: Edition, Hima	d The	Tuto Publ	rial: 18	alysis Titration. 5, Total: 6 House,
Chatve 2019. REFERENCE B.K. S. Willar 2004.	sis: principles and instrumentations and applications of Thermatial Scanning Calorimetry (DSC), evolved gas detection, Thermal. G. R., Anand, Sham K., "Instrumental Methods of Chemicals: harma, Instrumental Method of Chemical Analysis, Krishna Pr	al Analysis" 5th rakashan Media	Lecture: Edition, Hima a (P) Ltd. 201 is" CBS Publ	d The	Tuto Publ	rial: 18	Alysis Titration. 5, Total: 6 House,
Chaty 2019. REFERENCE B.K. S Willar 2004.	sis: principles and instrumentations and applications of Thermatial Scanning Calorimetry (DSC), evolved gas detection, Thermal. G. R., Anand, Sham K., "Instrumental Methods of Chemical Scanning Calorimetry (DSC), evolved gas detection, Thermal. G. R., Anand, Sham K., "Instrumental Methods of Chemical Analysis, Krishna Programma, Instrumental Method of Chemical Analysis, Krishna Programma, Instrumental Method of Chemical Analysis, Krishna Programma, Instrumental Methods of Chemical Analysis,	al Analysis" 5th rakashan Media	Lecture: Edition, Hima a (P) Ltd. 201 is" CBS Publ	d The	Tuto Publ	rial: 18	Alysis Titration. 5, Total: 6 House,
TEXT BOOK: Chatve 2019. REFERENCE B.K. S. Willar 2004. Kaur. COURSE OU'	sis: principles and instrumentations and applications of Therm Itial Scanning Calorimetry (DSC), evolved gas detection, Therefal. G. R., Anand, Sham K., "Instrumental Methods of Chemical Scanning Calorimetry (DSC), evolved gas detection, Therefal. G. R., Anand, Sham K., "Instrumental Methods of Chemical Analysis, Krishna Prod,H.H., Merritt,L.L., Dean,J.A, and Settle, F.A, "Instrumental method, "Instrumental Methods of Chemical Analysis", XII Edition, Proceedings of the Course, the students will be able to	rmo Mechanica al Analysis" 5th rakashan Media ethods of analys	Lecture: Edition, Hima a (P) Ltd. 201 is" CBS Publ an, Meerat, 2	d The 45, 9. isher 018.	Publ	rial: 15 ishing Distribu	alysis Titration. 5, Total: 6 House, ttors, 7 Ed
EXT BOOK: Chatve 2019. EFFERENCE B.K. S Willar 2004. Kaur. COURSE OU Do completio	sis: principles and instrumentations and applications of Therm Itial Scanning Calorimetry (DSC), evolved gas detection, There Itial Scanning Calorimetry (DS	rmo Mechanica al Analysis" 5th rakashan Media ethods of analys ragati prakasha	Lecture: Edition, Hima a (P) Ltd. 201 is" CBS Publ an, Meerat, 2	d The 45, 45, 9. 10 18. U	Publ	rial: 15 ishing Distribu BT Maighest standir	Alysis Titration. 5, Total: 6 House, Itors, 7 Ed pped Level) ng (K2)
EXT BOOK: Chatve 2019. EFFERENCE B.K. S. Willar 2004. Kaur. COURSE OU' On completic techn CO2 apply	sis: principles and instrumentations and applications of Thermatial Scanning Calorimetry (DSC), evolved gas detection, Therefital Scanning Calorimetry (DSC), evolved gas detection, There	rmo Mechanica al Analysis" 5th rakashan Media ethods of analys ragati prakasha on of various sp	Lecture: Edition, Hima a (P) Ltd. 201 is" CBS Publ an, Meerat, 2	d The	Publ s & C (Hi	rial: 15 ishing Distribu BT Ma ighest standir	alysis Titration. 5, Total: 6 House, ttors, 7 Ed pped Level) ng (K2)
EXT BOOK: Chatve 2019. EFFERENCE Willare 2004. Kaur. COURSE OU' illustratechn CO apply	sis: principles and instrumentations and applications of Therm Itial Scanning Calorimetry (DSC), evolved gas detection, There Itial Scanning Calorimetry (DS	rmo Mechanica al Analysis" 5th rakashan Media ethods of analys ragati prakasha on of various sp	Lecture: Edition, Hima a (P) Ltd. 201 is" CBS Publ an, Meerat, 2	d The	Publ s & C (Hi	rial: 15 ishing Distribu BT Maighest standir	alysis Titration. 5, Total: 6 House, ttors, 7 Ed pped Level) ng (K2)
CHARTON DIFFERENCE EEXT BOOK: Charton 2019. EFFERENCE Willar 2004. Kaur. COURSE OU'Don completion illustratechn apply CO apply	sis: principles and instrumentations and applications of Thermatial Scanning Calorimetry (DSC), evolved gas detection, Therefital Scanning Calorimetry (DSC), evolved gas detection, There	rmo Mechanica al Analysis" 5th rakashan Media athods of analys ragati prakasha on of various sp le. morphology.	Lecture: Edition, Hima a (P) Ltd. 201 is" CBS Publ an, Meerat, 2	d The 45, 45, 46, 46, 46, 47, 48, 48, 48, 48, 48, 48, 48, 48, 48, 48	Publ Fubl rial: 15 ishing Distribu BT Ma ighest standir ng (K3	alysis Titration. 5, Total: 6 House, ttors, 7 Ed pped Level) ng (K2)	
Thermal Analydon Therma	sis: principles and instrumentations and applications of Thermatial Scanning Calorimetry (DSC), evolved gas detection, Thermatial Scanning Calorimetry (DSC), evolved gas detection, Thermatial G. R., Anand, Sham K., "Instrumental Methods of Chemical Analysis, Krishna Prid,H.H., Merritt,L.L., Dean,J.A, and Settle, F.A, "Instrumental method, "Instrumental Methods of Chemical Analysis", XII Edition, Pricomes: In of the course, the students will be able to the basics of spectroscopy to understand the instrumentation of the IR, Raman and NMR for quantitative analysis of the sample the various techniques for the better understanding of surface	rmo Mechanica al Analysis" 5th rakashan Media thods of analys Pragati prakasha on of various sp le. morphology. analysis of orga	Lecture: Edition, Hima a (P) Ltd. 201 is" CBS Publ an, Meerat, 2 pectral	9. isher 018. U	Publ S & C (Hi nders	rial: 18 ishing Distribu BT Ma ighest standir ng (K3	alysis Titration. 5, Total: 6 House, ttors, 7 Ed pped Level) ng (K2)
Thermal Analydon DTA), Differe TEXT BOOK: Chatve 2019. REFERENCE B.K. S. Willar 2004. Kaur. COURSE OU'Don completic technicol apply 203 apply 203 apply 203	sis: principles and instrumentations and applications of Thermatial Scanning Calorimetry (DSC), evolved gas detection, Therefall. G. R., Anand, Sham K., "Instrumental Methods of Chemicals: harma, Instrumental Method of Chemical Analysis, Krishna Prad, H., Merritt, L.L., Dean, J.A., and Settle, F.A., "Instrumental medh, "Instrumental Methods of Chemical Analysis", XII Edition, Practice of the course, the students will be able to the basics of spectroscopy to understand the instrumentation of the IR, Raman and NMR for quantitative analysis of the sample the various techniques for the better understanding of surface on the principle, instrumentation of mass spectroscopy for the analysis of the sample of the principle, instrumentation of mass spectroscopy for the analysis of the sample of the principle, instrumentation of mass spectroscopy for the analysis of the sample of the principle, instrumentation of mass spectroscopy for the analysis of the sample of the principle, instrumentation of mass spectroscopy for the analysis of the sample of the principle, instrumentation of mass spectroscopy for the analysis of the sample of the principle, instrumentation of mass spectroscopy for the analysis of the sample of the principle, instrumentation of mass spectroscopy for the analysis of the sample of the principle, instrumentation of mass spectroscopy for the analysis of the sample of the principle of t	al Analysis" 5th rakashan Media ethods of analys on of various sp le. morphology. analysis of orga y of the compou	Lecture: Edition, Hima a (P) Ltd. 201 is" CBS Publ an, Meerat, 2 pectral	9. isher 018. U	Publ S & C (Hi nders	rial: 18 ishing Distribu BT Ma ighest standir ng (K3	pped Level) ng (K2)

CO1	3	1							
CO2	3	2	1	1					
CO3	3	2	1	1					
CO4	3	1							
CO5	3	1							

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSES	SMFNT	PATTERN	I - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

 $^{^{\}ast}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

Programme & Branch	All BE / BTech Branches Sem. Ca	Category	L	Т	Р	Credit
Prerequisites	Nil 5	OE	3	1	0	4
Preamble	This course aims to refresh the knowledge of chemistry required for comstudents with a capacity to solve the problems in chemistry while participating including TNFUSRC-FORESTER (paper-II: General science-chemistry), Uchemistry), GATE (thermodynamics concept for chemical & mechanical en	ating various UPSC-IAS	s coi (pre	mpet	itive e	xamination ral science
Unit – I	Periodic Classification of Elements					9+
	odic table-Law and classification of elements- Modern periodic law-Modern periodic law					
Unit – II	Chemical Equations and Bonding					9+
Chemical Bondi covalent compou nomenclature an Unit – III	 ions: Types of ions and radicals- oxidation and reduction-redox reactions - balaing: Octet rule -types of chemical bond -formation of ionic and covalent bond and differences between ionic and covalent compounds-Coordinate covalent isomerism - application in analytical chemistry. Acids, Bases, Salts and Metallurgy 	ond- comm ent bond- (non p Coor	orope dinat	erties o	mpounds 9+
	ry – Bronsted- Lowry theory- conjugate acid-base- Lewis concept- HSAB- applied	olications- p	oH so	cale-	Impor	tance of pl
	alts-classification of salts-uses of salts. duction-terminologies in metallurgy-differences between minerals and ores-o	-occurrence	e of	meta	als- me	etallurov o
aluminum, coppe	r and iron.		O 0.			
Unit – IV	Carbon and its Compounds					9+
		and ite cor	mnoi	ınde-	allotro	ny-nhyeic
functional groups	pounds of carbon-modern definition of organic chemistry- bonding in carbon at and its compounds-chemical properties of carbon compounds-homologous sel-classification of organic compounds based on functional group-ethanol-ethan	series-hyd				their types
functional groups Unit - V Introduction- sor	and its compounds-chemical properties of carbon compounds-homologous s - classification of organic compounds based on functional group-ethanol-ethan Thermodynamics ne important terms in thermodynamics-thermodynamic system, process, p	series-hyd anoic acid. properties	lroca	rbon	s and ergy-	their types 9+ first law of
functional groups Unit – V Introduction- sor thermodynamics: reversible isother in ideal gases- so change for syste	and its compounds-chemical properties of carbon compounds-homologous selectassification of organic compounds based on functional group-ethanol-ethan Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamic system, process, properties and interpretation-applications of first law of thermodynamics of an ideal gas-adiabatic expansion of an ideal gaseond laws of thermodynamics: entropy-entropy change for isolated system only (ideal gas)- entropy change for mixing of ideal gases-entropy of physical companies.	series-hyd anoic acid. properties hermodyna gas-isobar n (system a	and s	d en- s-mol	ergy- ar hea ochorio	g+ first law cat capacity c processess)- entrop
functional groups Unit – V Introduction- sor thermodynamics: reversible isother in ideal gases- so change for syste	and its compounds-chemical properties of carbon compounds-homologous states classification of organic compounds based on functional group-ethanol-ethan Thermodynamics Thermodynamics Thermodynamics Thermodynamics in thermodynamics-thermodynamic system, process, promote the material expression and interpretation- applications of first law of the male expansion/compression of an ideal gas-adiabatic expansion of an ideal green group decond laws of thermodynamics: entropy- entropy change for isolated system only (ideal gas)- entropy change for mixing of ideal gases-entropy of physical relations.	properties hermodyna gas-isobar n (system a	and sand sand sand sand sand sand sand s	d en s-mol nd iso surro	ergy- ar head ochorion	9+ first law eat capacity processes gs)- entrop
functional groups Unit – V Introduction- sor thermodynamics: reversible isother in ideal gases- si change for syste changes-Maxwel	and its compounds-chemical properties of carbon compounds-homologous states classification of organic compounds based on functional group-ethanol-ethan Thermodynamics Thermodynamics Thermodynamics Thermodynamics in thermodynamics-thermodynamic system, process, promote the material expression and interpretation- applications of first law of the male expansion/compression of an ideal gas-adiabatic expansion of an ideal green group decond laws of thermodynamics: entropy- entropy change for isolated system only (ideal gas)- entropy change for mixing of ideal gases-entropy of physical relations.	properties hermodyna gas-isobar n (system a	and sand sand sand sand sand sand sand s	d en s-mol nd iso surro	ergy- ar head ochorion	9+ first law eat capacity processes gs)- entrop
functional groups Unit – V Introduction- sor thermodynamics: reversible isother in ideal gases- schange for syste changes-Maxwel TEXT BOOK:	and its compounds-chemical properties of carbon compounds-homologous selectassification of organic compounds based on functional group-ethanol-ethan Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamic system, process, proceedings of the first law of the smaller expansion of an ideal gas-adiabatic expansion of an ideal gase-cond laws of thermodynamics: entropy-entropy change for isolated system only (ideal gase)-entropy change for mixing of ideal gases-entropy of physical relations. Thermodynamics Thermodynami	properties hermodyna gas-isobar n (system a nysical char	and sanges	d ensemoles enter	ergy- ar header ochoric unding ropy o	9+ first law of at capacity processe gs)- entrop of chemica
functional groups Unit – V Introduction- sor thermodynamics: reversible isother in ideal gases- schange for syste changes-Maxwel TEXT BOOK: 1. Steven S Units-I, I Wiley ed	and its compounds-chemical properties of carbon compounds-homologous sectors classification of organic compounds based on functional group-ethanol-ethan Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamic system, process, proceedings of first law of the small expansion/compression and interpretation-applications of first law of the small expansion/compression of an ideal gas-adiabatic expansion of an ideal greecond laws of thermodynamics: entropy-entropy change for isolated system of the system of	properties hermodyna gas-isobar n (system a nysical char Lecture:	and sanges	d ensemoles enter	ergy- ar hea ochorio unding ropy o	9+ first law of the capacity of chemical control of the control of
functional groups Unit - V Introduction- sor thermodynamics: reversible isother in ideal gases- schange for syste changes-Maxwel TEXT BOOK: 1. Steven S Units-I, II Wiley ed I, II, III, V	and its compounds-chemical properties of carbon compounds-homologous sectors classification of organic compounds based on functional group-ethanol-ethan Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamic system, process, proceedings of first law of the small expansion/compression and interpretation-applications of first law of the small expansion/compression of an ideal gas-adiabatic expansion of an ideal greecond laws of thermodynamics: entropy-entropy change for isolated system of the system of	properties hermodyna gas-isobar n (system a nysical char Lecture:	and sanges	d ensemoles enter	ergy- ar hea ochorio unding ropy o	9+ first law (at capacity processe gs)- entropof chemica 5, Total: 6
functional groups Unit – V Introduction- sor thermodynamics: reversible isother in ideal gases- schange for syste changes-Maxwel TEXT BOOK: 1. Steven S Units-I, II Wiley ed I, II, III, V REFERENCES:	and its compounds-chemical properties of carbon compounds-homologous sectors classification of organic compounds based on functional group-ethanol-ethan Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamic system, process, proceedings of first law of the small expansion/compression and interpretation-applications of first law of the small expansion/compression of an ideal gas-adiabatic expansion of an ideal greecond laws of thermodynamics: entropy-entropy change for isolated system of the system of	properties hermodyna gas-isobar n (system a nysical char Lecture: ition, Cenga	and sanges	d ensemoles enter	ergy- ar hea ochorio unding ropy o	9+ first law cat capacity processe gs)- entropof chemica 5, Total: 6
functional groups Unit - V Introduction- sor thermodynamics: reversible isother in ideal gases- schange for syste changes-Maxwel TEXT BOOK: 1. Steven SUnits-I, II 2. Wiley ed I, II, III, V REFERENCES: 1. B.R. Pur	and its compounds-chemical properties of carbon compounds-homologous states classification of organic compounds based on functional group-ethanol-ethan Thermodynamics Thermodynamics Thermodynamics Thermodynamics Thermodynamics in thermodynamics-thermodynamic system, process, pr	properties hermodyna gas-isobar n (system a nysical char Lecture: ition, Cenga	and sanges	d ensemoles enter	ergy- ar hea ochorio unding ropy o	9+ first law cat capacity processe gs)- entropof chemica 5, Total: 6
functional groups Unit - V Introduction- sor thermodynamics: reversible isother in ideal gases- schange for syste changes-Maxwel TEXT BOOK: 1. Steven Struits-I, II 2. Wiley ed I, II, III, V REFERENCES: 1. B.R. Pur 2. Paula Br COURSE OUTCO	and its compounds-chemical properties of carbon compounds-homologous site classification of organic compounds based on functional group-ethanol-ethan Thermodynamics Thermodynamics The important terms in thermodynamics-thermodynamic system, process, promathematical expression and interpretation- applications of first law of the small expansion/compression of an ideal gas-adiabatic expansion of an ideal gecond laws of thermodynamics: entropy- entropy change for isolated system only (ideal gas)- entropy change for mixing of ideal gases-entropy of physical relations. S. Zumdahl, Susan A. Zumdahl and Donald J. DeCoste, "Chemistry", 10th Edition, III, IV. itorial board. "Wiley Engineering Chemistry". 2nd Edition, Wiley India Pvt. Ltd, No. (1). J. L.R. Sharma, Principles of Inorganic Chemistry, 33rd Edition, Vishal Publishin uise, "Organic Chemistry", 8th Edition, Pearson Education, 2020. OMES:	properties hermodyna gas-isobar n (system a nysical char Lecture: ition, Cenga	and sanges	d enrices-mole de la constant de la	ergy- ar head cochoriounding ropy of the print of the pri	9+ first law of the care capacity of chemical control of the capacity of the c
functional groups Unit – V Introduction- sor thermodynamics: reversible isother in ideal gases- schange for systechanges-Maxwel TEXT BOOK: 1. Steven Struction Wiley ed I, II, III, V REFERENCES: 1. B.R. Pur 2. Paula Br COURSE OUTCO on completion of apply the	and its compounds-chemical properties of carbon compounds-homologous sical classification of organic compounds based on functional group-ethanol-ethan Thermodynamics Thermodynamics The important terms in thermodynamics-thermodynamic system, process, pro	series-hydenoic acid. properties hermodyna gas-isobar (system anysical chare) Lecture: ition, Cengare New Delhi	and sanges	d enres-mol	ergy- ar header	9+ first law cat capacity c processe gs)- entrop of chemica 5, Total: 6
functional groups Unit - V Introduction- sor thermodynamics: reversible isother in ideal gases- schange for syste changes-Maxwel TEXT BOOK: 1. Steven S Units-I, II, III, V REFERENCES: 1. B.R. Pur 2. Paula Br COURSE OUTCO on completion of apply the and reactions of the course of the cours	and its compounds-chemical properties of carbon compounds-nomologous sic-classification of organic compounds based on functional group-ethanol-ethan Thermodynamics Thermodynamics Thermodynamics The important terms in thermodynamics-thermodynamic system, process, promathematical expression and interpretation- applications of first law of the small expansion/compression of an ideal gas-adiabatic expansion of an ideal gasecond laws of thermodynamics: entropy- entropy change for isolated system of monly (ideal gas)- entropy change for mixing of ideal gases-entropy of physical relations. S. Zumdahl, Susan A. Zumdahl and Donald J. DeCoste, "Chemistry", 10th Edition, III, IV. itorial board. "Wiley Engineering Chemistry". 2nd Edition, Wiley India Pvt. Ltd, No. J. L.R. Sharma, Principles of Inorganic Chemistry, 33rd Edition, Vishal Publishin uise, "Organic Chemistry", 8th Edition, Pearson Education, 2020. DMES: of the course, the students will be able to	series-hydenoic acid. properties hermodyna gas-isobar (system a pysical chare) Lecture: ition, Cengare New Delhi	and sanges	d enres-molendisce surrous Learn print	ergy- ar heachoridunding ropy of rial: 1 ning, 2 2019,	first law of at capacity processes gs)- entrop of chemica control of chemica control of chemica control of chemica control of chemica control of chemica control of c
functional groups Unit – V Introduction- sor thermodynamics: reversible isother in ideal gases- schange for syste changes-Maxwel TEXT BOOK: 1. Steven S Units-I, II Wiley ed I, II, III, V REFERENCES: 1. B.R. Pur 2. Paula Br COURSE OUTCO on completion of apply the and read CO2 utilize the equation apply the ap	and its compounds-chemical properties of carbon compounds-homologous si-classification of organic compounds based on functional group-ethanol-ethanologous si-classification of organic compounds based on functional group-ethanol-ethanologous me important terms in thermodynamics-thermodynamic system, process, promathematical expression and interpretation-applications of first law of the mal expansion/compression of an ideal gas-adiabatic expansion of an ideal gecond laws of thermodynamics: entropy-entropy change for isolated system of only (ideal gas)-entropy change for mixing of ideal gases-entropy of physical relations. S. Zumdahl, Susan A. Zumdahl and Donald J. DeCoste, "Chemistry", 10th Edition, III, IV. itorial board. "Wiley Engineering Chemistry". 2nd Edition, Wiley India Pvt. Ltd, No. it, L.R. Sharma, Principles of Inorganic Chemistry, 33rd Edition, Vishal Publishin uise, "Organic Chemistry", 8th Edition, Pearson Education, 2020. OMES: of the course, the students will be able to be basic concept of periodic classification of elements to explain the periodic protivity series of s, p & d block elements. e concepts of chemical equation and bonding to solve the problems in balance.	series-hydronic acid. properties hermodyna gas-isobar of (system a pysical charant control of the control of t	age i, Re	d enrice-mole de la constant de la c	ergy- ar header behavior of the control of the cont	first law of at capacity or processe gs)- entrop of chemica control of chemica control of chemica control of chemica control of chemica control of chemica control of chemica control of chemica control of contr
functional groups Unit - V Introduction- sor thermodynamics: reversible isother in ideal gases- schange for syste changes-Maxwel TEXT BOOK: 1. Steven S Units-I, II Wiley ed I, II, III, VIII, VIII, VI	and its compounds-chemical properties of carbon compounds-homologous sicalassification of organic compounds based on functional group-ethanol-ethanolithm Thermodynamics Thermodynamics Thermodynamics in thermodynamics-thermodynamic system, process, process, process, procession and interpretation- applications of first law of the small expansion/compression of an ideal gas-adiabatic expansion of an ideal gecond laws of thermodynamics: entropy- entropy change for isolated system on only (ideal gas)- entropy change for mixing of ideal gases-entropy of physical relations. S. Zumdahl, Susan A. Zumdahl and Donald J. DeCoste, "Chemistry", 10th Edition, III, IV. itorial board. "Wiley Engineering Chemistry". 2nd Edition, Wiley India Pvt. Ltd, No. it, L.R. Sharma, Principles of Inorganic Chemistry, 33rd Edition, Vishal Publishin uise, "Organic Chemistry", 8th Edition, Pearson Education, 2020. OMES: of the course, the students will be able to be basic concept of periodic classification of elements to explain the periodic putivity series of s, p & d block elements. The concepts of chemical equation and bonding to solve the problems in balance and differentiate ionic and covalent compounds. The concept of acid, base, salts and metallurgy to explain HSAB concepts, Important processing and interpretation of elements.	series-hydenoic acid. properties hermodyna gas-isobar (system a sysical chare) Lecture: ition, Cengare New Delhi ing Co., 20 properties noing ionic cortance of	age i, Re	d enrice-mole disconsistential disconsis	ergy- ar header	first law at capacity corporates for the corporate for the corporate for Units- apped t Level) g (K3) g (K3)

	Mapping of COs with POs and PSOs													
COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	2	1											
CO3	3	2	1											
CO4	3	2	1											
CO5	3	2	1											

^{1 -} Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

Programme Branch	All BE / BTech Branches	Sem.	Category	L	Т	Р	Credit
Prerequisite	es Nil	5	OE	3	1	0	4
Preamble	Outside Observing for the design circulate and the			11			1
Tournois	Organic Chemistry for Industry aims to equip the s in order to meet the industrial needs.	tudents to have wide	e-range know	ieage	e on c	organi	c chemistry
Unit – I	Basic aspects of Organic Chemistry						9+3
	rmediates: carbocations, carbanions, free radicals, carbe plications- Nucleophilic uni- and bimolecular reactions (S e).						
Unit – II	Molecular Rearrangements						9+3
Migration of	volving electron deficient, carbon, nitrogen, oxygen cent carbon: Wagner-Meerwein, Pinacol-pinacolone, benzyl-ber ent, Hofmann, Curtius, Lossen rearrangements- Migration c	nzilic acid rearrange	ment – Migra	tion			
Unit – III	Synthetic Reagents & Applications						9+3
l ithium alum	inium hydrida, cadium barahydrida, calanium di avida, car	mium totrovido, sha	avl icathicava	noto	NIL	$r \sim r \sim r \sim r$	unconomida
(NBS)- lead toluenesulph Trimethyl sil	inium hydride- sodium borohydride- selenium-di-oxide- osr tetraacetate - dicyclohexylcarbodiimide (DCC) – pyridini onyl chloride – trifluoroacetic acid- lithium diisopropylamide d iodide - dichlorodicyanobenzoquinone (DDQ) – Gilman re	um chlorochromate e (LDA) – 1,3- dithia	e (PCC) – Sv ine (reactive i	wern umpo	oxid olung	ation) - cro	–p- wn ethers- alysts.
(NBS)- lead toluenesulph Trimethyl sil Unit – IV	tetraacetate - dicyclohexylcarbodiimide (DCC) - pyridinionyl chloride - trifluoroacetic acid- lithium diisopropylamide	um chlorochromate e (LDA) – 1,3- dithia eagent– phase trans	e (PCC) – Stane (reactive to ster catalysts-	vern umpo Wilk	oxid olung insor	ation) - cro ı's cat	–p- wn ethers- alysts. 9+3
(NBS)- lead toluenesulph Trimethyl sill Unit – IV Extraction: filtration- pre Distillation: Crystallization	tetraacetate - dicyclohexylcarbodiimide (DCC) - pyridinionyl chloride - trifluoroacetic acid- lithium diisopropylamide liodide - dichlorodicyanobenzoquinone (DDQ) - Gilman re Unit Operations Liquid equilibria-extraction with reflux-extraction with agitat ssure and vacuum filtration-centrifugal filtration. Azeotropic and steam distillation. Evaporation: Types of en from aqueous-non- aqueous solutions factors affecting controls.	um chlorochromate e (LDA) – 1,3- dithia eagent– phase trans ion-counter current vaporators-factors	e (PCC) – Sume (reactive unifer catalysts- extraction. File	vern umpo Wilk Itrati	oxid olung insor on: 7	ation) - cro i's cat heory	-p- wn ethers- alysts. 9+3 y of
(NBS)- lead toluenesulph Trimethyl sily Unit – IV Extraction: filtration- pre Distillation: Crystallizatio Unit – V	tetraacetate - dicyclohexylcarbodiimide (DCC) - pyridinionyl chloride - trifluoroacetic acid- lithium diisopropylamide li iodide - dichlorodicyanobenzoquinone (DDQ) - Gilman re Unit Operations Liquid equilibria-extraction with reflux-extraction with agitat ssure and vacuum filtration-centrifugal filtration. Azeotropic and steam distillation. Evaporation: Types of en from aqueous-non- aqueous solutions factors affecting countries.	um chlorochromate (LDA) – 1,3- dithia eagent– phase transion-counter current evaporators-factors arystallization-nuclea	e (PCC) – Summe (reactive of the catalysts-extraction. File affecting evaption.	wern umpo Wilk Itrati orati	oxid olung insor on: 7	ation) - cro i's cat heory	-p- wn ethers- alysts. 9+3 y of Illization:
(NBS)- lead toluenesulph Trimethyl sily Unit – IV Extraction: filtration- pre Distillation: Crystallizatio Unit – V Nitration: N nitration-mix Halogenatio process.	tetraacetate - dicyclohexylcarbodiimide (DCC) - pyridinionyl chloride - trifluoroacetic acid- lithium diisopropylamide liodide - dichlorodicyanobenzoquinone (DDQ) - Gilman re Unit Operations Liquid equilibria-extraction with reflux-extraction with agitat ssure and vacuum filtration-centrifugal filtration. Azeotropic and steam distillation. Evaporation: Types of en from aqueous-non- aqueous solutions factors affecting contractions.	um chlorochromate (LDA) – 1,3- dithia eagent– phase transion-counter current evaporators-factors a systallization-nuclear faromatic nitration-tic halogenations-Ca	e (PCC) – Summe (reactive of the catalysts-extraction. File affecting evaption.	wern umpo Wilk Itrati orati ipme	oxid blung insor on: 7 on. C	ation) - cro 's cat Theory Trysta Techr thalogo	—p- wn ethers- alysts. 9+3 y of Illization: 9+3 nical enation
(NBS)- lead toluenesulph Trimethyl sily Unit – IV Extraction: filtration- pre Distillation: Crystallizatio Unit – V Nitration: N nitration-mix Halogenatio process.	tetraacetate - dicyclohexylcarbodiimide (DCC) — pyridinionyl chloride — trifluoroacetic acid- lithium diisopropylamide li iodide - dichlorodicyanobenzoquinone (DDQ) — Gilman re Unit Operations Liquid equilibria-extraction with reflux-extraction with agitates used and vacuum filtration-centrifugal filtration. Azeotropic and steam distillation. Evaporation: Types of en from aqueous-non- aqueous solutions factors affecting contrating agents-aromatic nitration-kinetics and mechanism contration agents aromatic nitration-kinetics and mechanism contrations. When the discontration is the discontration of halogenations cataly in the discontration is described acid for nitration.	um chlorochromate (LDA) – 1,3- dithia eagent– phase transion-counter current evaporators-factors a systallization-nuclear faromatic nitration-tic halogenations-Ca	e (PCC) – Summe (reactive unifer catalysts- extraction. File affecting evaption. process equipmes study on distribution.	wern umpo Wilk Itrati orati ipme indus n-Pr	oxidolung insor on: 7 on. Control ont for	ation) - cro) - cro 's cat heory rysta techr halogo tion of	—p- wn ethers- alysts. 9+3 y of Illization: 9+3 nical enation Vitamins:
(NBS)- lead toluenesulph Trimethyl sily Unit – IV Extraction: filtration- pre Distillation: Crystallizatio Unit – V Nitration-mix Halogenatio process. Fermentatio B2 and B12.	tetraacetate - dicyclohexylcarbodiimide (DCC) — pyridinionyl chloride — trifluoroacetic acid- lithium diisopropylamide li iodide - dichlorodicyanobenzoquinone (DDQ) — Gilman re Unit Operations Liquid equilibria-extraction with reflux-extraction with agitates used and vacuum filtration-centrifugal filtration. Azeotropic and steam distillation. Evaporation: Types of en from aqueous-non- aqueous solutions factors affecting confrom agents-aromatic nitration-kinetics and mechanism of ed acid for nitration. In: Kinetics of halogenations-types of halogenations-cataly on: Aerobic and anaerobic fermentation. Production of Antibute.	um chlorochromate (LDA) – 1,3- dithia eagent– phase transion-counter current evaporators-factors a systallization-nuclear faromatic nitration-tic halogenations-Capiotics: Penicillin and	e (PCC) – Summe (reactive of the catalysts-extraction. File affecting evaption. process equipmes study on the study on the catalysts-extraction.	wern umpo Wilk Itrati orati ipme indus n-Pr 45,	oxid blung insor on: 1 on. C	ation) - cro) - cro 's cat heory techr halogo tion of	—p- wn ethers- alysts. 9+3 y of Illization: 9+3 nical enation Vitamins: 5, Total: 66
(NBS)- lead toluenesulph Trimethyl sily Unit – IV Extraction: filtration- pre Distillation: Crystallization: Unit – V Nitration: N nitration-mix Halogenation process. Fermentation B2 and B12. TEXT BOOK 1. P.S. V.	tetraacetate - dicyclohexylcarbodiimide (DCC) - pyridinionyl chloride - trifluoroacetic acid- lithium diisopropylamide liodide - dichlorodicyanobenzoquinone (DDQ) - Gilman re Unit Operations Liquid equilibria-extraction with reflux-extraction with agitat ssure and vacuum filtration-centrifugal filtration. Azeotropic and steam distillation. Evaporation: Types of en from aqueous-non- aqueous solutions factors affecting contrating agents-aromatic nitration-kinetics and mechanism of ed acid for nitration. In: Kinetics of halogenations-types of halogenations-cataly on: Aerobic and anaerobic fermentation. Production of Antibody. Kalsi," Organic Reactions and their Mechanisms", 5th Editions.	um chlorochromate (LDA) – 1,3- dithia eagent – phase transion-counter current evaporators-factors a cystallization-nuclea of aromatic nitration-tic halogenations-Capiotics: Penicillin and on, New Age Internation-	e (PCC) — Sine (reactive of the catalysts- extraction. File affecting evaption. process equeses study on the catalysts- extraction of the catalysts- extraction	wern umpo Wilk Itrati orati ipme indus n-Pr 45,	oxid blung insor on: 1 on. C	ation) - cro) - cro 's cat heory techr halogo tion of	—p- wn ethers- alysts. 9+3 y of Illization: 9+3 nical enation Vitamins: 5, Total: 60
(NBS)- lead toluenesulph Trimethyl sily Unit – IV Extraction: filtration- pre Distillation: Crystallizatio Unit – V Nitration: N nitration-mix Halogenatio process. Fermentatio B2 and B12. TEXT BOOK 1. P.S. V.	tetraacetate - dicyclohexylcarbodiimide (DCC) — pyridinionyl chloride — trifluoroacetic acid- lithium diisopropylamide li iodide - dichlorodicyanobenzoquinone (DDQ) — Gilman re Unit Operations Liquid equilibria-extraction with reflux-extraction with agitates used and vacuum filtration-centrifugal filtration. Azeotropic and steam distillation. Evaporation: Types of en from aqueous-non- aqueous solutions factors affecting confrom agents-aromatic nitration-kinetics and mechanism of ed acid for nitration. In: Kinetics of halogenations-types of halogenations-cataly on: Aerobic and anaerobic fermentation. Production of Antibute.	um chlorochromate (LDA) – 1,3- dithia eagent – phase transion-counter current evaporators-factors a cystallization-nuclea of aromatic nitration-tic halogenations-Capiotics: Penicillin and on, New Age Internation-	e (PCC) — Sine (reactive of the catalysts- extraction. File affecting evaption. process equeses study on the catalysts- extraction of the catalysts- extraction	wern umpo Wilk Itrati orati ipme indus n-Pr 45,	oxid blung insor on: 1 on. C	ation) - cro) - cro 's cat heory techr halogo tion of	—p- wn ethers- alysts. 9+3 y of Illization: 9+3 nical enation Vitamins: 5, Total: 66
(NBS)- lead coluenesulph Trimethyl silly Unit – IV Extraction: filtration- pre Distillation: Crystallizatio Unit – V Nitration: N nitration-mix Halogenation Process. Fermentation B2 and B12. TEXT BOOK 1. P.S. V. Arui	tetraacetate - dicyclohexylcarbodiimide (DCC) — pyridinionyl chloride — trifluoroacetic acid- lithium diisopropylamide liodide - dichlorodicyanobenzoquinone (DDQ) — Gilman re Unit Operations Liquid equilibria-extraction with reflux-extraction with agitat ssure and vacuum filtration-centrifugal filtration. Azeotropic and steam distillation. Evaporation: Types of en from aqueous-non- aqueous solutions factors affecting conforming agents-aromatic nitration-kinetics and mechanism of ead acid for nitration. In: Kinetics of halogenations-types of halogenations-cataly on: Aerobic and anaerobic fermentation. Production of Antibus and East. Kalsi," Organic Reactions and their Mechanisms", 5th Edition Bahl, B.S.Bahl, "Advanced Organic Chemistry", 6th Edition ES:	um chlorochromate (LDA) – 1,3- dithia eagent – phase transion-counter current evaporators-factors a rystallization-nuclear of aromatic nitration-tic halogenations-Capiotics: Penicillin and on, New Age Internation, S Chand, 2022, for	e (PCC) — Sine (reactive of the catalysts- extraction. File affecting evaption. process equences study on the catalysts- extraction before the catalysts- extraction. File affecting evaption. process equences study on the catalysts of the cata	wern umpo Wilk Itrati orati ipme indus n-Pr 45,	oxid blung insor on: 1 on. C	ation) - cro) - cro 's cat heory techr halogo tion of	—p- wn ethers- alysts. 9+3 y of Illization: 9+3 nical enation Vitamins: 5, Total: 66
(NBS)- lead coluenesulph Trimethyl silly Unit – IV Extraction: filtration- pre Distillation: Crystallizatio Unit – V Nitration: Natiration-mix Halogenatio process. Fermentation B2 and B12. TEXT BOOK 1. P.S. V. C. Arui	tetraacetate - dicyclohexylcarbodiimide (DCC) — pyridinionyl chloride — trifluoroacetic acid- lithium diisopropylamide liodide - dichlorodicyanobenzoquinone (DDQ) — Gilman re Unit Operations Liquid equilibria-extraction with reflux-extraction with agitat ssure and vacuum filtration-centrifugal filtration. Azeotropic and steam distillation. Evaporation: Types of en from aqueous-non- aqueous solutions factors affecting conformation agents-aromatic nitration-kinetics and mechanism of ead acid for nitration. In: Kinetics of halogenations-types of halogenations-catalyon: Aerobic and anaerobic fermentation. Production of Antibus and East and Machanisms, 5th Edition Bahl, B.S.Bahl, "Advanced Organic Chemistry", 6th Edition ES: Ahluwalia, Rakesh Parashar, "Organic Reaction Mechanisms."	um chlorochromate (LDA) – 1,3- dithia eagent – phase transion-counter current evaporators-factors a rystallization-nuclea of aromatic nitration-tic halogenations-Capiotics: Penicillin and on, New Age Internation, S Chand, 2022, forms" Fourth Edition, 2	e (PCC) — Sune (reactive uniter catalysts- extraction. File affecting evaption. process equipase study on d Streptomyci Lecture: etional publish or Unit-IV, V.	wern umpo Wilk ltrati orati ipme indus n-Pr 45, ers,	oxid blung insor on: 1 on. C nt for oduc Tuto	ation) - cro 's cat Theory Trysta Ttechr thalogo tion of rial: 1	—p- wn ethers- alysts. 9+3 r of Illization: 9+3 nical enation Vitamins: 5, Total: 66 Init-I, II, III,
(NBS)- lead toluenesulph Trimethyl sily Unit – IV Extraction: filtration- pre Distillation: Crystallizatio Unit – V Nitration-mix Halogenatio process. Fermentation B12. TEXT BOOK 1. P.S. V. 2. Arun REFERENC 1. V.K. 2. Jonn	tetraacetate - dicyclohexylcarbodiimide (DCC) — pyridinionyl chloride — trifluoroacetic acid- lithium diisopropylamide liodide - dichlorodicyanobenzoquinone (DDQ) — Gilman re Unit Operations Liquid equilibria-extraction with reflux-extraction with agitat ssure and vacuum filtration-centrifugal filtration. Azeotropic and steam distillation. Evaporation: Types of en from aqueous-non- aqueous solutions factors affecting conforming agents-aromatic nitration-kinetics and mechanism of ead acid for nitration. In: Kinetics of halogenations-types of halogenations-cataly on: Aerobic and anaerobic fermentation. Production of Antibus and East. Kalsi," Organic Reactions and their Mechanisms", 5th Edition Bahl, B.S.Bahl, "Advanced Organic Chemistry", 6th Edition ES:	um chlorochromate (LDA) – 1,3- dithia eagent – phase trans ion-counter current evaporators-factors a rystallization-nuclea of aromatic nitration-tic halogenations-Capiotics: Penicillin and on, New Age Internation, S Chand, 2022, forms" Fourth Edition, 2 emistry", 2nd Edition, 2	e (PCC) — Sune (reactive uniter catalysts- extraction. File affecting evaption. process equipase study on d Streptomyci Lecture: etional publish or Unit-IV, V.	wern umpo Wilk ltrati orati ipme indus n-Pr 45, ers,	oxid blung insor on: 1 on. C nt for oduc Tuto	ation) - cro 's cat Theory Trysta Ttechr thalogo tion of rial: 1	—p- wn ethers- alysts. 9+3 r of Illization: 9+3 nical enation Vitamins: 5, Total: 6

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	illustrate the basic concept of organic intermediates to explain the SN1, SN2, E1 and E2 reactions.	Understanding (K2)
CO2	utilize the concepts of molecular rearrangement to explain reactions involving electron deficient, carbon, nitrogen, oxygen centers, emphasis on synthetic utility of the rearrangements.	Applying (K3)
CO3	select the suitable synthetic regents for various functional group conversions in organic synthesis.	Applying (K3)
CO4	make use of the concept of extraction, filtration, distillation, evaporation, crystallization for the purification of organic compounds.	Applying (K3)
CO5	apply the concept of nitration, halogenations and fermentation to explain the industrial unit process.	Applying (K3)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1												
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

 * ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

	22CYO04 - CORROSION SCIEN	NCE AND ENGINEER	ING				
Programme & Branch	All BE / BTech Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	6	OE	3	1	0	4
Preamble	Corrosion science and engineering aims to equipand prevention methods in order to meet the inc		a wide-range	of k	nowle	edge o	on corrosion
Unit – I	Corrosion and its Units						9+3
and mpy (mils per rates - weight loss Unit - II Electrode potential	roblems) – units of corrosion rate: mdd (milligrams year) — importance of corrosion prevention in various method, weight gain method and chemical analysis. Thermodynamics of Corrosion s, Electrical double layer, Gouy-Chapman model, Stell - criterion of corrosion (Problems) - basis of Po	s industries: direct and s of solution. ern model, Bockris – De	d indirect effect	iller r	dete	rminir I - free	9+3 e energy and
aluminium and Iro	n - limitations.	dibaix biagiailis - Fi	ourbaix diagra	ams	OI W	alei, i	
Unit – III	Kinetics of Corrosion						9+3
and Traud) - app	olarization – Evan's diagram – activation polarizatio lication of mixed potential theory – effect of metal i reaction – effect of cathodic area – passivity – Flac sequence theory.	in acid solution - cath	odic protection	n of	iron	in aci	d solution -
Unit – IV	Types of Corrosion						9+3
theory, weld deca	Crevice - differential aeration corrosion (ii) pitting — y and knife line attack (iv) stress - SCC mechanis - causes and its control.						
Unit - V	Prevention of Corrosion						9+3
inhibitors – preve disease – Langeli	of inhibitors, chemisorption of inhibitors, effect on tion of corrosion at the design stage and in service er saturation index and its uses - corrosion prevent cathodic protection: sacrificial anodes and external of	ce conditions – contro tion by surface coating	l of catastrop gs – phospha	hic o	xidat and it	ion ar s use	nd hydroger s -principle:
			Lecture:	45,	Tuto	rial: 1	5, Total: 60
TEXT BOOK:							
1. E. McCaf	ferty, Introduction to Corrosion Science, 2 nd Edition,	Springer, 2017.					
REFERENCES:							
 Wiley pub 	n, Corrosion and Corrosion Control: An Introduction olisher, 2008.						
2. Fontanna	, "Corrosion Engineering", (Materials Science and N	Metallurgy series), McG	Graw Hill inter	natio	nal E	d., 20	005.

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	illustrate the mechanism, expression of rate of corrosion and importance of corrosion studies to familiarize for industrial needs.	Understanding (K2)
CO2	demonstrate the thermodynamics and kinetics of different models of corrosion with respect to the environment.	Applying (K3)
CO3	utilize the theories of corrosion to interpret with the real time applications.	Applying (K3)
CO4	organize the various types of corrosion to understand the corrosion problems.	Applying (K3)
CO5	summarize the corrosion prevention methods to avoid corrosion related issues.	Understanding (K2)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1												
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	1												

^{1 –} Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

Programme & Branch	All BE / BTech Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	6	OE	3	1	0	4
			l .		ı		
Preamble	This course aims to provide knowledge on che	emistry of cosmetics for	engineering s	tude	nts.		
Unit 1	Formulation of Cosmetic Product						9+3
and foam (foam f	ic sciences of cleansing – surfactant and adsorp formation, stability, drainage, rupture and collaps urfaces and barriers – basics of emulsion (stability	se and defoaming) - ba	asics of dispe	ersion	ns -	electri	cal charge
Unit 2	Structuring Materials and Regulation for Co	osmetics					9+3
functions and effe and personal care india - future chall	er/hydrophilic base materials, oleaginous/hydroph cts - materials that add or improve functional valu product safety – potential contaminants in cosme enges in cosmetics material development.	ue, emotional value and	materials for o	quali	ty co	ntrol –	cosmetic gulation in
Unit 3	Polymers in Cosmetic Products						9+3
	etics and personal care products - hair-condition	ning polymers - polymer	s for the treat	men	t of s	kin - r	oolvmers a
polymers in cosm controlled release Unit 4 Introduction – nat	etics and personal care products - hair-condition matrices - dendritic polymers - polymeric antimic Natural Products and Fragrance in Cosmet ural products - extraction methods - encapsulation chemicals - fragrance creation and duplication	crobials and bacteriostate tics ion and controlled relea	se - allergens	s in (cosm	etics -	9+3 - testing for
polymers in cosm controlled release Unit 4 Introduction – nat allergens - aroma	matrices - dendritic polymers - polymeric antimic Natural Products and Fragrance in Cosmet	crobials and bacteriostate tics ion and controlled relea	se - allergens	s in (cosm	etics -	9+3 - testing fo
polymers in cosm controlled release Unit 4 Introduction – nat allergens - aroma sensitivities. Unit 5	Natural Products and Fragrance in Cosmet ural products – extraction methods - encapsulati chemicals - fragrance creation and duplication Preparation of Cosmetics	crobials and bacteriostate crobials and bacteriostate crobials and controlled relea n - fragrance application	se - allergens ss malodor	s in (cosm	etics - nce a	9+3 - testing for the following for the string for
controlled release Unit 4 Introduction – nat allergens - aroma sensitivities. Unit 5 Cosmetics in day	Natural Products and Fragrance in Cosmet ural products – extraction methods - encapsulating chemicals - fragrance creation and duplication	crobials and bacteriostate crobials and bacteriostate crobials and controlled relea n - fragrance application	se - allergens is malodor n methods of I	s in (cosm ragra	etics - nce a	9+3 - testing for the following for the string for
polymers in cosm controlled release Unit 4 Introduction – nat allergens - aroma sensitivities. Unit 5 Cosmetics in day	Natural Products and Fragrance in Cosmet ural products – extraction methods - encapsulation chemicals - fragrance creation and duplication Preparation of Cosmetics to day life – characteristics, types, formulation, pre	crobials and bacteriostate crobials and bacteriostate crobials and controlled relea n - fragrance application	se - allergens is malodor n methods of I	s in (cosm ragra	etics - nce a	9+3 - testing fillergies ar 9+3 o, powder
polymers in cosm controlled release Unit 4 Introduction – nat allergens - aroma sensitivities. Unit 5 Cosmetics in day nail lacquer, crear	Natural Products and Fragrance in Cosmet ural products – extraction methods - encapsulation chemicals - fragrance creation and duplication Preparation of Cosmetics to day life – characteristics, types, formulation, pre	crobials and bacteriostate tics ion and controlled relea n - fragrance application eparation and evaluation ach, Yuji Yamashita, Cos	se - allergens s malodor n methods of I	s in o	cosm ragra ck, sh	etics - nce a nampo	9+3 - testing fillergies ar 9+3 - to, powder 5, Total: 6
polymers in cosm controlled release Unit 4 Introduction – nat allergens - aroma sensitivities. Unit 5 Cosmetics in day nail lacquer, crear TEXT BOOK: 1. Kazutami Theoretic	matrices - dendritic polymers - polymeric antimic Natural Products and Fragrance in Cosmet ural products - extraction methods - encapsulation chemicals - fragrance creation and duplication Preparation of Cosmetics to day life - characteristics, types, formulation, press, toothpaste and hair dye. Sakamoto, Robert Y. Lochhead, Howard I. Maiba	crobials and bacteriostate tics ion and controlled relea n - fragrance application eparation and evaluation ach, Yuji Yamashita, Cor r Units- I, II, III, IV, V.	se - allergens ss malodor n methods of I Lecture:	ipstic	cosm ragra ck, sh	etics - nce a nampo	9+3 - testing f llergies ar 9+3 - to, powder 5, Total: 6
polymers in cosm controlled release Unit 4 Introduction – nat allergens - aroma sensitivities. Unit 5 Cosmetics in day nail lacquer, crear TEXT BOOK: 1. Kazutami Theoretic	Matural Products and Fragrance in Cosmet ural products – extraction methods - encapsulation chemicals - fragrance creation and duplication Preparation of Cosmetics to day life – characteristics, types, formulation, prens, toothpaste and hair dye. Sakamoto, Robert Y. Lochhead, Howard I. Maiba al Principles and Applications, Elsevier, 2017, for	crobials and bacteriostate tics ion and controlled relea n - fragrance application eparation and evaluation ach, Yuji Yamashita, Cor r Units- I, II, III, IV, V.	se - allergens ss malodor n methods of I Lecture:	ipstic	cosm ragra ck, sh	etics - nce a nampo	9+3 - testing f llergies ar 9+3 - to, powder 5, Total: 6
polymers in cosm controlled release Unit 4 Introduction – nat allergens - aroma sensitivities. Unit 5 Cosmetics in day nail lacquer, crear TEXT BOOK: 1. Kazutami Theoretic 2. Gaurav K REFERENCES:	Matural Products and Fragrance in Cosmet ural products – extraction methods - encapsulation chemicals - fragrance creation and duplication Preparation of Cosmetics to day life – characteristics, types, formulation, prens, toothpaste and hair dye. Sakamoto, Robert Y. Lochhead, Howard I. Maiba al Principles and Applications, Elsevier, 2017, for	erobials and bacteriostate tics ion and controlled releant - fragrance application eparation and evaluation ach, Yuji Yamashita, Controlled releant - fragrance application ach, Yuji Yamashita, Controlled releant - fragrance application	se - allergens s malodor n methods of I Lecture: smetic Science	s in (– fil	cosm ragra ck, sh Tuto	etics - nce a nampo	9+3 - testing f llergies ar 9+3 - to, powder 5, Total: 6

		UTCON		se, the s	tudents	s will be	able to)						BT Map (Highest			
CO1	outli	ne the	formulati	ion of cos	metics	products	3.						U	Inderstand	ling (K2)		
CO2	iden	tify the	structuri	ng materi	als and	regulati	on invol	ved in c	cosmeti	cs deve	lopment.			Applying (K3)			
CO3	interpret the polymers and its role in cosmetics.												U	Understanding (K2)			
CO4	develop knowledge about natural products and Fragrance in Cosmetics.													Applying	(K3)		
CO5				ge of cosi ferent cos							tion, pre	paration ar	nd	Applying	(K3)		
						Mappi	ng of C	Os with	h POs	and PS	Os						
COs/F	Pos	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2		
CO	1	3	1														
CO	2	3	2	1													
CO	3	3	1														
CO	4	3	2	1													
CO	5	3	2	1													
1 – Sli	ght, 2	– Mode	erate, 3 -	- Substan	tial, BT	- Bloom'	s Taxon	omy			•						
						ASSE	SSMEN	T PATI	TERN -	THEOF	RY						
	t / Blo Catego		Rei	memberi (K1) %	ng U	Indersta (K2)	_	Apply (K3)	_	Analyz (K4)		Evaluating (K5) %		reating (K6) %	Total %		
	CAT1 25 35 40 100																

CAT2

CAT3

ESE

 * ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

		22CYO06 - NANOCOMPOSI	TE MATERIALS					
Progra Branch	nmme&	All BE / BTech Branches	Sem.	Category	L	Т	Р	Credit
Prereq	Juisites	Nil	6	OE	3	1	0	4
Preamb	ble	This course aims to equip the students to have know and applications of nanocomposites.	wledge on process	ng, characteri	zatio	n, pr	operti	es, features
Unit -	I	Introduction of nanocomposites						9+3
	and molecu	ocomposites – nanocomposites past and present – no lar solids – role of statistics in materials – primary, se						to solids -
Propert	ties: physics	s of modulus – continuum measurements – yield – fr es – surface mechanical properties –diffusion and pe nano reinforcements – matrix materials – hazards of p	rmeability - featur					composites
Unit - I	•	Processing of nanocomposites	Darticles.					9+3
in situ process	polymerizat ocesses wit ses.	flow, experimental viscosity, non-newtonian flow -low on, post-forming, hazards of solvent processing - me h small shears or low-shear rates flow, meltprocesses	lt, high shear and	direct process	sing:	melti	ng an	d softening,
Unit - I	IV	Characterization of nanocomposites						9+3
	omposites -	aracterization – experiment design – sample prepa - texture – electromagnetic energy –visualization –						
Unit - \	V	Applications of nanocomposites						9+3
protein	nanocomp	 optical, structural applications – nanoparticulate sysosites – applications-polypropylene nanocomposites aterials – application for corrosion protection. 						
				Lecture:	45,	Tuto	rial: 1	5, Total: 60
TEXT E	BOOK:							
TEXT E	Thomas E	. Twardowski, "Introduction to Nanocomposite Materns, April 2007, for Units-I, II, III, IV.	ials – Properties, I	Processing, C	hara	cteriz	ation'	', DesTech
	Thomas E	ns, April 2007, for Units-I, II, III, IV. drich, Stoyko Fakivov, Zhony Shang, "Polymer Comp	•					
1.	Thomas E Publication Klaus Frie	ns, April 2007, for Units-I, II, III, IV. drich, Stoyko Fakivov, Zhony Shang, "Polymer Comp	•					
1.	Thomas E Publication Klaus Frie for Units-I	ns, April 2007, for Units-I, II, III, IV. drich, Stoyko Fakivov, Zhony Shang, "Polymer Comp	osites from Nano -	- to Macro – s	cale'			

	SE OUTCOMES: npletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	identify the knowledge of nanocomposites and to explain its structure.	Applying (K3)
CO2	apply the knowledge on various properties and features of nanocomposites.	Applying (K3)
CO3	choose the various concepts involving in the processing of nanocomposites.	Applying (K3)
CO4	apply the acquired knowledge on characterization of nanocomposites.	Applying (K3)
CO5	organize the applications of nanocomposites in various fields.	Applying (K3)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

 * ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

	22CYO07 - WASTE AND HAZARDOUS W						
Programme & Branch	All BE / BTech Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	7	OE	3	0	0	3
Preamble	Waste and Hazardous waste management aims to eq waste management.	quip the student	s to have a wi	ide-r	ange	of kn	owledge or
Unit – I	Solid Waste Management						
processing and to types, methods a	efinition, sources, types, composition of solid waste- So ransformation of solid waste – combustion, aerobic compo and control of leachate in landfills - recycling of material ting of plastics, recycling of glass.	sting, vermicon	posting, pyro	lysis	, land	dfill-cla	assification
Unit – II	Hazardous Waste Management						
extraction and lea waste: aerobic, a Unit – III E-Waste Manage	ment: acid base neutralization, chemical precipitation, aching, ion exchange, photolytic reaction- thermal treatment naerobic, reductive dehalogenations - land treatment and the work of the wore of the work of the work of the work of the work of the work of	ent methods: incomposting. gation, treatmen	ineration – bi	odeg	grada	tion o	f hazardous
Biomedical was	te Management: Introduction-definition -components of b	biomedical was	e-waste gene	eratic	n –w	aste i	dentificatio
and waste contro	ol-waste storage-labeling and color coding-handling and t	transportation-w					
and waste contro hydroclave, micr		transportation-w					- autoclave
and waste control hydroclave, micr Unit – IV Introduction- sou	ol-waste storage-labeling and color coding-handling and to owave treatments- chemical disinfection – sanitary and sec	transportation-w cure landfill.	aste treatmer	nt an	d dis	posal	- autoclave
and waste control hydroclave, micr Unit – IV Introduction- sou	ol-waste storage-labeling and color coding-handling and to owave treatments- chemical disinfection – sanitary and see Pollution From Major Industries And Management rices and characteristics - waste treatment flow sheets for	transportation-w cure landfill.	aste treatmer	nt an	d dis	posal	- autoclave
and waste control hydroclave, micr Unit – IV Introduction- sou pharmaceuticals, Unit – V Solid waste mana plastic waste mana	ol-waste storage-labeling and color coding-handling and to owave treatments- chemical disinfection – sanitary and see Pollution From Major Industries And Management rces and characteristics - waste treatment flow sheets for sugar, petroleum refinery, fertilizer and dairy industries.	transportation-w cure landfill. selected indust es - biomedical	ries such as t	extile	es, ta	posal Inneria	- autoclave
and waste control hydroclave, micr Unit – IV Introduction- sou pharmaceuticals, Unit – V Solid waste mana plastic waste mana	ol-waste storage-labeling and color coding-handling and to owave treatments- chemical disinfection – sanitary and secondary Pollution From Major Industries And Management roses and characteristics - waste treatment flow sheets for sugar, petroleum refinery, fertilizer and dairy industries. Solid Waste Management and Legislation agement plan - solid waste (management and handling) rule anagement rules - e-waste management rules - hazardor	transportation-w cure landfill. selected indust es - biomedical	ries such as t	extile	es, ta	posal Inneria	- autoclave
and waste control hydroclave, micr Unit – IV Introduction- sou pharmaceuticals, Unit – V Solid waste mana plastic waste ma movement) rules	ol-waste storage-labeling and color coding-handling and to owave treatments- chemical disinfection – sanitary and secondary Pollution From Major Industries And Management roses and characteristics - waste treatment flow sheets for sugar, petroleum refinery, fertilizer and dairy industries. Solid Waste Management and Legislation agement plan - solid waste (management and handling) rule anagement rules - e-waste management rules - hazardor	transportation-w cure landfill. selected indust es - biomedical	ries such as t	extile	es, ta	posal Inneria	- autoclave
and waste control hydroclave, microl hydroclave, microl waste management and waste management and waste management and waste management and waste management and waste management and waste management and waste management and waste management and waste management and waste management and waste management and waste management and waste management and waste control hydroclave, and waste management and waste m	ol-waste storage-labeling and color coding-handling and to owave treatments- chemical disinfection – sanitary and see Pollution From Major Industries And Management roses and characteristics - waste treatment flow sheets for sugar, petroleum refinery, fertilizer and dairy industries. Solid Waste Management and Legislation agement plan - solid waste (management and handling) rule inagement rules - e-waste management rules - hazardou - construction and demolition waste management rules. Tohobanoglous, Hillary Theisen, Samuel a Vigil, Integrated ment issues) McGraw hill Education (India) Pvt. Ltd., 2015,	transportation-woure landfill. selected indust es - biomedical us and other wo	ries such as t waste (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managaste) (managast	extilingeme	ees, ta	nneriand hand tra	es, dling) rules nsboundar Total: 4
and waste control hydroclave , micr Unit – IV Introduction- sou pharmaceuticals, Unit – V Solid waste mana plastic waste man movement) rules TEXT BOOK: 1. George manager SC Bhati	ol-waste storage-labeling and color coding-handling and to owave treatments- chemical disinfection – sanitary and see Pollution From Major Industries And Management roses and characteristics - waste treatment flow sheets for sugar, petroleum refinery, fertilizer and dairy industries. Solid Waste Management and Legislation agement plan - solid waste (management and handling) rule anagement rules - e-waste management rules - hazardou - construction and demolition waste management rules. Tochobanoglous, Hillary Theisen, Samuel a Vigil, Integrated ment issues) McGraw hill Education (India) Pvt. Ltd., 2015, ia, Handbook of Industrial pollution and control (Volume-1),	transportation-woure landfill. selected indust es - biomedical us and other wo	ries such as t waste (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managaste) (managast	extilingeme	ees, ta	nneriand hand tra	es, dling) rules nsboundar Total: 4
and waste control hydroclave, micr Unit – IV Introduction- sou pharmaceuticals, Unit – V Solid waste manaplastic waste manaplastic waste manaplastic waste manaplastic waste manaplastic waste manaplastic waste manaplastic waste manaplastic waste manaplastic waste manaplastic waste manaplastic waste manaplastic waste manaplastic waste manaplastic waste manaplastic waste manaplastic waste wast	ol-waste storage-labeling and color coding-handling and to owave treatments- chemical disinfection – sanitary and see Pollution From Major Industries And Management roses and characteristics - waste treatment flow sheets for sugar, petroleum refinery, fertilizer and dairy industries. Solid Waste Management and Legislation agement plan - solid waste (management and handling) rule anagement rules - e-waste management rules - hazardou - construction and demolition waste management rules. Tochobanoglous, Hillary Theisen, Samuel a Vigil, Integrated ment issues) McGraw hill Education (India) Pvt. Ltd., 2015, ia, Handbook of Industrial pollution and control (Volume-1),	transportation-woure landfill. selected indust es - biomedical us and other wo	ries such as t waste (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managaste) (managast	extilingeme	ees, ta	nneriand hand tra	es, dling) rules nsboundar Total: 4
and waste control hydroclave , micr Unit – IV Introduction- sou pharmaceuticals, Unit – V Solid waste mana plastic waste ma movement) rules TEXT BOOK: 1. George manager 2. SC Bhati Unit-II, II REFERENCES: Manual of	ol-waste storage-labeling and color coding-handling and to owave treatments- chemical disinfection – sanitary and see Pollution From Major Industries And Management roses and characteristics - waste treatment flow sheets for sugar, petroleum refinery, fertilizer and dairy industries. Solid Waste Management and Legislation agement plan - solid waste (management and handling) rule anagement rules - e-waste management rules - hazardou - construction and demolition waste management rules. Tochobanoglous, Hillary Theisen, Samuel a Vigil, Integrated ment issues) McGraw hill Education (India) Pvt. Ltd., 2015, ia, Handbook of Industrial pollution and control (Volume-1),	ransportation-woure landfill. selected indust es - biomedical us and other would land the selected indust selected indust es - biomedical us and other would land the selected indust selected indust es - biomedical us and other would land the selected indust es - biomedical us and other would land the selected indust es - biomedical us and other would land the selected indust es - biomedical us and other would land the selected indust es - biomedical us and other would land the selected indust es - biomedical us and other would land the selected indust es - biomedical us and other would land the selected indust es - biomedical us and other would land the selected indust es - biomedical us and other would land the selected indust es - biomedical us and other would land the selected indust es - biomedical us and other would land the selected indust es - biomedical us and other would land the selected indust es - biomedical us and other would land the selected industry land the sel	ries such as t waste (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managaste)))))	geme	es, ta	nnerie	es, dling) rules nsboundar Total: 4 siple and
and waste control hydroclave, micr Unit – IV Introduction- sou pharmaceuticals, Unit – V Solid waste manaplastic waste manamovement) rules TEXT BOOK: 1. George manager 2. SC Bhati Unit-II, II REFERENCES: 1. Manual of (CPHEE)	ol-waste storage-labeling and color coding-handling and to owave treatments- chemical disinfection – sanitary and see Pollution From Major Industries And Management roes and characteristics - waste treatment flow sheets for sugar, petroleum refinery, fertilizer and dairy industries. Solid Waste Management and Legislation agement plan - solid waste (management and handling) rules anagement rules - e-waste management rules - hazardou - construction and demolition waste management rules. Tochobanoglous, Hillary Theisen, Samuel a Vigil, Integrated ment issues) McGraw hill Education (India) Pvt. Ltd., 2015, a, Handbook of Industrial pollution and control (Volume-1), I, IV, V.	ransportation-woure landfill. selected indust es - biomedical us and other would waste ma for Unit-I, II, V. CBS Publisher	ries such as t waste (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managastes (managaste) (managast	gemeering	ees, ta	nnerical distribution of the prince of the p	- autoclave es, dling) rules nsboundar Total: 4 iple and 2002, for

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	apply the technical points that are required to set up a solid waste management system.	Applying (K3)
CO2	explain the various disposal and treatment methods of hazardous wastes.	Understanding (K2)
CO3	organize the appropriate method for managing e-waste and biomedical waste.	Applying (K3)
CO4	identify the hazards from various industries and apply the waste management techniques for its treatment.	Applying (K3)
CO5	relate the legal legislation to solid waste management.	Understanding (K2)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1			3							
CO2	2	1					3							
CO3	3	2	1	1			3							
CO4	3	2	1	1			3							
CO5	2	1					3							

^{1 -} Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

 $^{^{\}star}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

	22CYO08 - CHEMISTRY IN	EVERY DAY LIFE					
Programme& Branch	All BE / BTech Branches	Sem.	Category	L	т	Р	Credit
Prerequisites	Nil	7	OE	3	0	0	3
Preamble	This course aims to prepare the students to have th milk powder, soil, fertilizer, pesticides, insecticides our everyday activities.						
Unit – I	Oils, Fats and Sugar						9
	veen oils and fats – properties – classification – edible o on – refining of crude vegetable oils – processing of an eet root.						
Unit – II	Adulterants in food						9
	on and prevention – common food adulterants – food a alysis of adulterants in edible oils, coffee powder, chilli p adulterants						
Unit – III	Creams and Milk powder						9
of fat in cream - involved in each	osition-chemistry of creaming process- Factors influenc - Milk powder: Need for making powder-drying process- h.						
Unit – IV	Soil and Fertilizers						9
Fertilizers: prima	Composition of soil - Organic and Inorganic constituen ary nutrients –role of Nitrogen, potassium and phosphore sition - Secondary nutrients – micronutrients and their	ous on plant growth -	-Complex fer	tilizeı	s and	d mixe	d fertilizers
Unit – V	Pesticides, Insecticides, Fungicides and Herbi	cides					9
Inorganic pestic	lassification – general methods of application and tox cides – borates - Organic pesticides – D.D.T. and BHC- rin and Aldrin (Chemical name - Structure- functions and	-Plant derivatives: p	yrethrin and N	Vicot	ine -	Synth	etic organi
(dithiocarbamat	te) fungicides - Industrial fungicides: Creosote fraction exyacetic acid and 2,4,5-tricholorophenoxyaceticacid (str	s - Herbicides: Sele	ctive and no				
(dithiocarbamat	te) fungicides - Industrial fungicides: Creosote fraction	s - Herbicides: Sele	ctive and no				
(dithiocarbamat	te) fungicides - Industrial fungicides: Creosote fraction	s - Herbicides: Sele	ctive and no				4-
(dithiocarbamat dicholoropheno	te) fungicides - Industrial fungicides: Creosote fraction	s - Herbicides: Sele ructure and function)	ctive and no				4-
(dithiocarbamat dicholoropheno.) TEXT BOOK: 1. Sharma	te) fungicides - Industrial fungicides: Creosote fraction exyacetic acid and 2,4,5-tricholorophenoxyaceticacid (str	s - Herbicides: Sele ructure and function)	ctive and not				4-
TEXT BOOK: 1. Sharma	te) fungicides - Industrial fungicides: Creosote fractions exyacetic acid and 2,4,5-tricholorophenoxyaceticacid (structure) a B K , Industrial Chemistry, Goel publishing house, New Ramani, Food Chemistry, MJP Publishers, Chennai, 20	s - Herbicides: Sele ructure and function)	ctive and not				4-
TEXT BOOK: 1. Sharma 2. Alex V REFERENCES	te) fungicides - Industrial fungicides: Creosote fractions exyacetic acid and 2,4,5-tricholorophenoxyaceticacid (structure) a B K , Industrial Chemistry, Goel publishing house, New Ramani, Food Chemistry, MJP Publishers, Chennai, 20	s - Herbicides: Sele ructure and function) w Delhi, 2011, for Ur 109, for Units -II, III, \	ctive and not				4-
TEXT BOOK: 1. Sharma 2. Alex V REFERENCES 1. Dillip Ku	te) fungicides - Industrial fungicides: Creosote fractions exyacetic acid and 2,4,5-tricholorophenoxyaceticacid (strong a B K , Industrial Chemistry, Goel publishing house, New Ramani, Food Chemistry, MJP Publishers, Chennai, 20	s - Herbicides: Selectucture and function) w Delhi, 2011, for Ur 109, for Units -II, III, \ i Publishers, Reprint	ctive and not				4-
TEXT BOOK: 1. Sharma 2. Alex V REFERENCES 1. Dilip Ku 2. K. Baga	te) fungicides - Industrial fungicides: Creosote fractions by acetic acid and 2,4,5-tricholorophenoxyaceticacid (strong a B K , Industrial Chemistry, Goel publishing house, New Ramani, Food Chemistry, MJP Publishers, Chennai, 20 :: umar Das, Introductory Soil Science, 1st Edition, Kalyan	s - Herbicides: Selectucture and function) w Delhi, 2011, for Ur 009, for Units -II, III, \ i Publishers, Reprint Chennai, 2006.	ctive and not				4-

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	outline the importance of oils, fats and sugar.	Understanding (K2)
CO2	identify the harmful effects of adulterants in food.	Applying (K3)
CO3	develop the knowledge on creams and milk powder.	Applying (K3)
CO4	interpret the nature and composition of soil and fertilizers.	Understanding (K2)
CO5	illustrate the difference of pesticides, insecticides, fungicides and herbicides.	Understanding (K2)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1												
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	1												
CO5	3	1												

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

 * ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

Programme & Branch	All BE / BTech Branches	Sem.	Category	L	Т	Р	Cre
Prerequisites	Nil	8	OE	3	0	0	3
Preamble	This course aims to provide knowledge for eng	lineering students on co	mponents of	healt	h, fitr	ness a	and also
Unit 1	Nutrition						9
and/ or excess vitamins: A, D,E calcium, iron, zi Unit 2 Disease pattern	Women Health and reproductive health- menopause – hypothyroid	carbohydrates and dietriniacin, pyridoxine, folat	ary fibre – lip e, vitamin B1: cies and prog	ids - 2 and rams	- production productio	teins · min C	fat so – mine
	ild nutrition and health - concept of small family - me	ethods of family plannin	g - merits and	den	nerits	•	
Unit 3	Nutrition for Nursing Mother and Infants						9
	psychology of lactation, hormonal control, composi- advantages of breast feeding, food and nutritional unization.						
Unit 4	Nutrition for Physical Fitness						9
disorders, bone	physical fitness and nutrition in the prevention and maken health and cancer - nutrition and exercise regimes to fobesity - critical review of various dietary regime	for pre and postnatal fitr	ness - nutritio	nal a	nd ex	cercise	e regim
ioi managomon		· ·					
Unit 5 Women in famil	Role of Women in National Development y and community: Demographic changes menarche, owhood. Women in society: Women's role, their res	, marriage, fertility, morb					cy, sex
Unit 5 Women in family ratio, aging, wid status.	y and community: Demographic changes menarche,	, marriage, fertility, morb					cy, sex tional
Unit 5 Women in family ratio, aging, wid status. TEXT BOOK:	y and community: Demographic changes menarche, owhood. Women in society: Women's role, their res	, marriage, fertility, mork ources, and contribution	n to family, an	nd eff			cy, sex tional
Unit 5 Women in family ratio, aging, wid status. TEXT BOOK: 1. Srilaksh	y and community: Demographic changes menarche, owhood. Women in society: Women's role, their resonant, B., Nutrition Science, New Age International (P) //erma, Women's Health and Nutrition: Role of State	, marriage, fertility, mork ources, and contribution) Ltd., New Delhi, 2017,	for Units- I, IV	nd eff	ect o	f nutri	cy, sex tional
Unit 5 Women in family ratio, aging, wid status. TEXT BOOK: 1. Srilaksi 2. Arpita Vunits -	y and community: Demographic changes menarche, owhood. Women in society: Women's role, their resonant, B., Nutrition Science, New Age International (P) (Ferma, Women's Health and Nutrition: Role of State II, III, IV.	, marriage, fertility, mork ources, and contribution) Ltd., New Delhi, 2017,	for Units- I, IV	nd eff	ect o	f nutri	cy, sex tional
Unit 5 Women in family ratio, aging, wid status. TEXT BOOK: 1. Srilaksh 2. Arpita \ Units -	y and community: Demographic changes menarche, owhood. Women in society: Women's role, their resonant, B., Nutrition Science, New Age International (P) (Ferma, Women's Health and Nutrition: Role of State II, III, IV.	, marriage, fertility, mork ources, and contribution) Ltd., New Delhi, 2017, and Voluntary Organiza	for Units- I, IV	nd eff	ect o	f nutri	cy, sex tional
Unit 5 Women in family ratio, aging, wid status. TEXT BOOK: 1. Srilaksi Arpita \ Units - REFERENCES 1. Shubha	y and community: Demographic changes menarche, owhood. Women in society: Women's role, their resonant, B., Nutrition Science, New Age International (P) //erma, Women's Health and Nutrition: Role of State II, III, IV.	, marriage, fertility, mork ources, and contribution) Ltd., New Delhi, 2017, and Voluntary Organiza w Hill, 2010.	for Units- I, IV	nd eff	ect o	f nutri	cy, sex tional
Unit 5 Women in family ratio, aging, wid status. TEXT BOOK: 1. Srilaksh 2. Arpita \ Units - REFERENCES 1. Shubha 2. Rujuta 3. Swamir	y and community: Demographic changes menarche, owhood. Women in society: Women's role, their resonation. Momen in society: Women's role, their resonation. Women's Role of State II, III, IV.	, marriage, fertility, mork ources, and contribution) Ltd., New Delhi, 2017, and Voluntary Organiza w Hill, 2010.	for Units- I, I\	/, V. Publ	isher	f nutri	Tota
Unit 5 Women in family ratio, aging, wid status. TEXT BOOK: 1. Srilaksh 2. Arpita \ Units - REFERENCES 1. Shubha 2. Rujuta 3. Swamir Co. Ltd	y and community: Demographic changes menarche, owhood. Women in society: Women's role, their resonant, B., Nutrition Science, New Age International (P) (Verma, Women's Health and Nutrition: Role of State II, III, IV.	, marriage, fertility, mork ources, and contribution) Ltd., New Delhi, 2017, and Voluntary Organiza w Hill, 2010.	for Units- I, I\	/, V. Publ	ect o	s, 201	Tota Tota Tota Tota
Unit 5 Women in family ratio, aging, wid status. TEXT BOOK: 1. Srilaksi 2. Arpita V Units - REFERENCES 1. Shubha 2. Rujuta 2. Rujuta 3. Swamir Co. Ltd COURSE OUT On completion	y and community: Demographic changes menarche, owhood. Women in society: Women's role, their resonant, B., Nutrition Science, New Age International (P) Yerma, Women's Health and Nutrition: Role of State II, III, IV. Ingini A Joshi , Nutrition and Dietetics, TataMacGrav Diwekar, Women and The Weight Loss Tamasha, Women, M., Advanced Textbook on Food and Nutrition, Bangalore, 2012.	marriage, fertility, mork ources, and contribution ources, and contribution ources, and contribution ources, and voluntary Organization with Hill, 2010.	for Units- I, I\	/, V. Publ	isher	s, 201 and Po	Tota Tota Tota Tota
Unit 5 Women in family ratio, aging, wid status. TEXT BOOK: 1. Srilaksh 2. Arpita \ Units - REFERENCES 1. Shubha 2. Rujuta 3. Swamir Co. Ltd COURSE OUT COn completion CO1 make u	y and community: Demographic changes menarche, owhood. Women in society: Women's role, their resonant, B., Nutrition Science, New Age International (P) Verma, Women's Health and Nutrition: Role of State II, III, IV. Ingini A Joshi , Nutrition and Dietetics, TataMacGrav Diwekar, Women and The Weight Loss Tamasha, Women, M., Advanced Textbook on Food and Nutrition, Bangalore, 2012.	w Hill, 2010. Vestland Itd, 2010. on, Vol. 1, Second Edition	for Units- I, I\	/, V. Publ	isher	s, 201 and Pu and Pu art Ma ighes	Tota Tota Tota Tota Tota Tota Tota Tota Tota Tota
Unit 5 Women in family ratio, aging, wid status. TEXT BOOK: 1. Srilaksh 2. Arpita \ Units - REFERENCES 1. Shubha 2. Rujuta 3. Swamir Co. Ltd COURSE OUTO On completion CO1 make u CO2 explain	y and community: Demographic changes menarche, owhood. Women in society: Women's role, their resonance, New Age International (P) Yerma, Women's Health and Nutrition: Role of State II, III, IV. In the state of the course, the students will be able to see of the knowledge of dietary sources in day to day	marriage, fertility, mork ources, and contribution ources, and contribution ources, and contribution outces, and voluntary Organization with Hill, 2010. Westland Itd, 2010. On, Vol. 1, Second Edition of life. Valifie.	for Units- I, I\	/, V. Publ	isher	s, 201 and Po BT Maighes pplyir erstar	Tota Tota Tota Tota Tota Tota Tota Tota Tota Tota
Unit 5 Women in family ratio, aging, wid status. TEXT BOOK: 1. Srilaksh 2. Arpita \ Units - REFERENCES 1. Shubha 2. Rujuta 3. Swamir Co. Ltd COURSE OUTOOn completion CO1 make u CO2 explain CO3 develop	y and community: Demographic changes menarche, owhood. Women in society: Women's role, their resonant, B., Nutrition Science, New Age International (P) Yerma, Women's Health and Nutrition: Role of State II, III, IV. Ingini A Joshi , Nutrition and Dietetics, TataMacGrave Diwekar, Women and The Weight Loss Tamasha, Women, M., Advanced Textbook on Food and Nutrition, Bangalore, 2012. COMES: of the course, the students will be able to see of the knowledge of dietary sources in day to day the disease pattern and policies towards women he	marriage, fertility, mork ources, and contribution ources, and contribution ources, and contribution outces, and voluntary Organization with Hill, 2010. Westland Itd, 2010. On, Vol. 1, Second Edition of life. alth. Infants.	for Units- I, I\	/, V. Publ	isher (H A	s, 201 and Pu and Pu ar Ma ighes applyir erstar	Tota Tota Tota Tota Tota Tota Tota Tota Tota Tota Tota Tota Tota Tota Tota Tota Tota

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	1												
CO3	3	2	1											
CO4	3	2	1											
CO5	3	1												

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

 $^{^*}$ ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

				(Com	mon to A	All Engine	eering a	nd Tech	nology	Branches)				
Prograi Branch		All BE/	BTech E	·					37	Sem.	Category	L	Т	Р	Credit
Preregu		Nil								All	OE	4	0	0	4
-															
Preamb	ole	cultura the bas	l aspects	of Gern day voo	nany and cabulary.	d Germa . On kee	n speaki n learnir	ng coun	tries. O	ne can le	eness toward arn to introdu nderstand th	ice on	eself	and ab	le to gai
Jnit – I			Day (Gut			1									9
Simple	sentences, \	/erb conj	ugation a	and perso	onal pror	noun.		ets, Cou	untries a	and langu	ages spoke	n. Gra	mma	r – W	
Jnit – II			s & Colle						A rtialaa	Diurol M	arba baya	2 2 4 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	ha V	oo/No	9 augation
Hobbies	s, Protession	i, vveek, iv	nontns, S	eason a	na Gene	rate Proi	nie. Grar	nmar –	Articles,	Piurai, v	erbs – have a	and to	ре, ү	es/No	question
Jnit – I	II	n the C	ity (In d	er Stadt	:):										9
	of places/buil on articles an			asking fo	r directio	ons, Und	erstandi	ng meai	ns of tra	nsport. G	rammar – de	efinite	and i	ndefini	te article
Jnit – ľ			nd Appo												9
Jnderst	tanding time	and recip	procating	g, Appoir	ntments,	Asking	shopping excuse,	g. Gram Family.	mar – 7 Gramm	Accusativ nar – Prej	e case, Verb positions: <i>an</i>	os with n, um,	Acci	usative <i>bi</i> s, P	'ossessiv
rticles- Jnit – \	- mein, dein. I		erbs- <i>mi</i> zing (Ze												9
	-						pecific ir	nformati	on in tex	ts. Gramı	mar – Separ	able ve	erbs, l	Prepos	-
	tive case, Pa												,	•	
															Total:
1.							ieber, "N	etzwerk	Deutsc	h als Frer	ndsprache A	1–ursl	ouch,	Arbeit	sbuch u
1. REFER	Stefanie De	h 2 CDs",	Goyal P	ublisher	s, Delhi,	2015.					ndsprache A	1–ursł	ouch,	Arbeit	sbuch u
1. REFER	Stefanie De Glossar wit	h 2 CDs", mit.edu –	Goyal P Massacl	ublisher	s, Delhi,	2015. of Techn	ology O	pen Cou	ırseware	e		1–urst	ouch,	Arbeit	sbuch ui
1. REFER 1. 2.	Stefanie De Glossar wit ENCES: https://ocw. https://www	h 2 CDs", mit.edu – v.dw.com/	Goyal P Massacl	ublisher	s, Delhi,	2015. of Techn	ology O	pen Cou	ırseware	e		1–ursl			
1. 1. 2. COURS	Stefanie De Glossar wit ENCES: https://ocw. https://www.	h Ž CDs", mit.edu – /.dw.com/	Goyal P Massacl en/learn-	husetts I	s, Delhi, Institute	2015. of Techn	ology O	pen Cou	ırseware	e		1–ursl	E	3T Maŗ	pped
1. REFER 1. 2. COURS	Stefanie De Glossar wit ENCES: https://ocw. https://www	mit.edu – .dw.com/	Goyal P Massacl en/learn-	husetts I german	nstitute of a Deutso	2015. of Techn che Wello	ology O _l	pen Cou	ırseware	e		1–ursl	E (Hi	3T Map	pped Level)
1. REFER 1. 2. COURS	Stefanie De Glossar wit ENCES: https://ocw. https://www. SE OUTCOM inpletion of to understand	mit.edu – v.dw.com/ MES: structure	Massaclen/learn-	husetts I german tudents age and	nstitute of a positive of the control of the contro	of Techniche Welle	ology O _l	pen Cou	ırseware	e		1–ursl	E (Hi	3T Map ghest nember	oped Level) ring (K1)
1. REFER 1. 2. COURS On com	Stefanie De Glossar wit ENCES: https://ocw. https://www.	mit.edu – v.dw.com/ MES: structure	Massaclen/learn-	husetts I german tudents age and	nstitute of a positive of the control of the contro	of Techniche Welle	ology O _l	pen Cou	ırseware	e		1–ursl	E (Hi	3T Map ghest nember	oped Level) ring (K1)
1. REFER 1. 2. COURSON com CO1 CO2	Stefanie De Glossar wit ENCES: https://ocw. https://www. SE OUTCOM inpletion of to understand	mit.edu – v.dw.com/ IES: the cours structure	Massaclen/learn-	husetts I german tudents age and	nstitute of the control of the contr	of Techniche Weller able to cing each verbs	ology O e, Geran	pen Cou	ırseware	e		1-ursl	E (Hi Rem	3T Map ghest nember	oped Level) ring (K1) ding (K2)
1. REFER 1. 2. COURS On com CO1 CO2 CO3	Stefanie De Glossar wit ENCES: https://ocw. https://www. SE OUTCOM npletion of t understand understand	mit.edu – d.dw.com/ MES: the cours structure vocabula	Massaclen/learn-	husetts I -german tudents age and asons ar	nstitute of a positive of the control of the contro	of Techniche Welliche Welliche to being each verbs	ology O e, Geran n other	pen Cou	ırseware	e		1-ursl	E (Hi Rem Unde	3T Map ghest nember erstand	oped Level) ring (K1) ding (K2)
1. 2. COURS	Stefanie De Glossar wit ENCES: https://ocw. https://www. SE OUTCOM inpletion of to understand	mit.edu – d.dw.com/ MES: the cours structure vocabula	Massaclen/learn-	husetts I german tudents age and asons ar	nstitute of a positive of the control of the contro	of Techniche Welliche Welliche to being each verbs	ology O e, Geran n other	pen Cou	ırseware	e		1-ursl	E (Hi Rem Unde	3T Map ghest nember erstand	pped
1. REFER 1. 2. COURS On com CO1 CO2 CO3	Stefanie De Glossar wit ENCES: https://ocw. https://www. SE OUTCOM npletion of t understand understand	mit.edu – v.dw.com/ IES: the cours structure vocabula ctions in a	Massaclen/learn-	husetts I german tudents age and asons ar ace and a	nstitute of a point of	of Technoche Welloche Welloche to bing each verbs	ology O e, Geran n other	pen Cou	ırseware	e		1-ursl	E (Hii Rem Unde	3T Map ghest nember erstand erstand	oped Level) ring (K1) ding (K2)
1. REFER 1. 2. COURS On com CO1 CO2 CO3 CO4	Stefanie De Glossar wit ENCES: https://ocw. https://www. SE OUTCOM npletion of to understand understand ask for direct	mit.edu – v.dw.com/ IES: the cours structure vocabula ctions in a	Massaclen/learn-	husetts I german tudents age and asons ar ace and a	nstitute of a point of	of Technoche Welloche Welloche to bing each verbs	ology O e, Geran n other	pen Cou	ırseware	e		1-ursl	E (Hii Rem Unde	3T Map ghest nember erstand erstand	oped Level) ring (K1) ding (K2) ding (K2)
1. REFER 1. 2. COURS	Stefanie De Glossar wit ENCES: https://ocw. https://www. SE OUTCOM inpletion of to understand understand ask for direct	mit.edu – v.dw.com/ IES: the cours structure vocabula ctions in a	Massaclen/learn-	husetts I german tudents age and asons ar ace and a	mstitute of the property of th	of Technoche Welloche Welloche to bing each verbs	nology O e, Geran n other required ments.	pen Cou	urseward	e onal Broa		1-ursl	E (Hii Rem Unde	3T Map ghest nember erstand erstand	oped Level) ring (K1) ding (K2) ding (K2)
1. REFER 1. 2. COURS On com CO1 CO2 CO3 CO4 CO5	Stefanie De Glossar wit ENCES: https://ocw. https://www. SE OUTCOM npletion of to understand understand ask for direct understand learn to soci	mit.edu – v.dw.com/ IES: the cours structure vocabula ctions in a	Massaclen/learn-	husetts I german tudents age and asons ar ace and a	mstitute of the property of th	of Techniche Welle able to cing each verbs asport as appoint ry	nology O e, Geran n other required ments.	pen Cou	urseward	e onal Broa		1-ursl	E (Hi (Hi Unde	3T Map ghest nember erstand erstand	oped Level) ring (K1) ding (K2) ding (K2)
1. REFER 1. 2. COURS CO1 CO2 CO3 CO4 CO5	Stefanie De Glossar wit ENCES: https://ocw. https://www. SE OUTCOMnpletion of to understand understand ask for direct understand learn to soo OS PO1	mit.edu – v.dw.com/ IES: the cours structure vocabula ctions in a food hab sialize in a	Massaclen/learn- se, the stood languary on sea a new place its of German	husetts I german tudents age and asons ar ace and a	mstitute of a point of	of Technoche Welloche Welloche Sing each verbs appoint ry	n other required ments.	pen Counany's I	nternation	e onal Broa	dcaster		E (Hi (Hi Unde	3T Map ghest nember erstand erstand	oped Level) ing (K1) ding (K2) ding (K2)
1. REFER 1. 2. COURS COURS COO Stefanie De Glossar wit ENCES: https://ocw. https://www. SE OUTCOM pletion of to understand understand ask for direct understand learn to soo OS PO1	mit.edu – v.dw.com/ IES: the cours structure vocabula ctions in a food hab sialize in a	Massaclen/learn- se, the stood languary on sea a new place its of German	husetts I german tudents age and asons ar ace and a	mstitute of a point of	of Technoche Welloche Welloche Sing each verbs appoint ry	n other required ments.	pen Counany's I	nternation	e onal Broa s PO10	dcaster	PO1	E (Hi (Hi Unde	3T Map ghest nember erstand erstand	oped Level) ing (K1) ding (K2) ding (K2)	
1. REFER 1. 2. COURS On com CO1 CO2 CO3 CO4 CO5 CO5/PC	Stefanie De Glossar wit ENCES: https://ocw. https://ocw. https://www. SE OUTCOM npletion of to understand understand ask for direct understand learn to soo	mit.edu – v.dw.com/ IES: the cours structure vocabula ctions in a food hab sialize in a	Massaclen/learn- se, the stood languary on sea a new place its of German	husetts I german tudents age and asons ar ace and a	mstitute of a point of	of Technoche Welloche Welloche Sing each verbs appoint ry	n other required ments.	pen Counany's I	nternation nternation	e ponal Broa	dcaster	PO1 3	E (Hi (Hi Unde	3T Map ghest nember erstand erstand	oped Level) ing (K1) ding (K2) ding (K2) ding (K2)
1. REFER 1. 2. COURS CO1 CO2 CO5 CO5 CO2	Stefanie De Glossar wit ENCES: https://ocw. https://ocw. https://www. SE OUTCOM pletion of to understand understand ask for direct understand learn to soo OS PO1	mit.edu – v.dw.com/ IES: the cours structure vocabula ctions in a food hab sialize in a	Massaclen/learn- se, the stood languary on sea a new place its of German	husetts I german tudents age and asons ar ace and a	mstitute of a point of	of Technoche Wellowable to being each verbs appoint appoint ry	n other required ments.	pen Counany's I	nternation of PSO PO9 2 2 2	e onal Broa	dcaster	PO1 3 3	E (Hi (Hi Unde	3T Map ghest nember erstand erstand	oped Level) ing (K1) ding (K2) ding (K2) ding (K2)

		ASSESSMEN	IT PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	75	25					100
CAT2	25	75					100
CAT3	25	75					100
ESE	25	75					100
* ±3% may be varied (CAT 1,2,3 – 50 mark	s & ESE – 100 mar	ks)				-

								NESE L								
					(Comr	non to A	II Engine	eering a	nd Tech	nology	Branches)				
Prograr Branch		&	All BE	/BTech E	Branches	S					Sem.	Category	L	T	Р	Credit
Prerequ	uisite	s	Nil								All	OE	4	0	0	4
Preamb	ole		to gree									atakana and ability to un				
Jnit – I			Introd	uction to	Hiragan											9
		rt 2, Ch					-		_		ilar sound	led vocabula	ries fo	r eac	h chart	
Unit – II					Nouns,		•									9
Forming	g simp	ole sent	ences, a	isking qu	estions, p	ositionir	ng differe	entiation	and ow	ning fur	ndamenta	ls – new par	ticles a	nd us	sages	
Unit – II					Verbs, t											9
Jsage of particles				ntences	and fram	ing then	n – plac	e and ti	me mar	kers usa	ages – gi	ving and rec	eiving	– on	nission	of certain
Unit – I\					Adjectiv											9
			d verbs kes expr		ng them	to relate	day to c	day conv	ersation	s- posit	ive and ne	egative endir	ng of th	e sar	ne – in	troductio
Unit – V		ia aisiir			Counter	rs and k	(anii:									9
How to	use n		s-How to	use qua				djective	s and N	ouns-O	ther nece	ssary particl	es-Hov	v to u	ise nur	_
quantifie	ers –	55 kanj	i charact	ters												
																Total:4
ГЕХТ В	воок	:														
			NIHON	GO-Jana	nese for	Everyor	ne" 2 nd F	=dition (Goval Pi	ıhlisher	s & Distril	outors Pvt. L	td Ne	w De	lhi 20°	17
1.			14111014	oo dapa		Lvoryor	10,2 .	, \	J oyal i v	201101101	o a Diotili	JG(010 1 Vt. E	10., 110	50	, 20	
	ENICE	-0-														
KEFER	ENCE	:5:														
			Pezzopa	ne. "Trv N	N5". 2 nd E	dition. T	ankobo	n Softco	ver. Jap	an. 201	7.					
1.	Marg	herita I			N5", 2 nd E							0040				
1.	Marg	herita I										apan, 2018.				
1. 2.	Marg Saya	herita I ika Kuri	ashina, "	Japanes	e Word S	peedma	ıster", 2 ⁿ					apan, 2018.			BT Map	•
1. 2. COURS On com	Marg Saya SE OU	herita I ka Kur ITCOM on of t	ashina, " ES: he cours	Japanes	e Word S	peedma	ster", 2 ⁿ	nd Editior	n, Tanko			apan, 2018.		(Hi	ghest	Level)
1. 2. COURS On com	Saya SE OUnpletic	herita I ika Kura ITCOM on of th and un	eshina, " ES: he cours derstand	Japanesonse, the side typical e	e Word S	peedma	ster", 2 ⁿ	nd Editior	n, Tanko			apan, 2018.		(Hi Rem	ghest ember	Level) ing (K1)
2. COURS On com	Saya SE OUnpletic	herita I ika Kura ITCOM on of th and un	eshina, " ES: he cours derstand	Japanes	e Word S	peedma	ster", 2 ⁿ	nd Editior	n, Tanko			apan, 2018.		(Hi Rem	ghest ember	Level)
1. 2. COURS On com	Saya SE OU npletion read greet	herita I ka Kura ITCOM on of the and un	es: he cours derstand	Se, the side typical e	e Word S tudents v expression	peedma will be a n in Hira	ister", 2 ⁿ ible to	nd Editior	n, Tanko			apan, 2018.		(Hi Rem Unde	ghest lember erstand	Level) ing (K1)
1. 2. COURS On com CO1 CO2 CO3	Saya SE OU npletion read greet	herita I ka Kur ITCOM on of tl and un t and in	eshina, " ES: he cours derstand troduce	Se, the state oneself a	e Word S tudents v expression nd other versations	peedma will be a n in Hira s – basio	ister", 2 ⁿ ible to	nd Editior	n, Tanko			apan, 2018.		(Hi Rem Unde	ghest ember erstancerstancerstance	Level) ing (K1) ling (K2) ling (K2)
1. 2. COURS On com	Saya SE OU npletion read greet	herita I ka Kur ITCOM on of tl and un t and in	eshina, " ES: he cours derstand troduce	Se, the state oneself a	e Word S tudents v expression	peedma will be a n in Hira s – basio	ister", 2 ⁿ ible to	nd Editior	n, Tanko			apan, 2018.		(Hi Rem Unde	ghest ember erstancerstancerstance	Level) ing (K1) ling (K2)
1. 2. COURS On common CO1 CO2 CO3 CO4	Marg Saya SE OUnpletion read greet communde	herita I ka Kurs ITCOM on of the and un thand in municate	ES: he cours derstand troduce te day to	Se, the state oneself a day convision Japa	e Word S tudents v expression nd other versations anese Scr	will be an in Hira	uster", 2 ⁿ uble to ugana ar	ed Edition	n, Tanko			apan, 2018.		(Hi Rem Unde Unde	ghest ember erstand erstand	Level) ing (K1) ling (K2) ling (K2)
1. 2. COURS On com CO1 CO2 CO3 CO4	Marg Saya SE OUnpletion read greet communde	herita I ka Kurs ITCOM on of the and un thand in municate	ES: he cours derstand troduce te day to	Se, the state oneself a day convision Japa	e Word S tudents v expression nd other versations	will be an in Hira	uster", 2 ⁿ uble to ugana ar	ed Edition	n, Tanko			apan, 2018.		(Hi Rem Unde Unde	ghest ember erstand erstand	Level) ing (K1) ling (K2) ling (K2) ling (K2)
1. 2. COURS On commCO1 CO2 CO3 CO4	Marg Saya SE OUnpletion read greet communde	herita I ka Kurs ITCOM on of the and un thand in municate	ES: he cours derstand troduce te day to	Se, the state oneself a day convision Japa	e Word S tudents v expression nd other versations anese Scr	will be an in Hira	ister", 2 ⁿ ible to igana ar	nd Katak	ana	bon So	ftcover, Ja	apan, 2018.		(Hi Rem Unde Unde	ghest ember erstand erstand	Level) ing (K1) ling (K2) ling (K2) ling (K2)
1. 2. COURS On com CO1 CO2 CO3 CO4 CO5	Marg Saya SE OUnpletion read greet communde	Interita I Ika Kuri ITCOM on of the and un thand in municate irstand	eshina, " ES: he cours derstand troduce te day to the Kanj	se, the side typical education day convision Japa	e Word S tudents v expression nd other versations anese Scr	will be a n in Hira s – basic ript s, month	ible to agana ar c level	and cour	ana nters	nd PSO	ftcover, Ja			(Hi Rem Unde Unde Unde	ghest lember erstand erstand erstand	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2)
1. 2. COURS On com CO1 CO2 CO3 CO4 CO5	Saya SE OUnpletion read greet communde comp	herita I ka Kurs ITCOM on of the and un thand in municate	ES: he cours derstand troduce te day to	Se, the state oneself a day convision Japa	e Word S tudents v expression nd other versations anese Scr	will be an in Hira	ister", 2 ⁿ ible to igana ar	nd Katak	ana POs a	nd PSC	ftcover, Ja	PO11	PO1	(Hi Rem Unde Unde Unde	ghest ember erstand erstand	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2)
1. 2. COURS On com CO1 CO2 CO3 CO4 CO5 CO5/PC CO1	Marg Saya SE OUnpletic read greet communde comp	Interita I Ika Kuri ITCOM on of the and un thand in municate irstand	eshina, " ES: he cours derstand troduce te day to the Kanj	se, the side typical education day convision Japa	e Word S tudents v expression nd other versations anese Scr	will be a n in Hira s – basic ript s, month	ible to agana ar c level	and cour	ana nters	nd PSC	es PO10		PO1: 3	(Hi Rem Unde Unde Unde	ghest lember erstand erstand erstand	Level) ing (K1) ling (K2) ling (K2) ling (K2)
1. 2. COURS On com CO1 CO2 CO3 CO4 CO5 CO1 CO2 CO1 CO2 CO1 CO2 CO1 CO2 CO1 CO2 CO1 CO2	Saya SE OUnpletion read greet communde comp	Interita I Ika Kuri ITCOM on of the and un thand in municate irstand	eshina, " ES: he cours derstand troduce te day to the Kanj	se, the side typical education day convision Japa	e Word S tudents v expression nd other versations anese Scr	will be a n in Hira s – basic ript s, month	ible to agana ar c level	and cour	ana POs a	nd PSC	PS PO10 3 3		PO1: 3 3 3	(Hi Rem Unde Unde Unde	ghest lember erstand erstand erstand	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2)
1. 2. COURS On com CO1 CO2 CO3 CO4 CO5 CO5/PC CO1	Saya SE OUnpletion read greet communde comp	Interita I Ika Kuri ITCOM on of the and un thand in municate irstand	eshina, " ES: he cours derstand troduce te day to the Kanj	se, the side typical education day convision Japa	e Word S tudents v expression nd other versations anese Scr	will be a n in Hira s – basic ript s, month	ible to agana ar c level	and cour	ana POs a POs 1	nd PSC	es PO10		PO1: 3	(Hi Rem Unde Unde Unde	ghest lember erstand erstand erstand	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2)
1. 2. COURS On com CO1 CO2 CO3 CO4 CO5 CO1 CO2 CO1 CO2 CO3 CO4 CO5 CO1 CO2 CO1 CO2 CO1 CO2 CO1 CO2 CO2 CO3 CO4 CO5 CO1 CO2 CO1 CO2 CO2 CO1 CO1 CO2 CO1 CO1 CO2 CO1 CO1 CO1 CO1 CO1 CO1 CO1 CO1 CO1 CO1	Marg Saya SE OUnpletic read greet communde comp	Interita I Ika Kuri ITCOM on of the and un thand in municate irstand	eshina, " ES: he cours derstand troduce te day to the Kanj	se, the side typical education day convision Japa	e Word S tudents v expression nd other versations anese Scr	will be a n in Hira s – basic ript s, month	ible to agana ar c level	and cour	ana POs a POs 1 1	nd PSO PO9 2 2	PS PO10 3 3		PO1: 3 3 3	(Hi Rem Unde Unde Unde	ghest lember erstand erstand erstand	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2)
1. 2. COURS On com CO1 CO2 CO3 CO4 CO5 CO1 CO2 CO3	Saya SE OUnpletion read greet communde comp	Interita I Ika Kuri ITCOM on of the and un that and in municate irstand	eshina, " ES: he cours derstand troduce te day to the Kanj	se, the side typical education day convision Japa	e Word S tudents v expression nd other versations anese Scr	will be a n in Hira s – basic ript s, month	ible to agana ar c level	and cour	ana POs a POs a 1 1	nd PSC PO9 2 2 2	PS PO10 3 3 3 3		PO1: 3 3 3 3 3	(Hi Rem Unde Unde Unde	ghest lember erstand erstand erstand	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2)
1. 2. COURS On common CO1 CO2 CO3 CO4 CO5 CO3 CO4 CO5 CO3 CO4 CO5 CO5 CO4 CO5	Marg Saya SE OUnpletic read greet communde comp	Interita I Ika Kuri ITCOM on of ti and un It and in municati Interitand ITCOM On of ti It and in	ES: he cours derstand troduce te day to the Kanj d concep	se, the set of typical ed typical	e Word S tudents v expression nd other versations anese Scr	will be a n in Hira s – basic ript s, month Mapp PO5	ister", 2 ⁿ ible to agana ar c level as, time a	and cour	ana POS a POS 1 1 1	nd PSO PO9 2 2 2 2	Pos Po10 3 3 3 3 3		PO1: 3 3 3 3 3 3	(Hi Rem Unde Unde Unde	ghest lember erstand erstand erstand	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2)

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	75	25					100
CAT2	25	75					100
CAT3	25	75					100
ESE	25	75					100
* ±3% may be varied (0	CAT 1,2,3 – 50 mark	s & ESE – 100 marl	ks)				

				22GEO03 -	DESIGN THINK	ING FOR	ENGIN	IEERS					
Programm Branch	e &	All BE/	BTech B	ranches exc	ept CSE, CSD &	Al		Sem.	Category	L	Т	Р	Credit
Prerequisit	tes	Nil						5	OE	3	1	0	4
Preamble			n and sta		entered problem- edback to unloc								
Unit – I				g and Explor									9+3
	Design -	Thinking	- Explor		ve Phases, Meth Tools – STEEP								
Unit – II		Empat	-										9+3
	: Method	•		Observation	- Deep User Inte	erview –	Empath	y Map -	User Journ	ney Ma	ap -	Need F	inding –
User Insigh	ıts - User	Persona	Developi	ment.	·		·			•	•		· ·
Unit – III		Experi											9+3
Journey – F					PER – Analogou	s Inspira	ition – [Deconstr	uct & Reco	nstruc	t – U	ser Ex	perience
Unit – IV		Engag											9+3
Users.	ethods &		-	ling – Art of S	tory Telling – Sto	ryboardi	ng – Co	-Creatio	n with User	s – Cc	llect	Feedb	
Unit – V		Evolve											9+3
					rategic Requirem eds, CAP, 4S – C					ctivity	Syste	m Inte	gration –
									Lecture	e:45, 1	utor	ial:15,	Total:60
TEXT BOO	K:												
		Hwa "De	esian Thin	king The Gui	debook", Design	Thinking	Master	Trainers	of Bhutan	2017	(F-F	Rook)	
REFERENC		a, D	Joigit Tim	itting The Gar	account, Boolgin		mactor	114111010	or Briatari,		(70011)	
Pre Jea	ess, 2011 anne Liec	tka and											
	ide", Coil	dtka, Tim	Ogilvie, a		g for Growth: A D	· ·	· ·		· ·				·
COURSE C	OUTCOM	dtka, Tim umbia Ur	Ogilvie, a	and Rachel Bress, 2014.	rozenske, "The D	· ·	· ·		· ·		Step	Projec	ped
On comple	OUTCOM etion of the	dtka, Tim umbia Ur ES: he cours	Ogilvie, aniversity F	and Rachel B Press, 2014. udents will b	rozenske, "The D	esigning	for Gro	wth Field	dBook: A St		Step B (Hig	Project T Map	ped Level)
On comple	OUTCOM etion of the	dtka, Tim umbia Ur ES: he cours	Ogilvie, aniversity F	and Rachel B Press, 2014. udents will b	rozenske, "The D	esigning	for Gro	wth Field	dBook: A St		Step B (Hig	Projec	ped Level)
On comple	OUTCOM etion of the nstruct de erview the	dtka, Tim umbia Ur ES: he cours esign cha e user, a	Ogilvie, and ogitished of the street of the	and Rachel Bress, 2014. udents will b	e able to e design challeng	esigning	for Gro	wth Field	dBook: A St	ep-by-	Step B (Hi	Project T Map	ped _evel)
On completion CO1 CO2 Interest to to the CO2	DUTCOM etion of the nstruct de erview the uncover t	esign cha e user, a he cours esign cha e user, a	Ogilvie, a niversity F	and Rachel Bi Press, 2014. udents will be and reframe the the feelings out the feelings ou	e able to e design challeng	esigning e into de deep use	for Gro	wth Field	dBook: A St	ep-by-	Step (Hig Ap	T Map ghest L	ped _evel) (K3)
On complete CO1 CO2 Interest CO2 CO3 De	DUTCOM etion of the nstruct de erview the uncover to velop ide	e user, a he deep	Ogilvie, a niversity F	and Rachel Bress, 2014. udents will be and reframe the the feelings out the and need by brain stor	e able to e design challeng f users to foster of	e into de deep use	for Gro	wth Field portunity standing	dBook: A St	ep-by-	Step (Hig Ap	T Map ghest L oplying	ped _evel) (K3) (K3)
On complete CO1 Co CO2 Interest to to to to to to to to to to to to to	DUTCOM etion of the nstruct de erview the uncover to velop ide ganize the	ES: he cours esign cha e user, a he deep as and p	Ogilvie, a niversity F	and Rachel Bress, 2014. udents will be and reframe the the feelings out t	e able to e design challeng f users to foster o s. ming using the id using ideal user o	e into de deep use eation to	sign opposite understools.	oortunity standing	dBook: A St	ep-by-	Step (High Ap Ap Ap	T Mapghest Loplying	pedevel) (K3) (K3) (K3)
CO1 CO2 Interest to U	DUTCOM etion of the nstruct de erview the uncover to velop ide ganize the	ES: he cours esign cha e user, a he deep as and p e user wa	Ogilvie, a niversity F	and Rachel Bress, 2014. udents will be and reframe the the feelings out t	e able to e design challeng f users to foster of seconds.	e into de deep use eation to	sign opposite understools.	oortunity standing	dBook: A St	ep-by-	Step (High Ap Ap Ap	T Mapghest Loplying	pedevel) (K3) (K3) (K3)
CO1 CO2 Interest to U	DUTCOM etion of the nstruct de- erview the uncover the velop ide ganize the velop sm	ES: he cours esign cha e user, a he deep as and p e user wa	Ogilvie, a niversity F	and Rachel Bi Press, 2014. udents will be and reframe the stand need by brain storm experience plementation	e able to e design challeng f users to foster o s. ming using the id using ideal user o	e into de deep use eation to experience	for Gro	portunity standing ey.	dBook: A St	ep-by-	Step (High Ap Ap Ap	T Mapghest Loplying	pedevel) (K3) (K3) (K3)
CO1 CO2 Intercond CO2 CO3 Dec CO4 CO5 CO5 CO5 CO5 CO5 CO5 CO5 CO5 CO5 CO5	DUTCOM etion of the nstruct de erview the uncover to velop ide ganize the velop sm m earlier	ES: he coursesign character was and per user wart strate phases.	Ogilvie, a niversity F	and Rachel Bi Press, 2014. udents will be and reframe the the feelings of the phase of the phase of the experience of t	e able to e design challeng f users to foster o s. ming using the id using ideal user o plan that will deliv	e into de deep use eation to experience ver/achie	for Grosign opportunders ols. the journ to the idea of the design of the design opportunity of the design of the d	portunity standing ey. dea/solut	dBook: A St	ep-by-	B (Hių) Ar Ar Ar	T Map ghest L pplying oplying oplying oplying oplying	ped _evel) (K3) (K3) (K3) (K3)
CO1 CO2 Interest to U	DUTCOM etion of the nstruct de- erview the uncover the velop ide ganize the velop sm	ES: he cours esign cha e user, a he deep as and p e user wa	Ogilvie, a niversity F	and Rachel Bi Press, 2014. udents will be and reframe the stand need by brain storm experience plementation	e able to e design challeng f users to foster o s. ming using the id using ideal user o plan that will deliv	e into de deep use eation to experience ver/achie	for Gro	portunity standing ey.	dBook: A St	ep-by-	B (Hių) Ar Ar Ar	T Mapghest Lopplying	pedevel) (K3) (K3) (K3)
On complete CO1 Co CO2 Interest of to u CO3 De CO4 Org CO5 froi COs/POs CO1	DUTCOMetion of the proview the uncover to velop ide ganize the velop sm m earlier	ES: he course esign character was and per user was art strate phases.	Ogilvie, a niversity F se, the strallenge ar nd know to user insignototypes alkthrough egies & important to the stranger of th	and Rachel Bi Press, 2014. udents will be and reframe the stand need by brain storm experience plementation Mapper PO4 PO	e able to e design challeng f users to foster o s. ming using the id using ideal user o plan that will deliv	e into de deep use eation to experience ver/achie	sign op or under ols. ce journ ve the id	oortunity standing ey. dea/solut	dBook: A St	ep-by-	B (Hių) Ar Ar Ar Ar	T Map ghest L pplying oplying oplying oplying oplying	ped _evel) (K3) (K3) (K3) (K3)
On complete CO1 Co CO2 Interest of to the	DUTCOM etion of the nstruct deserview the uncover to velop ide ganize the velop sm m earlier PO1 3	ES: he cours esign cha e user, a he deep eas and p e user wa art strate phases.	Ogilvie, a niversity F se, the strallenge ar nd know to user insignation of the strategy of th	and Rachel Bress, 2014. udents will be and reframe the the feelings of the sand need by brain storm experience plementation Mapper PO4 PO	e able to e design challeng f users to foster o s. ming using the id using ideal user o plan that will deliv	e into de deep use eation to experience ver/achie	sign oper undersols. Dee journ ve the ide d PSOs PO9 3	portunity standing ey. dea/solut	and be able	ep-by-	B (Hių) Ar Ar Ar Ar	T Map ghest L pplying oplying oplying oplying oplying	ped _evel) (K3) (K3) (K3) (K3)
On complete CO1 Co CO2 Interest or control CO3 De CO4 Org CO5 froi COS/POS CO1 CO2	putcometion of the struct does not the structure does not the s	ES: he course esign character was and proper to the course as and proper to the course was art strate phases. PO2 3 3	Ogilvie, a niversity F se, the strallenge ar nd know to user insignation of the strange of the s	and Rachel Bi Press, 2014. udents will be and reframe the stand need by brain storm experience plementation Mapper PO4 PO 1	e able to e design challeng f users to foster o s. ming using the id using ideal user o plan that will deliv	e into de deep use eation to experience ver/achie	sign op or undersols. ce journ ve the id	portunity standing ey. dea/solute PO10 2 2	and be able	ep-by-	B (Hių) Ar Ar Ar Ar	T Map ghest L pplying oplying oplying oplying oplying	ped _evel) (K3) (K3) (K3) (K3)
On complete CO1 Co CO2 Interest to to to to to to to to to to to to to	putcometion of the struct deserview the uncover the velop ide ganize the velop sm m earlier	ES: he course esign character was and per user was art strate phases.	Ogilvie, a niversity F se, the strallenge ar nd know to user insignototypes alkthrough egies & important to the strange of the	and Rachel Bress, 2014. udents will be and reframe the the feelings of the fe	e able to e design challeng f users to foster o s. ming using the id using ideal user o plan that will deliv	e into de deep use eation to experience ver/achie	sign opportunders ols. the journ to the id d PSOs PO9 3 3 3 3	portunity standing ey. dea/solute 2 2 2 2	and be able	ep-by-	B (Hių) Ar Ar Ar Ar	T Map ghest L pplying oplying oplying oplying oplying	ped _evel) (K3) (K3) (K3) (K3)

			22GE0	7UT - 111											
				(Offere	ed by De	epartme	ent of Me	echatror	nics Eng	gineering)				
Programm Branch	e &	All B.E	./B.Tech			•			`	Sem.	Category	L	т	Р	Credit
Prerequisi	tes	Nil								6	OE	3	1	0	4
Preamble Unit - I			urse will				think inn	ovation	concep	ots and ic	leas for bus	iness	mod	el deve	elopments.
	nking an	ativity– T d Entrep	ypes of i reneursh	nnovation ip – Des	on – cha sign Thir	allenges									s of design. ign thinking
Unit - II			tudy and		. 0	nauiry:									9+3
Explanator	focus gi	ch – prim oups – c	nary and depth inte	seconderviews -	ary data – analys	a – classisis of qu	ualitative	e data –	survey	method	s – observa	tions-	Prod	cess of	 qualitative identifying ions
Unit - III			ct Desig												9+3
Techniques prototyping interaction	s and too – tools	ols for co and tec	ncept ge chniques-	neration - overvi	, concer ew of p	ot evalu processe	ation – es and	Product materia	t archite ls – ev	ecture –N aluation	linimum Viatools and	able P techni	rodu ques	ct (MV for u	P)- Product ser-product
Unit - IV		Busine	ess Mode	el Canva	as (BMC	C):									9+3
Lean Canv Reasons a			fference	and buil	ding blo	cks- BN	ИС: Patt	terns –	Design	Strate	gy – Proce	ss–Bu	sines	ss mod	lel failures:
Unit - V	nu reme		d Comm	orcializ	ation:										9+3
Need for In Trade Secr		Propert	y- Basic o	concepts	s - Differ									hical I	
Trade Seci	ets and	iriuustria	i Design-	- i aleiil	LICEITSII	ig - rec	ririology	Commi	CICIAIIZ	alion – ii				! - ! - 4	F Total:CO
											I ecti	1re-45	I I I I I I	oriai. 1	a intalan
TEXT BOO	OK:										Lecti	ire:45	, Iut	oriai:1	5, Total:60
Dia		T.Krishr	nan, "8 St	eps To I	nnovatio	on: Goir	ng From	Jugaad	d To Exc	cellence"				oriai:1	5, 10tai:60
		T.Krishr	nan, "8 St	eps To I	nnovatio	on: Goir	ng From	Jugaad	d To Exc	cellence"	, Collins Inc			oriai:1	5, Total:60
1. REFEREN	shikesha										, Collins Ind			oriai:1	5, 10tal:60
1. REFEREN	shikesha CES: ter Druc	ker, "Inno	ovation a	nd Entre	preneur	ship", R	Routledg	e CRC	Press, I	_ondon,	, Collins Ind	dia, 20	13.		
1. Ris REFEREN 1. Pe 2. E	shikesha CES: ter Druc	ker, "Inno S.D. and	ovation a	nd Entre K.T. "Pro	preneur	ship", R	Routledg	e CRC	Press, I	ondon,	, Collins Ind 2014. Graw-Hill H	dia, 20	13. Educ	ation, 2	2020.
1. Ris REFEREN 1. Pe 2. E 3. A	ces: ter Druct ppinger, lexande	ker, "Inno S.D. and r Osterwa	ovation a d Ulrich, I alder, "B	nd Entre K.T. "Pro usiness	preneur oduct de model (ship", R	Routledg	e CRC	Press, I	ondon,	, Collins Ind 2014. Graw-Hill H	dia, 20	13. Educ	ation, 2	
1. Ris REFEREN 1. Pe 2. E 3. A e	ceshikesha ces: ter Druc ppinger, lexande dition, Jo	ker, "Inno S.D. and r Osterwo ohn Wiley	ovation and Ulrich, I alder, "Bi and Sor	nd Entre K.T. "Pro usiness ns; 2010	preneur oduct de model ç	rship", R esign an generati	Routledg	e CRC opment	Press, I ', 7 th ed k for vis	ondon, ition, Mc	, Collins Ind 2014. Graw-Hill H , game cha	dia, 20	13. Educ	ation, :	2020. engers", 1 st
1. Ris REFEREN 1. Pe 2. E 3. A e 4. In	ces: ter Druct ppinger, lexande dition, Jo	ker, "Inno S.D. and r Osterwa ohn Wiley	ovation and Ulrich, I alder, "Bo alder, "Bo and Sor Associati	nd Entre K.T. "Pro usiness ns; 2010 on, "Pat	epreneur oduct de model ç ent IPR	rship", R esign an generati Licensii	Routledg d develo ion: A ha	pe CRC opment' andbool	Press, I ', 7 th ed k for vis	ondon, ition, Mc	, Collins Ind 2014. Graw-Hill H	dia, 20	13. Educ	ation, :	2020. engers", 1 st
1. Ris REFEREN 1. Pe 2. E 3. A e 4. In	ces: ter Druct ppinger, lexande dition, Jo	ker, "Inno S.D. and r Osterwa ohn Wiley	ovation and Ulrich, I alder, "Bi and Sor	nd Entre K.T. "Pro usiness ns; 2010 on, "Pat	epreneur oduct de model ç ent IPR	rship", R esign an generati Licensii	Routledg d develo ion: A ha	pe CRC opment' andbool	Press, I ', 7 th ed k for vis	ondon, ition, Mc	, Collins Ind 2014. Graw-Hill H , game cha	dia, 20	13. Educ	ation, :	2020. engers", 1 st
1. Ris REFEREN 1. Pe 2. E 3. A e 4. Ir	ces: ter Druck ppinger, lexande dition, Jo ndian Inn Guide Bo	S.D. and S.D. and r Osterwa ohn Wiley rovators a ok for Re	ovation and Ulrich, I alder, "Bi and Sor Associati	nd Entre K.T. "Pro- usiness ns; 2010 on, "Paters, Innov	epreneur oduct de model ç ent IPR rators", N	rship", R rsign and generati Licensii Notion F	Routledg d develo ion: A ha ng – Tea Press, C	pe CRC opment' andbool	Press, I ', 7 th ed k for vis	ondon, ition, Mc	, Collins Ind 2014. Graw-Hill H , game cha	dia, 20	13. Educ , and	ation, 2 challe keting	2020. engers", 1 st :
1. Ris REFEREN 1. Pe 2. E 3. A e 4. Ir COURSE C On comple	cestion of solution S.D. and S.D	ovation and Ulrich, I alder, "Brand Son Associations esearcher se, the second control of	nd Entre K.T. "Pro- usiness ns; 2010 on, "Pates, Innov	epreneur oduct de model g ent IPR rators", N	ship", Resign and generation Licensin Notion For able to	Routledg d develon: A hanned ng – Tea Press, C	pe CRC opment' andbool	Press, I ', 7 th ed k for vis	ondon, ition, Mc	, Collins Ind 2014. Graw-Hill H , game cha	dia, 20	Educ , and n Mar	ation, 3 challe keting BT Ma ighest	2020. engers", 1 st : pped	
1. Ris REFEREN 1. Pe 2. E 3. A e 4. Ir COURSE C On comple	cestion of derstand	S.D. and S.D	ovation and Ulrich, I alder, "Boy and Sor Association escarcher se, the son need	nd Entre K.T. "Prousiness ns; 2010 on, "Paters, Innoventudents and des	epreneur oduct de model g ent IPR rators", N	rship", R rsign and generati Licensin Notion F r able to king pha	Routledged development of the control of the contro	pe CRC ppment* andbool chnolog hennai,	Press, I ', 7 th ed k for vis y Comr 2017	London, lition, Mcc sionaries mercializ	, Collins Ind 2014. Graw-Hill H , game cha	dia, 20	Educ , and n Mar (H	ation, 2 I challe keting BT Ma ighest erstan	2020. engers", 1 st : pped : Level) ding (K2)
1. Ris REFEREN 1. Pe 2. E 3. A e 4. Ir CO COURSE C On comple CO1 un CO2 ide	centify, sci	S.D. and r Osterwardhn Wiley ovators work for Restricted the cour linnovation and	ovation and Ulrich, I alder, "Bi and Sor Association searcher se, the son need analyse	nd Entre K.T. "Prousiness ns; 2010 on, "Paters, Innoventudents and des ideas fo	epreneur oduct de model o ent IPR rators", N	rship", R rsign and generati Licensia Notion F rable to king pha roducts	Routledged development of the control of the contro	ppment" andbool chnolog hennai,	Press, I ', 7 th ed k for vis ly Comr 2017	ondon, ition, Mc sionaries mercializ	, Collins Ind 2014. Graw-Hill H , game cha	igher I	Educe, and Mar	ation, 2 I challe keting BT Ma ighest erstan nalysir	2020. engers", 1 st : pped
1. Ris REFEREN 1. Pe 2. E 3. A e 4. Irr G COURSE C On comple CO1 un CO2 ide arc CO3	centify, sci	S.D. and S.D	ovation and Ulrich, I alder, "Brand Sor Association searcher se, the son need analyse or the product.	nd Entre K.T. "Prousiness ns; 2010 on, "Pates, Innoventudents and des ideas fo	epreneur oduct de model g ent IPR rators", N s will be ign think r new pr	rship", Resign and generation Licensin Notion For able to cing pharmoducts sed on the se	Routledged development of the control of the contro	ppment" andbool chnolog hennai,	Press, I ', 7 th ed k for vis ly Comr 2017	ondon, ition, Mc sionaries mercializ	, Collins Ind 2014. Graw-Hill H , game cha ation – Inno	igher I	Educ., and Mar	ation, in the street of the st	2020. engers", 1st : pped : Level) ding (K2) ng (K4) ng (K4)
1. Ris REFEREN 1. Pe 2. E 3. A e 4. Ir CO COURSE CO On comple CO1 un CO2 ide arc CO4 pre	centify, scientific testing and an interest an	S.D. and r Osterway ovators a covators a cov	ovation and Ulrich, I alder, "Bi y and Sor Association assemble see the see the process of the product.	nd Entre K.T. "Prousiness ns; 2010 on, "Patres, Innoventudents and des ideas for	epreneur oduct de model g ent IPR rators", N s will be ign think r new pr cepts ba	rship", R rsign and generati Licensin Notion F re able to king pha roducts sed on t	Routledged development of the customer of the	ppment" andbool chnolog hennai,	Press, I ', 7 th ed k for vis ly Comr 2017	ondon, ition, Mc sionaries mercializ	, Collins Ind 2014. Graw-Hill H , game cha ation – Inno	igher I	Educ, and Mar	ation, 2 I challe keting BT Ma ighest erstan nalysir nalysir	2020. engers", 1st : pped : Level) ding (K2) ng (K4) ng (K4)
1. Ris REFEREN 1. Pe 2. E 3. A e 4. Ir CO COURSE C On comple CO1 un CO2 ide CO3 de CO4 pre	centify, scientific testing and an interest an	S.D. and r Osterway ovators a covators a cov	ovation and Ulrich, I alder, "Brand Sor Association searcher se, the son need analyse or the product.	nd Entre K.T. "Prousiness ns; 2010 on, "Patres, Innoventudents and des ideas for	epreneur oduct de model g ent IPR rators", N s will be ign think r new pr cepts ba	rship", R rsign and generati Licensin Notion F re able to king pha roducts sed on t	Routledged development of the customer of the	ppment" andbool chnolog hennai,	Press, I ', 7 th ed k for vis ly Comr 2017	ondon, ition, Mc sionaries mercializ	, Collins Ind 2014. Graw-Hill H , game cha ation – Inno	igher I	Educ, and Mar	ation, 2 I challe keting BT Ma ighest erstan nalysir nalysir	2020. engers", 1st : pped : Level) ding (K2) ng (K4) ng (K4)
1. Ris REFEREN 1. Pe 2. E 3. A e 4. Ir CO COURSE CO On comple CO1 un CO2 ide arc CO4 pre	centify, scientific testing and an interest an	S.D. and r Osterway ovators a covators a cov	ovation and Ulrich, I alder, "Bi y and Sor Association assemble see the see the process of the product.	nd Entre K.T. "Prousiness ns; 2010 on, "Patres, Innoventudents and des ideas for	epreneur oduct de model g ent IPR rators", N s will be ign think r new pr cepts ba for MVP	rship", Resign and generation Licensin Notion For able to king pharoducts sed on the rideas'	Routledged development of the customer of the	pe CRC ppment* andbook chnolog hennai, on custo omer ne	Press, I	London, ition, Mcc sionaries mercializ eds d presen	, Collins Ind 2014. Graw-Hill H , game cha ation – Inno	igher I	Educ, and Mar	ation, 2 I challe keting BT Ma ighest erstan nalysir nalysir	2020. engers", 1st : pped : Level) ding (K2) ng (K4) ng (K4)
1. Ris REFEREN 1. Pe 2. E 3. A e 4. Ir CO COURSE C On comple CO1 un CO2 ide CO3 de arc CO4 pre CO5 pra	cesting and a straight of the control of the contro	S.D. and r Osterway ovators a cok for Resthe cour innovation and danalyse e of the pructured e procedu	ovation and Ulrich, I alder, "Bi and Sor Association assemble seems on need analyse the product. business for p	nd Entre K.T. "Pro usiness ns; 2010 on, "Paters, Innov students and des ideas fo duct cond model in	epreneur oduct de model of ent IPR rators", N s will be ign think r new pr cepts ba for MVP n of their	rship", Resign and generation Licensia Notion For able to king pharmoducts sed on the rideas'	Routledged development of the customer of the	ppment" andbool chnolog hennai, on custo omer ne	Press, I 7, 7 th ed k for vis y Comr 2017 mer nereds and	London, ition, Mcrisionaries mercializ eds d presen	, Collins Ind 2014. Graw-Hill H , game cha ation – Inno	igher Ingers	Educe, and Mar	ation, 2 I challe keting BT Ma ighest erstan nalysir applyin applyin	2020. engers", 1st : pped : Level) ding (K2) ng (K4) ng (K4) g (K3) g (K3)
1. Ris REFEREN 1. Pe 2. E 3. A e 4. Ir CO COURSE C On comple CO1 un CO2 ide CO3 de arc CO4 pre CO5 pra COs/POs	centify, scientific testing and an interest an	S.D. and r Osterway ovators a covators a cov	ovation and Ulrich, I alder, "Bi and Sor Association searcher se, the son need analyse the product. business ures for p	nd Entre K.T. "Prousiness ns; 2010 on, "Patres, Innoventudents and des ideas for	epreneur oduct de model g ent IPR rators", N s will be ign think r new pr cepts ba for MVP	rship", Resign and generation Licensin Notion For able to king pharoducts seed on the rideas' rideas' rideas' PO6	Routledged development of the customer of the	pe CRC ppment* andbook chnolog hennai, on custo omer ne	Press, I	London, ition, Mcc sionaries mercializ eds d presen	, Collins Ind 2014. Graw-Hill H , game cha ation – Inno	igher ngers	Educe, and Mar	ation, 2 I challe keting BT Ma ighest erstan nalysir nalysir	2020. engers", 1st : pped : Level) ding (K2) ng (K4) ng (K4)
1. Ris REFEREN 1. Pe 2. E 3. A e 4. Ir CO COURSE C On comple CO1 un CO2 ide arc CO4 pre CO5 pra CO5/POS CO1/POS	cestion of a chitecture edict a stactice the	S.D. and r Osterway ovators a cok for Resthe cour innovation and danalyse e of the pructured e procedu	ovation and Ulrich, I alder, "Bi alder, "Bi and Sor Association assemble seems on need analyse the product. business tures for p	nd Entre K.T. "Prousiness ns; 2010 on, "Paters, Innovertudents and des ideas for duct conditions are model to	epreneur oduct de model g ent IPR rators", N s will be ign think r new pr cepts ba for MVP n of their Mappi PO5	ship", Resign and generation and serioducts and serioducts are ideas' ng of C PO6 2	Routledged development of the customer of the	chnolog hennai, on custo omer ne	Press, I ', 7 th ed k for vis y Comr 2017 mer needs and	ondon, ition, Mc sionaries mercializ eds d presen	, Collins Ind 2014. Graw-Hill H , game cha ation – Inno	igher Ingers	Educe, and Mar	ation, 2 I challe keting BT Ma ighest erstan nalysir applyin applyin	2020. engers", 1st : pped : Level) ding (K2) ng (K4) ng (K4) g (K3) g (K3)
1. Ris REFEREN 1. Pe 2. E 3. A e 4. Ir CO COURSE C On comple CO1 un CO2 ide CO3 de arc CO4 pre CO5 pra CO5/POs CO1 CO2	cestion of action the control of the	S.D. and r Osterway ovators a covators a covators a covators and danalyse e of the pructured e procedu	ovation and Ulrich, I alder, "Bi alder, "Bi and Sor Association and Searcher see, the son need analyse the product. business sures for p	nd Entre K.T. "Prousiness ns; 2010 on, "Patres, Innovertudents and des ideas for fluct condents model for the condents rotection PO4	epreneur oduct de model of ent IPR rators", N s will be ign think r new pr cepts ba for MVP n of their	ship", Resign and generation able to continuous sed on the rideas' rid	Routledge de develor de la contraction de la con	chnolog hennai, n POs a PO8	Press, I 7, 7 th ed k for vis y Comr 2017 mer neceds and peds and PO9	London, ition, Mcrisionaries mercializ eds d presen	, Collins Ind 2014. Graw-Hill H , game cha ation – Inno	igher ngers	Educe, and Mar	ation, 2 I challe keting BT Ma ighest erstan nalysir applyin applyin	2020. engers", 1st : pped : Level) ding (K2) ng (K4) ng (K4) g (K3) g (K3)
1. Ris REFEREN 1. Pe 2. E 3. A e 4. Ir CO COURSE CO On comple CO1 un CO2 ide arc CO4 pre CO5 pra CO5/POS CO1 CO2 CO3	cestion of a chitecture edict a stactice the	S.D. and r Osterway ovators a cok for Resthe cour innovation and danalyse e of the pructured e procedu	ovation and Ulrich, I alder, "Bi alder, "Bi and Sor Association assemble seems on need analyse the product. business tures for p	nd Entre K.T. "Pro usiness ns; 2010 on, "Paters, Innov students and des ideas for luct cond rotection PO4 3 3 3	epreneur oduct de model g ent IPR eators", N s will be ign think r new pr cepts ba for MVP n of their PO5	ship", Resign and generation and serioducts sed on to the sed on t	Routledged development of the customer of the	chnolog hennai, POS a POS a 2 3	Press, I 7, 7 th ed k for vis y Comr 2017 mer nededs and nd PSC PO9	London, dition, Mccisionaries mercializateds eds d presen PO10 3 3 3	PO11 3 3	igher Ingers vation PO1 3 3	Educe, and Mar	ation, 2 I challe keting BT Ma ighest erstan nalysir applyin applyin	2020. engers", 1st : pped : Level) ding (K2) ng (K4) ng (K4) g (K3) g (K3)
1. Ris REFEREN 1. Pe 2. E 3. A e 4. Ir CO COURSE C On comple CO1 un CO2 ide arc CO4 pre CO5 pra CO5/POS CO1 CO2	cestion of action the control of the	S.D. and r Osterway ovators a covators a covators a covators and danalyse e of the pructured e procedu	ovation and Ulrich, I alder, "Bi alder, "Bi and Sor Association and Searcher see, the son need analyse the product. business sures for p	nd Entre K.T. "Prousiness ns; 2010 on, "Patres, Innovertudents and des ideas for fluct condents model for the condents rotection PO4	epreneur oduct de model g ent IPR rators", N s will be ign think r new pr cepts ba for MVP n of their PO5	ship", Resign and generation able to continuous sed on the rideas' rid	Routledge development of the customer of the c	chnolog hennai, n POs a PO8	Press, I 7, 7 th ed k for vis y Comr 2017 mer neceds and peds and PO9	eds d presen	, Collins Ind 2014. Graw-Hill H , game cha ation – Inno	igher Ingers vation PO1 3 3 3	Educe, and Mar	ation, 2 I challe keting BT Ma ighest erstan nalysir applyin applyin	2020. engers", 1st : pped : Level) ding (K2) ng (K4) ng (K4) g (K3) g (K3)

		ASSESSMEN	T PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	30	40	10			100
CAT2	20	30	40	20			100
CAT3	30	30	40				100
ESE	20	30	30	20			100

								SE LEVI						
				(Common to	All Engin	eering a	nd Tech	nology	Branches	5)				
Programme Branch	.	AII BE/B	BTech Bra	nches					Sem.	Category	L	Т	Р	Credit
Prerequisit	es	German	Language	Level 1					All	OE	4	0	0	4
Preamble		German vocabula	n language ary to unde gain a com	to help the le A1 level con erstand and opprehensive u	npetence. eciprocat	. This cou te in dail	urse will y life situ	help to uations	assimilation a broa	e the basic g der sense. A	ramma thoro	ar str ugh le	uctures earner	s and gair will be
Unit – I		Contact	s(Kontakt	te):										9
	understan			ons, speaking s, Making ap										
Unit – II		Accomo	odation(Di	ie Wohnung):									9
	ng Accon	nmodatio	on advertis	sements, de	scribing a									
<u> </u>			•	with to be ver		ive with	sehr/zu,	Adjectiv	ve with A	ccusative, pr	epositi	ons v	vith Da	
Unit - III				?(Arbeiten S derstanding .		inne adı	articomo	ante On	inione T	elenhonic co	nvereo	tione	Speal	9 king abou
	mar – Perl	fect tens	e, Particip	le II – regula	and irreg	gular ver					iveisa	110115	, opear	king abou
Unit – IV				e(Kleidung u		<u> </u>								9
Clothes, Ch Grammar – Dative, Verb	Interrogat	tive artic	clothes, re cles and D	eporting on period on peri	e articles,	enting or Partizip	neself ir II – se	n Super parable	markets, and nor	Information -separable \	and re	esear Perso	ch abo	out Berlin onouns i
Unit – V			and Vacati	ion(Gesundl	neit und	Urlaub):								9
										th tips. Gram				
Tourist desti	s – sollen, inations. G	müssen Grammar	ı, nicht dür r – Pronou	fen, dürfen, n: <i>man</i> , Que	Suggestic stion word	ons for tr	avel, Pa <i>r, Wen,</i> I	ath, Pos Was, W	tcards, w em, Adve	eather, Traverbs – Zuerst	el repo , <i>dann,</i>	rts, F <i>Spä</i>	Problen ter, Zu	ns in hote <i>m Schl</i> Total: 4
TEXT BOOK	s – sollen, inations. C	müssen Grammar gler, Pau	ı, nicht dür r – Pronou ıl Rusch, H	fen, dürfen.	Suggestic stion word	ons for tr	avel, Pa <i>r, Wen,</i> I	ath, Pos Was, W	tcards, w em, Adve	eather, Traverbs – Zuerst	el repo , <i>dann,</i>	rts, F <i>Spä</i>	Problen ter, Zu	ns in hote <i>m Schl</i> Total:4
TEXT BOOK 1. Stef Glos 2.	s – sollen, inations. G K: fanie Deng ssar with 2	müssen Grammar gler, Pau	ı, nicht dür r – Pronou ıl Rusch, H	fen, dürfen. n: <i>man</i> , Que: lelen Schmitz	Suggestic stion word	ons for tr	avel, Pa <i>r, Wen,</i> I	ath, Pos Was, W	tcards, w em, Adve	eather, Traverbs – Zuerst	el repo , <i>dann,</i>	rts, F <i>Spä</i>	Problen ter, Zu	ns in hote <i>m Schl</i> Total:4
TEXT BOOK 1. Stef Glos 2. REFERENCE	s – sollen, inations. G	müssen Grammar gler, Pau 2 CDs", (, nicht dür r – Pronou Il Rusch, H Goyal Pub	fen, dürfen. n: <i>man</i> , Que: lelen Schmitz	Suggestic stion word , Tanja S , 2015.	ons for tr ds – Wer ieber, "N	avel, Pa r, Wen, I	ath, Pos Was, W	tcards, w lem, Adve	eather, Traverbs – Zuerst	el repo , <i>dann,</i>	rts, F <i>Spä</i>	Problen ter, Zu	ns in hote <i>m Schl</i> Total:4
TEXT BOOK 1. Stef Glos 2. REFERENC 1. http	s – sollen, inations. G K: fanie Dengssar with 2 EES: s://ocw.mi	müssen Grammar gler, Pau 2 CDs", (n, nicht dür r – Pronou Il Rusch, H Goyal Pub Massachus	fen, dürfen. n: <i>man</i> , Que lelen Schmitz lishers, Delhi	Suggestic stion word , Tanja S , 2015.	ieber, "N	etzwerk	ath, Pos Was, W	tcards, w fem, Adve	eather, Trav rbs – Zuerst mdsprache A	el repo , <i>dann,</i>	rts, F <i>Spä</i>	Problen ter, Zu	ns in hote <i>m Schl</i> Total:4
TEXT BOOK 1. Stef Glos 2. REFERENC 1. http 2. http	s – sollen, inations. G K: fanie Dengssar with 2 EES: s://ocw.mi	müssen Grammar gler, Pau 2 CDs", (it.edu – N	n, nicht dür r – Pronou Il Rusch, H Goyal Pub Massachus	fen, dürfen. n: man, Ques lelen Schmitz lishers, Delhi	Suggestic stion word , Tanja S , 2015.	ieber, "N	etzwerk	ath, Pos Was, W	tcards, w fem, Adve	eather, Trav rbs – Zuerst mdsprache A	el repo , <i>dann,</i>	vuch,	Problen ter, Zu	ns in hote m Schl Total:4
TEXT BOOK 1. Stef Glos 2. REFERENC 1. http 2. http	s – sollen, inations. G K: fanie Dengssar with 2 EES: s://ocw.mi s://www.d	müssen Grammar gler, Pau 2 CDs", (it.edu – N lw.com/e	n, nicht dür r – Pronou il Rusch, H Goyal Pub Massachus en/learn-ge	fen, dürfen. n: man, Ques lelen Schmitz lishers, Delhi setts Institute	Suggestic stion word , Tanja S , 2015.	ieber, "N	etzwerk	ath, Pos Was, W	tcards, w fem, Adve	eather, Trav rbs – Zuerst mdsprache A	el repo , <i>dann,</i>	rts, F Spä	Arbeit:	ns in hote m Schl Total:4 sbuch und
TEXT BOOK 1. Stef Glos 2. REFERENC 1. http 2. http COURSE Of On complete	s – sollen, inations. G K: fanie Dengssar with 2 EES: s://ocw.mi s://www.d	müssen Grammar gler, Pau 2 CDs", (it.edu – N lw.com/e	n, nicht dür r – Pronou il Rusch, H Goyal Pub Massachus en/learn-ge	fen, dürfen. n: man, Ques lelen Schmitz lishers, Delhi setts Institute erman - Deuts	Suggestic stion word , Tanja S , 2015.	ieber, "N	etzwerk	ath, Pos Was, W	tcards, w fem, Adve	eather, Trav rbs – Zuerst mdsprache A	el repo , <i>dann,</i>	ouch,	Arbeits BT Map ghest	ns in hote m Schl Total:4
TEXT BOOK 1. Stef Glos 2. REFERENC 1. http 2. http COURSE Of On complet CO1 und	s – sollen, inations. G K: fanie Dengssar with 2 EES: s://ocw.mi s://www.d UTCOME tion of the erstand le	müssen Grammar gler, Pau 2 CDs", (it.edu – N lw.com/e	n, nicht dür r – Pronou il Rusch, H Goyal Pub Massachus en/learn-ge	fen, dürfen. n: man, Ques lelen Schmitz lishers, Delhi setts Institute erman - Deuts	Suggestics stion word word word word word word word word	ieber, "N	etzwerk	ath, Pos Was, W	tcards, w fem, Adve	eather, Trav rbs – Zuerst mdsprache A	el repo , <i>dann,</i>	e E (Hi	Arbeits BT Map ghest nember	ns in hote m Schl Total:4 sbuch und pped Level)
TEXT BOOK 1. Stef Glos 2. REFERENC 1. http 2. http COURSE Of On complet CO1 und CO2 assi	s – sollen, inations. G K: fanie Deng ssar with 2 EES: s://ocw.mi s://www.d UTCOME tion of the erstand le	müssen Grammar gler, Pau 2 CDs", (it.edu – N w.com/e s: e course etters and cabulary	Massachus en/learn-ge e, the stud d simple te	fen, dürfen. n: man, Ques lelen Schmitz lishers, Delhi setts Institute erman - Deuts lents will be	Suggesticstion word The Tanja Sanda	ieber, "N	etzwerk	ath, Pos Was, W	e ional Bro	eather, Trav rbs – Zuerst mdsprache A	el repo , <i>dann,</i>	euch, E (Hi Rem	Arbeits BT Map ghest nember	ns in hote m Schl Total:4 sbuch und pped Level) ring (K1)
TEXT BOOK 1. Stef Glos 2. REFERENC 1. http 2. http COURSE Of On complet CO1 und CO2 assi CO3 com	s – sollen, inations. G K: fanie Dengssar with 2 EES: s://ocw.mi s://www.d UTCOME tion of the erstand le	müssen Grammar gler, Pau 2 CDs", (it.edu – I w.com/e e course etters and cabulary concept (n, nicht dür r – Pronoui r – P	fen, dürfen. n: man, Ques lelen Schmitz lishers, Delhi setts Institute erman - Deuts lents will be exts	Suggesticstion word The strong	ieber, "N	etzwerk	ath, Pos Was, W	e ional Bro	eather, Trav rbs – Zuerst mdsprache A	el repo , <i>dann,</i>	euch, E (Hi Rem Unde	Arbeit: Arbeit: BT Map ghest nember erstance	pped Level) Ling (K2)
TEXT BOOK 1. Stef Glos 2. REFERENC 1. http 2. http COURSE O'On complet CO1 und CO2 assi CO3 com CO4 und	s – sollen, inations. G K: fanie Deng ssar with 2 EES: s://ocw.mi s://www.d UTCOME tion of the erstand le imilate voo hprehend deerstand he erstand he	müssen Grammar gler, Pau 2 CDs", (it.edu – I lw.com/e etters and cabulary concept (ow to do	n, nicht dür r – Pronoul Il Rusch, H Goyal Pub Massachus en/learn-ge e, the stud d simple te on Accom of time, tel shopping	fen, dürfen. n: man, Ques lelen Schmitz lishers, Delhi setts Institute erman - Deuts lents will be exts lendation an lephonic conv	Suggesticstion word Tanja S Tanja S To of Techr Tache Well Table to Tersation Tersation Tersation	ieber, "N nology Ope, Geran	etzwerk	ath, Pos Was, W	e ional Bro	eather, Trav rbs – Zuerst mdsprache A	el repo , <i>dann,</i>	ets, F Spä Duch, Duch, Et (Hi Rem Unde	Arbeit: Arbeit: BT Map ghest nember erstance	pped Level) ring (K2) ding (K2)
TEXT BOOK 1. Stef Glos 2. REFERENC 1. http 2. http COURSE O'On complet CO1 und CO2 assi CO3 com CO4 und	s – sollen, inations. G K: fanie Deng ssar with 2 EES: s://ocw.mi s://www.d UTCOME tion of the erstand le imilate voo hprehend deerstand he erstand he	müssen Grammar gler, Pau 2 CDs", (it.edu – I lw.com/e etters and cabulary concept (ow to do	n, nicht dür r – Pronoul Il Rusch, H Goyal Pub Massachus en/learn-ge e, the stud d simple te on Accom of time, tel shopping	fen, dürfen. n: man, Ques lelen Schmitz lishers, Delhi setts Institute erman - Deuts lents will be exts emodation an	Suggesticstion word Tanja S Tanja S To of Techr Tache Well Table to Tersation Tersation Tersation	ieber, "N nology Ope, Geran	etzwerk	ath, Pos Was, W	e ional Bro	eather, Trav rbs – Zuerst mdsprache A	el repo , <i>dann,</i>	ets, F Spä Duch, Duch, Et (Hi Rem Unde	Arbeit: Arbeit: BT Map ghest nember erstance	ns in hote m Schl Total:4 sbuch und pped Level) ring (K1) ding (K2)
TEXT BOOK 1. Stef Glos 2. REFERENC 1. http 2. http COURSE O'On complet CO1 und CO2 assi CO3 com CO4 und	s – sollen, inations. G K: fanie Deng ssar with 2 EES: s://ocw.mi s://www.d UTCOME tion of the erstand le imilate voo hprehend deerstand he erstand he	müssen Grammar gler, Pau 2 CDs", (it.edu – I lw.com/e etters and cabulary concept (ow to do	n, nicht dür r – Pronoul Il Rusch, H Goyal Pub Massachus en/learn-ge e, the stud d simple te on Accom of time, tel shopping	fen, dürfen. n: man, Ques lelen Schmitz lishers, Delhi setts Institute erman - Deuts lents will be exts lephonic conv in a German to plan perso	Suggesticstion word Tanja S Tanja S To of Techr Tache Well Table to Tersation Tersation Tersation	ieber, "N nology Ope, Geran	etzwerk pen Cou many's I	ath, Pos Was, W	tcards, we were a second to the second to th	eather, Trav rbs – Zuerst mdsprache A	el repo , <i>dann,</i>	ets, F Spä Duch, Duch, Et (Hi Rem Unde	Arbeit: Arbeit: BT Map ghest nember erstance	pped Level) ring (K2) ding (K2)
TEXT BOOK 1. Stef Glos 2. REFERENC 1. http 2. http COURSE Of On complet CO1 und CO2 assi CO3 com CO4 und	s – sollen, inations. G K: fanie Dengssar with 2 EES: s://ocw.mi s://www.d UTCOME tion of the erstand le imilate voc erstand he erstand be	müssen Grammar gler, Pau 2 CDs", (it.edu – I lw.com/e etters and cabulary concept (ow to do	n, nicht dür r – Pronoul Il Rusch, H Goyal Pub Massachus en/learn-ge e, the stud d simple te on Accom of time, tel shopping s and how	fen, dürfen. n: man, Ques lelen Schmitz lishers, Delhi setts Institute erman - Deuts lents will be exts lephonic conv in a German to plan perso	Suggestics Suggestics Suggestion word The suggesti	ieber, "N nology Ope, Geran	etzwerk pen Cou many's I	ath, Pos Was, W	tcards, we were a second to the second to th	eather, Trav rbs – Zuerst mdsprache A	el repo , <i>dann,</i>	ets, F Spä Duch, Duch, Et (Hi Rem Unde Unde	Arbeit: Arbeit: BT Map ghest nember erstance	pped Level) ring (K2) ding (K2)
TEXT BOOK 1. Stef Glos 2. REFERENC 1. http 2. http COURSE Of On complet CO1 und CO2 assi CO3 com CO4 und CO5 und	s – sollen, inations. G K: fanie Dengssar with 2 EES: s://ocw.mi s://www.d UTCOME tion of the erstand le imilate voc erstand he erstand be	müssen Grammar gler, Pau 2 CDs", (it.edu – I w.com/e etters and cabulary concept (ow to do ody parts	n, nicht dür r – Pronoul Il Rusch, H Goyal Pub Massachus en/learn-ge e, the stud d simple te on Accom of time, tel shopping s and how	fen, dürfen. n: man, Ques lelen Schmitz lishers, Delhi setts Institute erman - Deuts lents will be exts lephonic conv in a German to plan perso	Suggesticstion word Tanja S Tanja S Tanja S To of Techr Tache Well Table to Techr Tache Well Tach	ieber, "N nology Ope, Geran	etzwerk etzwerk pen Cou many's	ath, Pos Was, W	tcards, we were the als Free tional Broading	eather, Traverbs – Zuerst	1-urst	ets, F Spä Duch, Duch, Et (Hi Rem Unde Unde	Arbeit: Arbeit: BT Map ghest nember erstance erstance	ns in hote m Schl Total:4 Sbuch und sbuch und sbuch und shuch und

CO3				1	2	3	3	
CO4				1	2	3	3	
CO5				1	2	3	3	

ASSESSMENT PATTERN - THEORY

		ACCECOMEN	,				
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	75	25					100
CAT2	25	75					100
CAT3	25	75					100
ESE	25	75					100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Branch All BE/Brech Branches		Sem.	Category	L	Т	Р	Credit
Prerequisites German Language Level	2	All	OE	3	0	0	3
Preamble This course provides enrenhances the vocabulary equips one to express operations.	iching information about vari and speaking ability to resp pinions and negotiate appoin answer confidently in everyo	ond to and also see tments. With diligen	k information	in tho	se sit	uatior	s. It also
Jnit – I All about food (Rund Ur		,					9
Understand information about person, Speak absomething, To speak about feelings, To express Articles in Dative, Yes/No questions, Reflexive	opinions, To answer question						
Jnit – II School days (Nach der							9
Understand School reports, Speak and write co Understand School types in Germany and spea n Dativ and Akkusativ. Unit – III Media in everyday life (I To speak about advantages and disadvantage	ak about it. Grammar: Modal Medien in Alltag):	verbs in Past tense	, Positional Ve	erbs, ⁻	Two-v	vay pr	epositions 9
Inderstand and Write Movie reviews. Gramma	r: Comparative degree, Con	nparative Sentences	with 'Als' and	l 'Wie	, Sub	ordina	ate clause
with 'dass', Superlative degree. Unit – IV Feelings and expressio	no (Cofiible):					1	9
Jnit – IV Feelings and expression Express thanks and congratulations, Talk about		ormation about festiv	als and sneak	ahoi	ıt it T	o des	_
Express joy and regrets, Understand and writ Adjectives to be used along with definite article	e Blog entries, Write appro s.						rith 'Wenr
Jnit – V Profession and Travel (9
To have a conversation at ticket counter, To to career preferences, Ideate the dream job, To pre Express uncertainty, Understand and give direct Describe a statistic, Understand information ab Prepositions, verb – 'werden', Subordinate claustening.	epare and make telephone ca tions, Understand a newspa out a trip, Talk about travel.	alls, To understand t per article, Say you Grammar: Adjectiv	own opinion, e to be used a	Talk a	about with i	the w ndefin	ay to work ite articles
career preferences, Ideate the dream job, To pre Express uncertainty, Understand and give direct Describe a statistic, Understand information ab Prepositions, verb – 'werden', Subordinate claus istening.	epare and make telephone ca tions, Understand a newspa out a trip, Talk about travel. use – indirect questions, All chmitz, Tanja Sieber, "Netzw	alls, To understand t per article, Say you Grammar: Adjectiv units will include ele	own opinion, e to be used a ments for rea	Talk a along ding,	about with i writin	the w ndefin g, spe	ray to worl lite articles eaking and Total:4
career preferences, Ideate the dream job, To pre Express uncertainty, Understand and give direct Describe a statistic, Understand information ab Prepositions, verb – 'werden', Subordinate clauses Extra Book: Stefanie Dengler, Paul Rusch, Helen Se	epare and make telephone ca tions, Understand a newspa out a trip, Talk about travel. use – indirect questions, All chmitz, Tanja Sieber, "Netzw	alls, To understand t per article, Say you Grammar: Adjectiv units will include ele	own opinion, e to be used a ments for rea	Talk a along ding,	about with i writin	the w ndefin g, spe	ray to worl lite articles eaking and Total:4
career preferences, Ideate the dream job, To pre Express uncertainty, Understand and give direct Describe a statistic, Understand information ab Prepositions, verb – 'werden', Subordinate clause istening. TEXT BOOK: 1. Stefanie Dengler, Paul Rusch, Helen Sc Glossar with 2 CDs", Goyal Publishers 2.	epare and make telephone ca tions, Understand a newspa out a trip, Talk about travel. use – indirect questions, All chmitz, Tanja Sieber, "Netzw	alls, To understand t per article, Say you Grammar: Adjectiv units will include ele	own opinion, e to be used a ments for rea	Talk a along ding,	about with i writin	the w ndefin g, spe	ray to work lite articles eaking and Total:4
career preferences, Ideate the dream job, To pre Express uncertainty, Understand and give direct Describe a statistic, Understand information ab Prepositions, verb – 'werden', Subordinate clausistening. FEXT BOOK: 1. Stefanie Dengler, Paul Rusch, Helen Stefanie Dengler, Paul Rusch, Helen Stefanie Communication (Communication) 2.	epare and make telephone ca etions, Understand a newspa out a trip, Talk about travel. use – indirect questions, All chmitz, Tanja Sieber, "Netzw , Delhi, 2015	alls, To understand to per article, Say your Grammar: Adjective units will include elected with the per article and the per ar	own opinion, e to be used a ments for read mdsprache A1	Talk allong ding,	about with i writin	the windefing, spe	ray to worl lite articles eaking and Total:4
career preferences, Ideate the dream job, To pre Express uncertainty, Understand and give direct Describe a statistic, Understand information ab Prepositions, verb – 'werden', Subordinate clausistening. FEXT BOOK: 1. Stefanie Dengler, Paul Rusch, Helen Stefanie Dengler, Paul Rusch, Helen Stefanie Dengler, Goyal Publishers 2. REFERENCES:	epare and make telephone cations, Understand a newspations, Understand a newspation at trip, Talk about travel. Juse – indirect questions, All chmitz, Tanja Sieber, "Netzwa, Delhi, 2015	alls, To understand to per article, Say your Grammar: Adjective units will include elegant with the per article, Say your Grammar: Adjective units will include elegant with the per article and the per artic	own opinion, e to be used a ments for read mdsprache A1	Talk allong ding,	about with i writin	the windefing, spe	ray to work lite articles eaking and Total:4
career preferences, Ideate the dream job, To pre Express uncertainty, Understand and give direct Describe a statistic, Understand information ab Prepositions, verb – 'werden', Subordinate clausistening. FEXT BOOK: 1. Stefanie Dengler, Paul Rusch, Helen Stefanie Dengler, Paul Rusch, Helen Stefanie Communication (Communication) 2. REFERENCES: 1. Rosa-Maria Dallapiazza, Eduard von Stefanie Dengler, Paul Rusch, Helen Stefanie Communication (Communication) 2. https://www.dw.com/en/learn-german -	epare and make telephone cations, Understand a newspations, Understand a newspation at trip, Talk about travel. Juse – indirect questions, All chmitz, Tanja Sieber, "Netzwa, Delhi, 2015	alls, To understand to per article, Say your Grammar: Adjective units will include elegant with the per article, Say your Grammar: Adjective units will include elegant with the per article and the per artic	own opinion, e to be used a ments for read mdsprache A1	Talk allong ding,	about with i writin ouch,	the windefing, special Arbeit	ray to worl ite articles eaking and Total:4
career preferences, Ideate the dream job, To pre Express uncertainty, Understand and give direct Describe a statistic, Understand information above prepositions, verb — 'werden', Subordinate clausistening. TEXT BOOK: 1. Stefanie Dengler, Paul Rusch, Helen Scale Glossar with 2 CDs", Goyal Publishers 2. REFERENCES: 1. Rosa-Maria Dallapiazza, Eduard von Schutzen Glosser With Schutzen Glosser Gl	epare and make telephone cations, Understand a newspations, Understand a newspation at trip, Talk about travel. Juse – indirect questions, All chmitz, Tanja Sieber, "Netzwa, Delhi, 2015 Jan, Till Schonherr, "Tangrar Deutsche Welle, Geramany	alls, To understand to per article, Say your Grammar: Adjective units will include elegant with the per article, Say your Grammar: Adjective units will include elegant with the per article and the per artic	own opinion, e to be used a ments for read mdsprache A1	Talk allong ding,	about with i writin	the windefing, special Arbeit	ray to worl ite articles eaking and Total:4
career preferences, Ideate the dream job, To presexpress uncertainty, Understand and give direct Describe a statistic, Understand information aborepositions, verb – 'werden', Subordinate clausistening. FEXT BOOK: 1. Stefanie Dengler, Paul Rusch, Helen Stefanie Dengler, Paul Rusch	epare and make telephone cations, Understand a newspare out a trip, Talk about travel. Juse – indirect questions, All chmitz, Tanja Sieber, "Netzwa, Delhi, 2015 Jan, Till Schonherr, "Tangrar Deutsche Welle, Geramany will be able to	alls, To understand to per article, Say your Grammar: Adjective units will include element of the per article, Say your death of the per article, Say your death of the per article of t	own opinion, e to be used a ments for read mdsprache A1	Talk allong ding,	about with i writin ouch,	the windefing, special Arbeit 1.	ray to wor lite article eaking and Total:4
areer preferences, Ideate the dream job, To pre Express uncertainty, Understand and give direct Describe a statistic, Understand information ab Prepositions, verb – 'werden', Subordinate claustening. TEXT BOOK: 1. Stefanie Dengler, Paul Rusch, Helen St. Glossar with 2 CDs", Goyal Publishers 2. REFERENCES: 1. Rosa-Maria Dallapiazza, Eduard von St. 2. https://www.dw.com/en/learn-german	epare and make telephone cations, Understand a newspare out a trip, Talk about travel. Juse – indirect questions, All chmitz, Tanja Sieber, "Netzwa, Delhi, 2015 Jan, Till Schonherr, "Tangrar Deutsche Welle, Geramany will be able to ant and be able express one	alls, To understand to per article, Say your Grammar: Adjective units will include elected by the series of the se	own opinion, e to be used a ments for read mdsprache A1	Talk along ding,	buch, 201 B (Higher	Arbeit 1. T Maj	Total:4 Sebuch und pped Level)
career preferences, Ideate the dream job, To preferences uncertainty, Understand and give direct Describe a statistic, Understand information above prepositions, verb — 'werden', Subordinate clausistening. TEXT BOOK: 1. Stefanie Dengler, Paul Rusch, Helen Stefanie Dengler, Paul R	epare and make telephone cations, Understand a newspations, Understand a newspation at trip, Talk about travel. Juse — indirect questions, All chmitz, Tanja Sieber, "Netzwa, Delhi, 2015 Jan, Till Schonherr, "Tangrar Deutsche Welle, Geramany vill be able to ant and be able express one didiscuss about habits and process of the standard proc	alls, To understand to per article, Say your Grammar: Adjective units will include elected by the series of the se	own opinion, e to be used a ments for read mdsprache A1	Talk along ding,	B (High	Arbeit T Map ghest erstand	Total:4 Total:4 Esbuch und pped Level) ring (K1)
career preferences, Ideate the dream job, To preferences uncertainty, Understand and give direct Describe a statistic, Understand information aborepositions, verb — 'werden', Subordinate clausistening. TEXT BOOK: 1. Stefanie Dengler, Paul Rusch, Helen Scale Glossar with 2 CDs", Goyal Publishers 2. REFERENCES: 1. Rosa-Maria Dallapiazza, Eduard von Scale Hittps://www.dw.com/en/learn-german - COURSE OUTCOMES: On completion of the course, the students were understand German food style, restaur understand German school system and analyze and compare media in everydate and compare media in everydate.	epare and make telephone cations, Understand a newspations, Understand a newspations, Understand a newspations, Allows — indirect questions, — indir	alls, To understand to per article, Say your Grammar: Adjective units will include elected by the series of the se	own opinion, e to be used a ments for read mdsprache A1	Talk a along ding,	B (High	Arbeit 1. T Maj ghest embe	ray to worl ite articles eaking and Total:4 Esbuch und pped Level) ring (K1)

CO1				1	2	3	3	
CO2				1	2	3	3	
CO3				1	2	3	3	
CO4				1	2	3	3	
CO5				1	2	3	3	

ASSESSMENT	PATTERN	- THEORY

	/ (OOLOO!!!L!	· · · · · · · - · · · ·	•			
Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
75	25					100
25	75					100
25	75					100
25	75					100
	(K1) % 75 25 25	Remembering (K1) % Understanding (K2) % 75 25 25 75 25 75	Remembering (K1) % Understanding (K2) % Applying (K3) % 75 25 25 75 25 75	Remembering (K1) % Understanding (K2) % Applying (K3) % Analyzing (K4) % 75 25 25 25 75 25 25 75 25	Remembering (K1) % Understanding (K2) % Applying (K3) % Analyzing (K4) % Evaluating (K5) % 75 25	(K1) % (K2) % (K3) % (K4) % (K5) % (K6) % 75 25 75 25 25 75 25 25 25 25 25

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

				22	2GEO07-GE	RMAN LA	NGUAGE	E LEVE	L 4					
		T		(Comm	on to All En	ineering a	nd Techn	ology E	Branches	5)				
Prograr Branch		All BE/B	Tech B	ranches					Sem.	Category	L	Т	Р	Credit
Prerequ	uisites	German	Langua	age Level	13				All	OE	3	0	0	3
Preamb	ole	behavior various r concepts be able	ur and a media a s which to read a	nddressing nd at worl would lay and respo	g relationship k. Enhance the foundat	s in persor earner's gr on to have s, write sim	nal and prammatica a better ple forma	rofession al expo hold of	onal fron sure and the lang	erstanding va t. It helps one I cover the co uage. With fo etters and tex	to un re bas cused	dersta sic gra d lean	and repart ammat ning or	ports from tical ne should
Jnit – I		Learning								ı reasons, U				9
Gramma Unit - II Express and rea attractio Unit - II To comp informat Unit - II Talk abo	ar: Conjunct I sing enthusia cting, Makir on. Gramma II plain, apolo tion, Write a V out music st	Athletic asm, hope, ng an apporter: Conjunct Living T gize & give nd correct: Good Er yle, Buy co	,weil, Ko (Sportli , disappointment tions – co ogether in, As for a story. ntertain	ich): ointment, Underst deshalb, tr r (Zusami or someth Grammat ment (Gu	Understand tanding a re rotzdem, Ve men Leben) ning, Understik: Konjunct ute Unterhal	estions), G ng and wr port about bs with Da and experi v II- könnte tung):	iting fan o an excur tiv and Al ence repo	commersion, Ukkusati	ents, For Indersta v eport on clauses -	standing and sitions – bis, mulating follonding difficult the past, Talkarals and Wer	w-ups texts abou	s, Mak, Intro	king subducing	ab+dativ 9 uggestions g a tourist 9 pond to 9 nformatior
Articles: Jnit - V Talk abo Jnderst behavio Informat Gramma Subordii	Was fuer e out wishes, tand a text, I or, Express in tion, Discus atik: Konjund nate clause	ine? , Pron Passage Express wi Exchange intentions, Us about cli ctiv II (Wish	e of time ishes, G nformati Use the ichés ar ies, Sugg	n about parman/jeman e and Cul Sive Suggetion, Talk and write and gestions),	ainting, Und and/niemand Iture (Zeitab estions, Und about prover the salutation about them.	erstand des and alles/e lauf & Kul erstand a os, write a Understan All units w	scription of etwas/nick (tur): conversati story. Un and tips in vill include	of a pic hts , Re tion, Pl aderstal a text, e elem	an some nd inform Talk abo	ecribe a picturentences in Nething togetheration about court forms of a reading, writions, Rela	r, To ther oddres	ask oculture sing o	others ses, Disothers,	9 something cuss abou Give more
Articles: Unit - V Talk abo Underst Dehavio Onformat Gramma Subordii	Was fuer e out wishes, tand a text, I or, Express in tion, Discus atik: Konjund nate clauses	ine? , Pron Passage Express wi Exchange in ntentions, Us about cli ctiv II (Wishs with dami	ouns – I e of time ishes, G nformati Jse the ichés ar ies, Sugg it and Ui	n about poman/jema e and Cul Give Suggaion, Talk a appropria and write a gestions), mZu.	ainting, Undand/niemand/Iture (Zeitak estions, Undabout prover about prover the salutation about them. Verbs with p	erstand des and alles/e lauf & Kul erstand a os, write a Understan All units w repositions	scription of etwas/nicletur): conversatestory. Un nd tips in rill includes, W- ques	of a pic hts , Re tion, Pl derstar a text, e elem stions v	an some nd inform Talk abo ents for with prep	ecribe a picturentences in N ething togetheration about court forms of a reading, writing total properties of the court forms of a reading, writing total properties of the court forms of a reading, writing the court forms of a reading, writing the court forms of a reading, writing the court forms of a reading, writing the court forms of a reading, writing the court forms of a reading, writing the court forms of a reading, writing the court forms of a reading, writing the court forms of a reading the court forms of a reading the court forms of a reading, writing the court forms of a reading the court forms of a reading, writing the court forms of a reading, writing the court forms of a reading, writing the court forms of a reading the court forms of a reading, writing the court forms of a reading the court forms of a	omina er, To other o ddres ng, s tive se	ask oculture sing c peaki enten	others ses, Disothers, ng and ces in	9 something cuss abou Give more d listening Akkusativ,
Articles: Unit - V Talk abo Underst oehavio onformat Gramma Subordii TEXT B	Was fuer e out wishes, tand a text, I or, Express in tion, Discus atik: Konjund nate clause: BOOK: Stefanie De	ine? , Pron Passage Express wi Exchange in ntentions, Us about cli ctiv II (Wishs with dami	ouns – I e of time ishes, G nformati Jse the ichés ar ies, Sugg it and Ui	n about poman/jema e and Cul Give Suggaion, Talk a appropria and write a gestions), mZu.	ainting, Undand/niemand/Iture (Zeitak estions, Undabout prover about prover the salutation about them. Verbs with p	erstand des and alles/e lauf & Kul erstand a os, write a Understan All units w repositions	scription of etwas/nicletur): conversatestory. Un nd tips in rill includes, W- ques	of a pic hts , Re tion, Pl derstar a text, e elem stions v	an some nd inform Talk abo ents for with prep	ecribe a picturentences in N ething togetheration about court forms of a reading, writtositions, Rela	omina er, To other o ddres ng, s tive se	ask oculture sing c peaki enten	others ses, Disothers, ng and ces in	9 something cuss abou Give more d listening Akkusativ,
Articles: Unit - V Talk abo Underst behavio informat Gramma Subordin TEXT B 1. REFERI	Was fuer e out wishes, tand a text, I or, Express in tion, Discus atik: Konjund nate clause: BOOK: Stefanie De Goyal Publi ENCES:	ine? , Pron Passage Express wi Exchange in Intentions, Us about cli ctiv II (Wishs with dami	ouns – I e of time ishes, G nformati Jse the ichés ar ies, Sugg it and Ui	n about poman/jema e and Cul Give Sugge ion, Talk a appropria and write a gestions), mZu.	ainting, Undand/niemand/lture (Zeitak estions, Undabout prover the salutation about them. Verbs with p	erstand des and alles/e lauf & Kulerstand a cos, write a Understand All units we repositions a Sieber, "	scription of twas/nicletur): conversations of tips in not tips in rill include s, W- ques	of a pic hts , Re tion, Pl derstar a text, e elem stions v	an some and inform Talk aborents for with prep	ecribe a picturentences in N ething togetheration about court forms of a reading, writtositions, Rela	er, To ther oddres ng, s tive so	ask oculture sing c peaki enten	others ses, Disothers, ng and ces in	9 something cuss abou Give more d listening Akkusativ,
Articles: Jnit - V Talk abo Jnderst behavio onformat Gramma Subordii TEXT B 1. REFERI 1.	Was fuer e out wishes, tand a text, I or, Express in tion, Discus atik: Konjund inate clause BOOK: Stefanie De Goyal Publi ENCES: Rosa-Maria	ine? , Pron Passage Express wi Exchange intentions, Us about cli ctiv II (Wishes with dami	iouns – I e of time ishes, G informati Use the ichés ar ies, Sugg it and Ui	n about poman/jema e and Cul Give Suggetion, Talk and write and write and gestions), mZu. n, Helen Solard von Jane	ainting, Undand/niemand Iture (Zeitak estions, Undabout prover about tation about them. Verbs with p	erstand des and alles/e lauf & Kul erstand a cos, write a Understal All units wrepositions a Sieber, "	scription of twas/nich tur): conversation of tips in rill includes, W- questions 2 (Gram 2 (Gr	of a pic hts , Re tion, Pl iderstal a text, e elem stions v	lan some and inform Talk about the preparent of the prepa	excribe a picturentences in Note that the station about court forms of a reading, writtositions, Relations, Re	er, To ther oddres ng, s tive so	ask oculture sing c peaki enten	others ses, Disothers, ng and ces in	9 something cuss abou Give mon d listening Akkusativ
Articles: Unit - V Talk abo Underst behavio informat Gramma Subordii TEXT B 1. REFERI 1.	Was fuer e out wishes, tand a text, I or, Express in tion, Discus atik: Konjund inate clause BOOK: Stefanie De Goyal Publi ENCES: Rosa-Maria	ine? , Pron Passage Express wi Exchange intentions, Us about cli ctiv II (Wishes with dami	iouns – I e of time ishes, G informati Use the ichés ar ies, Sugg it and Ui	n about poman/jema e and Cul Give Suggetion, Talk and write and write and gestions), mZu. n, Helen Solard von Jane	ainting, Undand/niemand/lture (Zeitak estions, Undabout prover the salutation about them. Verbs with p	erstand des and alles/e lauf & Kul erstand a cos, write a Understal All units wrepositions a Sieber, "	scription of twas/nich tur): conversation of tips in rill includes, W- questioners.	of a pic hts , Re tion, Pl iderstal a text, e elem stions v	lan some and inform Talk about the preparent of the prepa	excribe a picturentences in Note that the station about court forms of a reading, writtositions, Relations, Re	er, To ther oddres ng, s tive so	ask oculture sing c peaki enten	others ses, Disothers, ng and ces in	9 something cuss abou Give more d listening Akkusativ,
Articles: Unit - V Talk abo Underst behavio informat Gramma Subordii TEXT B 1. REFERI 1. 2.	Was fuer e out wishes, tand a text, I or, Express in tion, Discus atik: Konjund inate clause BOOK: Stefanie De Goyal Publi ENCES: Rosa-Maria https://www	ine? , Pron Passage Express wi Exchange intentions, Us about clictiv II (Wishes with dami	iouns – I e of time ishes, G informati Use the ichés ar ies, Sugg it and Ui	n about poman/jema e and Cul Give Suggetion, Talk and write and write and gestions), mZu. n, Helen Solard von Jane	ainting, Undand/niemand Iture (Zeitak estions, Undabout prover about tation about them. Verbs with p	erstand des and alles/e lauf & Kul erstand a cos, write a Understal All units wrepositions a Sieber, "	scription of twas/nich tur): conversation of tips in rill includes, W- questioners.	of a pic hts , Re tion, Pl iderstal a text, e elem stions v	lan some and inform Talk about the preparent of the prepa	excribe a picturentences in Note that the station about court forms of a reading, writtositions, Relations, Re	er, To ther oddres ng, s tive so	ask oculture sing c peaking enten	others ses, Disothers, ng and ces in the ces in the ces in the ces in the ces in the ces in the ces in the ces in the ces in the ces in the ces in the ces in the ces in the ces in the ces in the ces in the ces in the ces	9 something cuss about Give more distening Akkusativ. Total:4:
Articles: Jnit - V Falk abo Jnderst Dehavio Dehavio Onformat Gramma Subordii FEXT B 1. REFERI 1. 2.	was fuer e out wishes, tand a text, I or, Express in tion, Discus atik: Konjund nate clause: BOOK: Stefanie De Goyal Publi ENCES: Rosa-Maria https://www	ine? , Pron Passage Express wi Exchange in Intentions, Us about cli ctiv II (Wishs with dami engler, Pau ishers, Dell A Dallapiazz J.dw.com/e	e of time ishes, G nformati Jse the ichés ar ies, Sugg it and Ui	n about poman/jema e and Cul Give Sugggion, Talk a appropria and write a gestions), mZu. a, Helen S ard von Ja german -	ainting, Undand/niemand Iture (Zeitak estions, Undabout prover about tation about them. Verbs with p	erstand des and alles/e lauf & Kulerstand a cos, write a Understand All units we repositions a Sieber, "herr, "Tangelle, Gerand	scription of twas/nich tur): conversation of tips in rill includes, W- questioners.	of a pic hts , Re tion, Pl iderstal a text, e elem stions v	lan some and inform Talk about the preparent of the prepa	excribe a picturentences in Note that the station about court forms of a reading, writtositions, Relations, Re	er, To ther oddres ng, s tive so	ask oculture sing opeaki enten	others ses, Disported in the ses, Disported in the ses	9 something cuss about Give more distening Akkusativ Total:4
Articles: Jnit - V Talk abo Jnderst Jn	Was fuer e out wishes, tand a text, I or, Express in tion, Discus atik: Konjund inate clause SOOK: Stefanie De Goyal Publi ENCES: Rosa-Maria https://www	ine? , Pron Passage Express wi Exchange intentions, Us about cliptiv II (Wishes with daminal pangler, Paulishers, Della Dallapiazza v.dw.com/e	e of time ishes, G ishes, G informati Use the ichés an ies, Sugg it and Ui Il Rusch hi, 2015 za, Edua	n about poman/jema e and Cul sive Suggetion, Talk and appropriate and write and gestions), mZu. and Helen Solution and write and won Jacard von Jacard	painting, Undand/niemand/Iture (Zeitak estions, Undabout prover about prover the salutation about them. Verbs with page (Schmitz, Tan an, Till Schore	erstand des and alles/e lauf & Kul erstand a os, write a Understan All units w repositions a Sieber, " herr, "Tangelle, Geran	scription of etwas/nich tur): conversa story. Un nd tips in rill includes, W- ques	of a pic hts , Re tion, Pl iderstal a text, e elem stions v	elative selan some and inform Talk aborents for with preposch als F	excribe a picturentences in Note that the station about court forms of a reading, writtositions, Relations, Re	er, To ther oddres ng, s tive so	ask oculturesing opeaking enten	others ses, Disported in the ses, Disported	9 something cuss about Give more distensing Akkusativ Total:4 peitsbuch*
Articles: Jnit – V Talk abo Jnderst Jn	Was fuer e out wishes, tand a text, I or, Express in tion, Discus tion, Discus tion, Discus tion, Conjunct inate clause: SOOK: Stefanie De Goyal Publi ENCES: Rosa-Maria https://www	ine? , Pron Passage Express wi Exchange in ntentions, Use about clip betiv II (Wishes with dami) engler, Paul ishers, Dell a Dallapiazz d.dw.com/e IES: the course arning in W	e of time ishes, G ishes, G ishes, G ishes, G ishes, G ishes, G ishes and U ishes, Sugg it an	n about poman/jema e and Cul sive Sugge ion, Talk a appropria nd write a gestions), mZu. a, Helen S ard von Ja german - udents w e, underst	ainting, Undand/niemand Iture (Zeitak estions, Undandout prover ite salutation about them. Verbs with p Schmitz, Tan an, Till Schor Deutsche W	erstand decand alles/erstand alles/erstand alles/erstand accepts, write a cos, writ	scription of etwas/nicle tur): conversation story. Unind tips in rill includes, W- question and the tips in rill and tips in rill includes, we have a second and tips in rill includes, we have a second and tips in rill includes and tips in rill includes and tips in rill includes a second and tips in rilliance and tips in rilliance a second and tips in rilliance a second and tips in rilliance and tips in rilliance and tips in rilliance and tips in rilliance and tips in rilliance and tips in rilliance and tips in rilliance and tips in rilliance and tips in rilliance and tips in rilliance and tips in rilliance and tips in rilliance and tips in rilliance and tips in rilliance a	of a pichts, Rention, Pladerstan a text, e elem stions was decreased as the control of the contr	elative selan some and inform Talk aborents for with preposch als F	excribe a picturentences in Note that the station about court forms of a reading, writtositions, Relations, Re	er, To ther oddres ng, s tive so	ask oculture sing copeaking entenders and control of the control o	ch, Arb	9 something cuss about Give more distening Akkusativ Total:4 peitsbuch*
Articles: Jnit - V Talk abo Jnderst Jn	was fuer e out wishes, tand a text, I or, Express in tion, Discus atik: Konjund nate clause: SOOK: Stefanie De Goyal Publi ENCES: Rosa-Maria https://www	ine? , Pron Passage Express wi Exchange in Intentions, I Is about clipitiv II (Wish Is with dami engler, Pau Ishers, Dell In Dallapiazz Inductory Ithe course Ithe course Ithe course Ithe course Ithe course	ouns – In the original of the original of the original of the original of the original of the original of the original of the original of the original of the original of the original of the original of the original orig	n about poman/jema	rainting, Undand/niemand Iture (Zeitak estions, Undandout prover te salutation about them. Verbs with p Cohmitz, Tan an, Till Schor Deutsche W rill be able to	erstand des and alles/e and alles/e and alles/e lauf & Kul erstand a cos, write a Understal All units we repositions a Sieber, " herr, "Tangelle, Gerand and unde the and unde alles and ma the and unde alles alles and ma the and unde alles alles alles and ma the and unde alles alles alles and ma the and unde alles al	scription of etwas/nicle tur): conversar story. Un and tips in rill include s, W- ques fine transport of the present of the pr	of a pic hts , Re tion, Pladerstal a text, e elem stions varies and ternation.	elative selan some and inform Talk aborents for with preposch als F	excribe a picturentences in Note that the station about court forms of a reading, writtositions, Relations, Re	er, To ther oddres ng, s tive so	ask oculture sing copeaking entenders are shown as a second control of the contro	others ses, Disothers, ng and ces in	9 something cuss about Give more distening Akkusativ Total:4: peitsbuch* ped Level) ring (K1)
Articles: Jnit - V Talk abo Jnderst Jn	was fuer e out wishes, tand a text, I or, Express in tion, Discus atik: Konjund nate clause: SOOK: Stefanie De Goyal Publi ENCES: Rosa-Maria https://www	ine? , Pron Passage Express wi Exchange in Intentions, Us about clip out of the course Intentions out of the course Intention out of the co	ouns – In the original of the original of the original of the original of the original of the original of the original of the original of the original of the original of the original of the original of the original of the original origin	n about poman/jema e and Cul give Sugggion, Talk a appropria and write a gestions), mZu. and the sugggion of the suggestions and write a german - udents w e, underst ons, make	painting, Undand/niemand Iture (Zeitak estions, Undandout prover the salutation about them. Verbs with p Cochmitz, Tan an, Till Schor Deutsche W Itll be able to tanding repo	erstand des and alles/e and alles/e and alles/e lauf & Kul erstand a cos, write a Understal All units we repositions a Sieber, " herr, "Tangelle, Gerand and unde the and unde alles and ma the and unde alles alles and ma the and unde alles alles alles and ma the and unde alles alles alles and ma the and unde alles al	scription of etwas/nicle tur): conversar story. Un and tips in rill include s, W- ques fine transport of the present of the pr	of a pic hts , Re tion, Pladerstal a text, e elem stions varies and ternation.	elative selan some and inform Talk aborents for with preposch als F	excribe a picturentences in Note that the station about court forms of a reading, writtositions, Relations, Re	er, To ther oddres ng, s tive so	ask oculture sing opeaking entender and control of the control of	others ses, Dispothers, ng and ces in a	9 something cuss about Give more distening Akkusativ Total:4: peitsbuch", peitsbuch", ing (K1) ding (K2)
Articles: Jnit – V Falk abo Jnderst Jn	was fuer e out wishes, tand a text, I or, Express in tion, Discus atik: Konjund nate clause: SOOK: Stefanie De Goyal Publi ENCES: Rosa-Maria https://www	ine? , Pron Passage Express wi Exchange in Intentions, Us about clip city II (Wishs with dami) engler, Paulishers, Della Dallapiazz J.dw.com/e IES: The course arning in W to different tionships and to various comes	e of time ishes, G nformati Jse the ichés ar ies, Sugg it and Ui Il Rusch hi, 2015 za, Edua n/learn- /orkplace t situatio	n about poman/jeman/jeman/jeman/jeman de and Cullive Suggion, Talk a appropria and write a gestions), mZu. and the control of the control	painting, Undand/niemand Iture (Zeitak estions, Undandout prover the salutation about them. Verbs with p Cochmitz, Tan an, Till Schor Deutsche W Itll be able to tanding repo	erstand decand alles/erstand males/erstand males/erstand males/erstand and underschange in	scription of etwas/nicletwas/nicletwr): conversations of the conversation of the conve	of a pic hts , Re tion, Pladerstal a text, e elem stions varies and ternation.	elative selan some and inform Talk aborents for with preposch als F	excribe a picturentences in Note that the station about court forms of a reading, writtositions, Relations, Re	er, To ther oddres ng, s tive so	ask oculture sing opeaking entender ursbuce 2011 E (Hi Rem Unde	others ses, Dispotential of the ses, Dispotent	9 something cuss about Give more distensing Akkusativ Total:4 Delitsbuch* Deped Level) Ting (K1) ding (K2)
Articles: Jnit – V Talk abo Jnderst Jn	was fuer e out wishes, tand a text, I or, Express in tion, Discus atik: Konjund nate clause: SOOK: Stefanie De Goyal Publi ENCES: Rosa-Maria https://www	ine? , Pron Passage Express wi Exchange in Intentions, Us about clip city II (Wishs with dami) engler, Paulishers, Della Dallapiazz J.dw.com/e IES: The course arning in W to different tionships and to various comes	e of time ishes, G nformati Jse the ichés ar ies, Sugg it and Ui Il Rusch hi, 2015 za, Edua n/learn- /orkplace t situatio	n about poman/jeman/jeman/jeman/jeman de and Cullive Suggion, Talk a appropria and write a gestions), mZu. and the control of the control	ainting, Undand/niemand Iture (Zeitak estions, Undandout prover ite salutation about them. Verbs with p Schmitz, Tan an, Till Schor Deutsche W rill be able to tanding repo e appointmen ppriately to e ainment sage of prove	erstand decand alles/erstand males and understand and understand and understand and alles/erstand and clients and cl	scription of etwas/nicle twas/nicle tur): conversation of titur): conversation of tips in nid tips in	of a pichts, Relation, Pladerstal a text, e elem stions varies a text. K Deuts German ternation. xts.	elative selative selative selative selative selative selative send inform Talk aborents for with preposch als Fan)", Goya onal Broad	excribe a picturentences in Note that the station about court forms of a reading, writtositions, Relations, Re	er, To ther oddres ng, s tive so	ask oculture sing opeaking entender ursbuce 2011 E (Hi Rem Unde	others ses, Dispotential of the ses, Dispotent	9 something cuss about Give more distening Akkusativ. Total:4: Delitsbuch* Deped Level) Ting (K1) ding (K2) ding (K2)
Articles: Unit - V Talk abo Underst Dehavio Onformat Gramma Subordii TEXT B 1. REFERI 2. COURS On com CO1 CO2 CO3 CO4	out wishes, tand a text, I on, Express in tion, Discus atik: Konjund nate clause: BOOK: Stefanie De Goyal Public ENCES: Rosa-Maria https://www. BE OUTCOM pletion of the leverage less are ciprocate to the mandle relation of the leverage less are ciprocate to the mandle relation of the leverage less are ciprocate to the mandle relation of the leverage less are ciprocate to the mandle relation of the leverage less are ciprocate to the mandle relation of the leverage less are ciprocate to the mandle relation of the leverage less are ciprocate to the mandle relation of the leverage less are ciprocate to the mandle relation of the leverage less are ciprocate to the les	ine? , Pron Passage Express wi Exchange in Intentions, Us about clip city II (Wishs with dami) engler, Paulishers, Della Dallapiazz J.dw.com/e IES: The course arning in W to different tionships and to various comes	e of time ishes, G nformati Jse the ichés ar ies, Sugg it and Ui Il Rusch hi, 2015 za, Edua n/learn- /orkplace t situatio	n about poman/jeman/jeman/jeman/jeman/jeman e and Cullive Suggion, Talk a appropria and write a gestions), mZu. a, Helen S. ard von Jagerman - udents we, understand appropria appro	ainting, Undand/niemand Iture (Zeitak estions, Undandout prover ite salutation about them. Verbs with p Schmitz, Tan an, Till Schor Deutsche W rill be able to tanding report e appointment ppriately to e ainment	erstand decand alles/erstand alles/erstand alles/erstand alles/erstand alles/erstand allerstand malerstand malerstand malerstand malerstand and under and und	scription of etwas/nicle tur): conversar story. Un and tips in rill include s, W- ques (Netzwerk gram 2 (Conany's Interpretation) ke preser retand text formation ches.	of a pichts, Relation, Pladerstal a text, e elem stions varies a text. K Deuts German ternation. xts.	elative selative selative selative selative selative selative send inform Talk aborents for with preposch als Fan)", Goya onal Broad	excribe a picturentences in Note that the station about court forms of a reading, writtositions, Relations, Re	er, To ther oddres ng, s tive so	ask oculture sing opeaking entender and a contract of the cont	others ses, Dispotential of the ses, Dispotent	9 something cuss about Give more distening Akkusativ Total:4 Deitsbuch* Deped Level) Ting (K1) Ding (K2) Ding (K2) Ding (K2)

CO1				1	2	3	3	
CO2				1	2	3	3	
CO3				1	2	3	3	
CO4				1	2	3	3	
CO5				1	2	3	3	

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	75	25					100
CAT2	25	75					100
CAT3	25	75					100
ESE	25	75					100

 $^{^*}$ ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

				(00	200 to All	l Engine	orina -	d Ta -l-	nologii !	VEL 2					
Programme	Q.			(Comm	non to All	I Enginee	ering ar	nd Lech	nology I	Branches)					
Branch	<u>u</u>	All BE	BTech E	Branches						Sem.	Category	L	Т	Р	Credit
Prerequisite	es	Japan	ese Lang	juage Lev	vel 1					All	OE	4	0	0	4
Preamble		The ha	scic loval	of Japane	asa whic	h provide	e unde	retandi	na of Hi	ragana K	atakana and	1 1 1 0 K	aniic	and n	rovides
reamble			ility to un								iest other pe				
Jnit – I				groups											9
ai form-Verb nouns-Basic			Give and	ask permi	ission to	do an ac	tion-Pr	esent co	ontinuol	us form-Ro	estrict other	person	trom	i doing	an action
Jnit – II				Casual F											9
nai form-Dict Casual style		form-ta fo	orm-Polit	e style an	id Casua	al style di	ifferenc	es-Con	versatio	n in plain	style-Place	of usa	ge o	f Polite	style ar
Init – III				ns and th											9
ntroduction t ght -Noun m			xpress s	omeone o	ne's tho	ught-Con	nvey the	e messa	age of o	ne person	to another-	Ask sor	neor	ne if so	mething
Jnit – IV		Introdu	uction to	If clause	and rer	maining l	Kanjis	:							9
f clause tara	form-E	xpress g	ratitude	for an acti	ion done	by other	r perso	n-Hypo	thetical	situation-	Particles to	use in o	case	of Mot	ion verb
50 Kanjis Jnit – V		Introdu	uction to	giving a	nd recei	ivina witl	h te fo	rm and	"when.	even if"	usages:				9
Providing to a	and get											nd ever	ı ife	etc.	
															Total:
															i Otai.
· 															
EXT BOOK	(:														
		NIHON	GO-Japa	inese for E	Everyone	e", 2 nd Ed	dition, C	Soyal Pu	ublisher	s & Distrib	outors Pvt. L	td., Nev	w De	elhi, 20°	17
1. "MIN	INA NC	NIHON	GO–Japa	inese for E	Everyone	e", 2 nd Ed	dition, C	Goyal Po	ublisher	s & Distrik	outors Pvt. L	td., Ne	w De	elhi, 20°	17
1. "MIN	INA NC				· · ·						outors Pvt. L	td., Nev	w De	elhi, 201	17
1. "MIN REFERENCE 1. Marg	INA NC ES: gherita	Pezzopa	ne, "Try N	N5", 2 nd Ed	dition, Ta	ankobon	Softcov	ver, Jap	an, 201	7.		td., Ne	w De	elhi, 201	17
1. "MIN REFERENCE 1. Marg	INA NC ES: gherita	Pezzopa	ne, "Try N	N5", 2 nd Ed	dition, Ta	ankobon	Softcov	ver, Jap	an, 201	7.	outors Pvt. L	td., Nev	w De	elhi, 20°	17
1. "MIN REFERENCE 1. Marg 2. Saya	NNA NC ES: gherita aka Kur	Pezzopa ashina, "	ne, "Try N	N5", 2 nd Ed	dition, Ta	ankobon	Softcov	ver, Jap	an, 201	7.		td., Ne			
1. "MIN REFERENCE 1. Marg 2. Saya COURSE OU	INA NC ES: gherita aka Kur	Pezzopa ashina, "	ne, "Try N Japanese	N5", 2 nd Ec	dition, Ta	ankobon ster", 2 nd I	Softcov	ver, Jap	an, 201	7.		td., Nev	E	3T Map	pped
1. "MIN REFERENCE 1. Marg 2. Saya COURSE OL On completi	INA NC ES: gherita aka Kur UTCOM ion of t	Pezzopa ashina, " IES: he cours	ne, "Try N Japanese se, the st	N5", 2 nd Ec	dition, Ta	ankobon ster", 2 nd I	Softcov	ver, Jap	an, 201	7.			E (Hi	3T Map ghest	
1. "MIN REFERENCE 1. Marg 2. Saya COURSE OL On completi CO1 diffet	INA NO ES: gherita aka Kur JTCOM ion of t rentiate	Pezzopal ashina, " IES: he cours groups o	ne, "Try N Japaneso se, the st of verbs a	N5", 2 nd Ed e Word Sp tudents w and its forr	dition, Table di	ankobon ster", 2 nd l	Softcov	ver, Jap	an, 201	7.			E (Hi Rem	3T Map ghest nember	oped Level) ring (K1)
1. "MIN REFERENCE 1. Marg 2. Saya COURSE OL On completi CO1 differ	INA NO ES: gherita aka Kur JTCOM ion of t rentiate	Pezzopal ashina, " IES: he cours groups o	ne, "Try N Japaneso se, the st of verbs a	N5", 2 nd Ed e Word Sp eudents w	dition, Table di	ankobon ster", 2 nd l	Softcov	ver, Jap	an, 201	7.			E (Hi Rem	3T Map ghest nember	oped Level) ring (K1)
1. "MIN REFERENCE 1. Marg 2. Saya COURSE OL On completi CO1 differ CO2 under	gherita aka Kur JTCOM ion of trentiate erstand	Pezzopal ashina, " IES: he cours groups of	ne, "Try N Japaneso se, the st of verbs a	N5", 2 nd Ed e Word Sp tudents w and its forr	dition, Ta peedmas vill be ab ms n of Japa	ankobon ster", 2 nd I	Softco	ver, Jap	an, 201	7.			E (Hi Rem Unde	3T Map ghest nember	oped Level) ring (K1) ding (K2)
1. "MIN REFERENCE 1. Marg 2. Saya COURSE OL On completi CO1 differ CO2 unde CO3 completi	gherita gherita aka Kur JTCOM ion of trentiate erstand	Pezzopal ashina, " IES: he cours groups of Polite for	ne, "Try N Japanese se, the st of verbs a rm and C	N5", 2 nd Ede Word Spandits wand its form	dition, Ta peedmas vill be ab ms n of Japa and expre	ankobon ster", 2 nd I	Softco	ver, Jap	an, 201	7.			E (Hi Rem Unde	3T Map ghest nember erstand	oped Level) ring (K1) ding (K2)
1. "MIN REFERENCE 1. Marg 2. Saya COURSE OL On completi CO1 differ CO2 unde CO3 comp	gherita gherita aka Kur JTCOM ion of trentiate erstand	Pezzopal ashina, " IES: he cours groups of Polite for	ne, "Try N Japanese se, the st of verbs a rm and C	N5", 2 nd Ede Word Spanding W	dition, Ta peedmas vill be ab ms n of Japa and expre	ankobon ster", 2 nd I	Softco	ver, Jap	an, 201	7.			E (Hi Rem Unde	3T Map ghest nember erstand	oped Level) ring (K1) ding (K2)
1. "MIN REFERENCE 1. Marg 2. Saya COURSE OL On completi CO1 differ CO2 unde CO3 comp	INA NO ES: gherita aka Kur JTCOM ion of t rentiate erstand prehenderstand	Pezzopa ashina, " ES: he cours groups of Polite for d persona the Kanji	ne, "Try N Japanese se, the st of verbs a rm and C al commu	N5", 2 nd Ede Word Spandits wand its form	dition, Table edmas vill be alims n of Japa and expresipt and If	ankobon ster", 2 nd I	Softcov	ver, Jap	an, 201	7.			E (Hi Rem Unde	BT Map ghest nember erstand erstand	oped Level) ring (K1) ding (K2) ding (K2)
1. "MIN REFERENCE 1. Marg 2. Saya COURSE OLD On completi CO1 differ CO2 unde CO3 comp	INA NO ES: gherita aka Kur JTCOM ion of t rentiate erstand prehenderstand	Pezzopa ashina, " ES: he cours groups of Polite for d persona the Kanji	ne, "Try N Japanese se, the st of verbs a rm and C al commu	N5", 2 nd Ede Word Spandits form asual form	dition, Table edmas vill be alims n of Japa and expresipt and If	ankobon ster", 2 nd I	Softcov	ver, Jap	an, 201	7.			E (Hi Rem Unde	BT Map ghest nember erstand erstand	oped Level) ring (K1) ding (K2) ding (K2)
1. "MIN REFERENCE 1. Marg 2. Saya COURSE OL On completi CO1 differ CO2 unde CO3 comp	INA NO ES: gherita aka Kur JTCOM ion of t rentiate erstand prehenderstand	Pezzopa ashina, " ES: he cours groups of Polite for d persona the Kanji	ne, "Try N Japanese se, the st of verbs a rm and C al commu	N5", 2 nd Ede Word Spandits form asual form	dition, Table above the second	ankobon ster", 2 nd I	Softcov Edition tings	ver, Jap , Tanko	an, 201	7.			E (Hi Rem Unde	BT Map ghest nember erstand erstand	pped Level)
1. "MIN REFERENCE 1. Marg 2. Saya COURSE OL On completi CO1 differ CO2 unde CO3 comp CO4 unde CO5 comp	gherita gherita aka Kur JTCOM ion of trentiate erstand prehence erstand prehence	Pezzopal ashina, " IES: he cours groups of Polite for d personat the Kanji d concep	ne, "Try N Japanese se, the st of verbs a rm and C al commu	N5", 2 nd Ede Word Spate and its formasual formanese Scring if", "where	dition, Table and expression and jo	ankobon ster", 2 nd l	Softcov Edition tings	ration	an, 201 bon Sof	7. itcover, Ja	ipan, 2018.		E (Hi) Rem Unde Unde	BT Map ghest nember erstand erstand	oped Level) ing (K1) ding (K2) ding (K2)
1. "MIN REFERENCE 1. Marg 2. Saya COURSE OL On completi CO1 differ CO2 unde CO3 comp CO4 unde CO5 comp	INA NO ES: gherita aka Kur JTCOM ion of t rentiate erstand prehenderstand	Pezzopa ashina, " ES: he cours groups of Polite for d persona the Kanji	ne, "Try N Japanese se, the st of verbs a rm and C al commu	N5", 2 nd Ede Word Spandits form asual form	dition, Table above the second	ankobon ster", 2 nd l	Softcov Edition tings	ver, Jap , Tanko nation POs a PO8	nd PSO	7. ftcover, Ja		PO12	E (Hi) Rem Unde Unde	BT Map ghest nember erstand erstand	oped Level) ing (K1) ding (K2) ding (K2)
1. "MIN REFERENCE 1. Marg 2. Saya COURSE OL On completi CO1 differ CO2 unde CO3 comp CO4 unde CO5 comp CO5 comp	gherita gherita aka Kur JTCOM ion of trentiate erstand prehence erstand prehence	Pezzopal ashina, " IES: he cours groups of Polite for d personat the Kanji d concep	ne, "Try N Japanese se, the st of verbs a rm and C al commu	N5", 2 nd Ede Word Spate and its formasual formanese Scring if", "where	dition, Table and expression and jo	ankobon ster", 2 nd l	Softcov Edition tings	ration POs a POS 1	nd PSO	7. ftcover, Ja	ipan, 2018.	PO12 3	E (Hi) Rem Unde Unde	BT Map ghest nember erstand erstand	oped Level) ing (K1) ding (K2) ding (K2)
1. "MIN REFERENCE 1. Marg 2. Saya COURSE OL On completi CO1 differ CO2 unde CO3 comp CO4 unde CO5 comp CO5 CO5/POS CO1 CO2	gherita gherita aka Kur JTCOM ion of trentiate erstand prehence erstand prehence	Pezzopal ashina, " IES: he cours groups of Polite for d personat the Kanji d concep	ne, "Try N Japanese se, the st of verbs a rm and C al commu	N5", 2 nd Ede Word Spate and its formasual formanese Scring if", "where	dition, Table and expression and jo	ankobon ster", 2 nd l cole to anese ess greet f clause bb-related	Softcov Edition tings	ration POs a PO8 1 1	nd PSO	7. ftcover, Ja s PO10 3 3	ipan, 2018.	PO12 3 3	E (Hi) Rem Unde Unde	BT Map ghest nember erstand erstand	oped Level) ing (K1) ding (K2) ding (K2)
1. "MIN REFERENCE 1. Marg 2. Saya COURSE OL On completi CO1 differ CO2 unde CO3 comp CO4 unde CO5 comp CO5 CO1 CO2 CO3 CO1 CO2 CO3	gherita gherita aka Kur JTCOM ion of trentiate erstand prehence erstand prehence	Pezzopal ashina, " IES: he cours groups of Polite for d personat the Kanji d concep	ne, "Try N Japanese se, the st of verbs a rm and C al commu	N5", 2 nd Ede Word Spate and its formasual formanese Scring if", "where	dition, Table and expression and jo	ankobon ster", 2 nd l cole to anese ess greet f clause bb-related	Softcov Edition tings	potential properties of the pr	nd PSO PO9 2 2 2	7. ftcover, Ja s PO10 3 3 3 3	ipan, 2018.	PO12 3 3 3 3	E (Hi) Rem Unde Unde	BT Map ghest nember erstand erstand	oped Level) ing (K1) ding (K2) ding (K2)
1. Marg 2. Saya COURSE OL On completi CO1 diffet CO2 unde CO3 comp CO4 unde CO5 comp CO5 comp	gherita gherita aka Kur JTCOM ion of trentiate erstand prehence erstand prehence	Pezzopal ashina, " IES: he cours groups of Polite for d personat the Kanji d concep	ne, "Try N Japanese se, the st of verbs a rm and C al commu	N5", 2 nd Ede Word Spate and its formasual formanese Scring if", "where	dition, Table and expression and jo	ankobon ster", 2 nd l cole to anese ess greet f clause bb-related	Softcov Edition tings	ration POs a PO8 1 1	nd PSO	7. ftcover, Ja s PO10 3 3	ipan, 2018.	PO12 3 3	E (Hi) Rem Unde Unde	BT Map ghest nember erstand erstand	oped Level) ring (K1) ding (K2) ding (K2)

		ASSESSMEN	IT PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	75	25					100
CAT2	25	75					100
CAT3	25	75					100
ESE	25	75					100
* ±3% may be varied (CAT 1,2,3 – 50 mark	s & ESE – 100 mar	ks)				

				(Common to	All Engin	eering a	nd Tech	noloav	Branches)				
Progra Branch	mme&	All BE	/BTech Br						Sem.	Category	L	Т	Р	Credit
Prereq	uisites	Japane	ese Langu	age Level 2					AII	OE	3	0	0	3
Preamb	ble			level of Japa 50 Kanji's an										
Unit – I				Potential ver	•		,	•						9
				ssions-Expre ions and Kar		ite-Pote	ntial Ver	b Sente	nces-Sim	ultaneous a	ctions-\	√erb	Group	s-te Forr
		erbs- Emb		Fransitive ar nt about Fac				with ar	n Intentio	ns-Affirmativ	e Sent	ence	es- Cor	9 junction
Unit – I			uction to V	/olitional for	ms:									9
Express	sions of Spe	akers Inte	ention-Expr	ressing Sugg	estion or A	dvice-U	sage of	Adverbs	s and Qua	ntifiers-Bas	ic Ques	stion	s and k	anji's.
Jnit – I				mperative a										9
Comma	anding perso	on- Interro	ogatives-Ex	xpressions o	Third Pe	rson-Act	ions and	d its Oc	currence	- Possibilitie	es of a	n Ac	tion-Ch	nanging
States I Unit - \	Basic Quest V			Conditional 1	orm and I	Passive	verhs:							9
Descrip	tion of Rec	uirement		aker's Judge				rections	and sug	gestions-Pa	ssive f	orm	s of Ve	-
Questic	ons and Kan	i's.												
														Total
EXTE	воок:													
1.	"MINNA NO	NIHON	GO–Japan	ese for Every	one", 2 nd l	Edition, (Goyal Pı	ublisher	s & Distrik	outors Pvt. L	td., Ne	w De	elhi, 201	17.
	"MINNA NO) NIHON	GO-Japan	ese for Every	one", 2 nd I	Edition, (Goyal Pu	ublisher	s & Distrik	outors Pvt. L	td., Ne	w De	elhi, 20°	17.
2.		NIHON(GO–Japan	ese for Every	rone", 2 nd l	Edition, (Goyal Pı	ublisher	s & Distrik	outors Pvt. L	td., Ne	w De	elhi, 20°	17.
2.	"MINNA NO) NIHON	GO-Japan	ese for Every	one", 2 nd I	Edition, (Goyal Pu	ublisher	s & Distrib	outors Pvt. L	td., Ne	w De	elhi, 201	17.
2.	RENCES:		· · ·	ese for Every						outors Pvt. L	td., Ne	w De	elhi, 20°	17.
2. REFER	RENCES: Margherita	Pezzopai	ne, "Try N5	5", 2 nd Edition	, Tankobo	n Softco	ver, Jap	an, 201	7.		td., Ne	w De	elhi, 20°	17.
2.	RENCES: Margherita	Pezzopai	ne, "Try N5		, Tankobo	n Softco	ver, Jap	an, 201	7.		td., Ne	w De	elhi, 20	17.
2. REFER 1. 2.	RENCES: Margherita Sayaka Ku	Pezzopal	ne, "Try N5	5", 2 nd Edition	, Tankobo	n Softco	ver, Jap	an, 201	7.		td., Ne			
2. REFER 1. 2.	RENCES: Margherita Sayaka Ku SE OUTCOM	Pezzopar rashina, ",	ne, "Try N5 Japanese ^v	5", 2 nd Edition	, Tankobo naster", 2 ^r	n Softco	ver, Jap	an, 201	7.		td., Ne		elhi, 20°	pped
2. REFER 1. 2. COURS On con	RENCES: Margherita Sayaka Ku SE OUTCOM	Pezzopal rashina, ", IES: the cours	ne, "Try N5 Japanese \ se, the stu	5", 2 nd Edition Word Speed	, Tankobo naster", 2 ^r	n Softco	ver, Jap	an, 201	7.			E (H	3T Map	pped Level)
2. REFER 1. 2. COURS On con	Margherita Sayaka Ku SE OUTCOM mpletion of read and un	Pezzopar rashina, ". IES: the cours nderstand	ne, "Try N5 Japanese V se, the stu	5", 2 nd Editior Word Speed dents will be abularies.	, Tankobo naster", 2 ^r	n Softco	ver, Jap	an, 201	7.			(H Rem	BT Map ighest nember	oped Level) ing (K1)
2. REFER 1. 2. COURSON con	Margherita Sayaka Ku SE OUTCOM mpletion of read and un	Pezzopar rashina, ". IES: the cours nderstand	ne, "Try N5 Japanese V se, the stu	5", 2 nd Edition Word Speed	, Tankobo naster", 2 ^r	n Softco	ver, Jap	an, 201	7.			(H Rem	BT Map ighest nember	oped Level) ing (K1)
2. REFER 1. 2. COURS On con CO1 CO2	Margherita Sayaka Ku SE OUTCOM Inpletion of read and understand	Pezzopar rashina, ". MES: the cours nderstand	ne, "Try N5 Japanese V se, the stu I BasicVoca	5", 2 nd Editior Word Speed dents will be abularies.	, Tankobo master", 2 ^r e able to	n Softco	ver, Jap	an, 201	7.			(H (H) Ren	3T Map ighest nember erstand	pped Level) ing (K1)
2. REFER 1. 2. COURS On con CO1 CO2 CO3	Margherita Sayaka Ku SE OUTCOM Inpletion of read and understand	Pezzopal rashina, ", MES: the course nderstand Convers d persona	ne, "Try N5 Japanese V se, the stu d BasicVoca ations used	5", 2 nd Edition Word Speed dents will be abularies. d in daily life.	, Tankobo master", 2 ^r e able to	n Softco	ver, Jap	an, 201	7.			(H (H) Rem Und	BT Mapighest nember erstand	oped Level) ing (K1) ling (K2)
2. REFER 1. 2. COURS	Margherita Sayaka Ku SE OUTCOM Inpletion of read and understand	Pezzopal rashina, ", MES: the course nderstand Convers d persona	ne, "Try N5 Japanese V se, the stu d BasicVoca ations used	5", 2 nd Edition Word Speed dents will be abularies. d in daily life.	, Tankobo master", 2 ^r e able to	n Softco	ver, Jap	an, 201	7.			(H (H) Rem Und	BT Mapighest nember erstand	oped Level) ing (K1)
2. REFER 1. 2. COURS On con CO1 CO2 CO3	RENCES: Margherita Sayaka Ku SE OUTCOM Inpletion of read and understand comprehent understand	Pezzopar rashina, "s MES: the course nderstand Convers d persona	ne, "Try N5 Japanese V se, the stu d BasicVoca ations used al commun i's in Japan	5", 2 nd Edition Word Speed dents will be abularies. d in daily life.	, Tankobo master", 2 ^r e able to xpress gre	n Softco d Edition	ver, Jap	an, 201	7.			(H (H) Ren Und Und	BT Mapighest nember erstanders	oped Level) ing (K1) ling (K2)
2. REFER 1. 2. COURSON con CO1 CO2 CO3 CO4	RENCES: Margherita Sayaka Ku SE OUTCOM Inpletion of read and understand comprehent understand	Pezzopar rashina, "s MES: the course nderstand Convers d persona	ne, "Try N5 Japanese V se, the stu d BasicVoca ations used al commun i's in Japan	b", 2 nd Edition Word Speed dents will be abularies. d in daily life. ication and e	, Tankobo master", 2 ^r e able to express green	n Softco d Edition	ver, Jap	an, 201	7.			(H (H) Ren Und Und	BT Mapighest nember erstanders	oped Level) ing (K1) ling (K2) ling (K2)
2. REFER 1. 2. COURS On con CO1 CO2 CO3 CO4 CO5	SENCES: Margherita Sayaka Ku SE OUTCOM Inpletion of read and understand comprehen understand comprehen comprehen	Pezzopal rashina, ". MES: the cours nderstand Convers d persona the Kanji d Cohere	ne, "Try N5 Japanese \(\) Se, the stu I BasicVocations used al commun i's in Japanent convers	5", 2 nd Edition Word Speed dents will be abularies. d in daily life. hication and e	, Tankobo master", 2 ^r e able to xpress green ryday situat	n Softco	ver, Jap	nan, 201	7. ftcover, Ja	apan, 2018.		(H) Ren Und Und	BT Mapighest nember erstanders	oped Level) ing (K1) ling (K2 ling (K2
2. REFER 1. 2. COURS On con CO1 CO2 CO3 CO4 CO5	Margherita Sayaka Ku SE OUTCOM mpletion of read and understand comprehen understand comprehen Comprehen	Pezzopar rashina, "s MES: the course nderstand Convers d persona	ne, "Try N5 Japanese \(\) Se, the stu I BasicVocations used al commun i's in Japan ent convers	b", 2 nd Edition Word Speed dents will be abularies. d in daily life. ication and e	, Tankobo master", 2 ^r e able to xpress green ryday situat	n Softco d Edition	ver, Jap n, Tanko n POs a PO8	nd PSO	7. ftcover, Ja		PO12	(H) Ren Und Und	BT Mapighest nember erstanders	oped Level) ing (K1) ling (K2) ling (K2)
2. REFER 1. 2. COURS On con CO1 CO2 CO3 CO4 CO5 CO5/Pc CO1	Margherita Sayaka Ku SE OUTCOM Inpletion of read and understand comprehen understand comprehen Understand	Pezzopal rashina, ". MES: the cours nderstand Convers d persona the Kanji d Cohere	ne, "Try N5 Japanese \(\) Se, the stu I BasicVocations used al commun i's in Japanent convers	5", 2 nd Edition Word Speed dents will be abularies. d in daily life. hication and e	, Tankobo master", 2 ^r e able to xpress green ryday situat	n Softco	POS a	nd PSO	7. ftcover, Ja PS PO10 3	apan, 2018.	PO12 3	(H) Ren Und Und	BT Mapighest nember erstanders	oped Level) ing (K1) ling (K2 ling (K2
2. REFER 1. 2. COURS On con CO1 CO2 CO3 CO4 CO5 CO5/Pc CO1 CO2	Margherita Sayaka Ku SE OUTCOM mpletion of read and understand comprehen understand comprehen OS PO1	Pezzopal rashina, ". MES: the cours nderstand Convers d persona the Kanji d Cohere	ne, "Try N5 Japanese \(\) Se, the stu I BasicVocations used al commun i's in Japanent convers	5", 2 nd Edition Word Speed dents will be abularies. d in daily life. hication and e	, Tankobo master", 2 ^r e able to xpress green ryday situat	n Softco	POS a	nd PSO	7. ftcover, Javes Polo 3 3	apan, 2018.	PO12 3 3	(H) Ren Und Und	BT Mapighest nember erstanders	oped Level) ing (K1) ling (K2 ling (K2
2. REFER 1. 2. COURSON CON CO1 CO2 CO3 CO4 CO5 CO1 CO2 CO3 CO4 CO5	Margherita Sayaka Ku SE OUTCOM Inpletion of read and understand comprehen understand comprehen Comprehen OS PO1	Pezzopal rashina, ". MES: the cours nderstand Convers d persona the Kanji d Cohere	ne, "Try N5 Japanese \(\) Se, the stu I BasicVocations used al commun i's in Japanent convers	5", 2 nd Edition Word Speed dents will be abularies. d in daily life. hication and e	, Tankobo master", 2 ^r e able to xpress green ryday situat	n Softco	POS at POS at 1	nd PSOP	7. ftcover, Ja PS PO10 3 3 3 3	apan, 2018.	PO12 3 3 3 3	(H) Ren Und Und	BT Mapighest nember erstanders	oped Level) ing (K1) ling (K2 ling (K2
2. REFER 1. 2. COURS On con CO1 CO2 CO3 CO4 CO5 CO5/Pc CO1 CO2	Margherita Sayaka Ku SE OUTCOM mpletion of read and understand comprehen understand comprehen OS PO1	Pezzopal rashina, ". MES: the cours nderstand Convers d persona the Kanji d Cohere	ne, "Try N5 Japanese \(\) Se, the stu I BasicVocations used al commun i's in Japanent convers	5", 2 nd Edition Word Speed dents will be abularies. d in daily life. hication and e	, Tankobo master", 2 ^r e able to xpress green ryday situat	n Softco	POS a	nd PSO	7. ftcover, Javes Polo 3 3	apan, 2018.	PO12 3 3	(H) Ren Und Und	BT Mapighest nember erstanders	oped Level) ing (K1 ling (K2 ling (K2 ling (K2

		ASSESSMEN	IT PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	75	25					100
CAT2	25	75					100
CAT3	25	75					100
ESE	25	75					100

						NESE L								
Dragramma 9			(Comm	non to A	II Engin	eering a	nd Tech	nology	Branches)				
Programme& Branch	All BE	/BTech Br	ranches						Sem.	Category	L	Т	Р	Credi
Prerequisites	JAPAN	NESE LAN	NGUAGE	LEVE	L 3				All	OE	3	0	0	3
Preamble										s of verbs, it				
Jnit – I		uction to				1		,				3		9
Causes and Sec	quences-Cau	ises and E	ffects-Int	terrogat	tive Patt	erns-Adj	ective a	s a Nou	n -Basic (Questions ar	nd Kanj	ji's		
Jnit – II		uction to l												9
Expressions for Questions and k		Receiving	of Thing	gs-Polite	Expres	ssion of	Reques	t-Indica	ting a Pur	pose of Act	ions-Ba	asic (Quantif	iers-Bas
Jnit – III		uction to	States o	f an Ac	tion:									9
Sentence Patte	n to Indicate	Appearan	nce-Degr	ee of A	ction an	d State-	Adjectiv	es as A	dverbs- C	onvey inforr	mation	-Bas	ic Que	stions ar
anji's. Jnit – IV	Introd	uction to	Caucativ	vo Vorh	·e•									9
Causative Form	s of Verbs-					ing-Hyp	othetica	l Quest	ions-Judg	ement and	Course	e of a	an acti	
Questions and I Unit – V		uction to I	Ralation	ehin in	Social	Status							1	9
Honorific expres							olite exp	ression	s-Basic Q	uestions an	d Kanji	's.		3
														Total:
EXT BOOK:														
EXT BOOK.														
1. "MINNA	NO NIHON	GO-Japar	nese for E	Everyor	ne", 2 nd I	Edition, (Goyal P	ublisher	s & Distrik	outors Pvt. L	td., Ne	w De	lhi, 201	17.
1. "MINNA 2.	NO NIHON	GO–Japar	nese for E	Everyor	ne", 2 nd I	Edition, (Goyal Pi	ublisher	s & Distrik	outors Pvt. L	td., Ne	w De	lhi, 201	17.
2.		GO–Japar	nese for E	Everyor	ne", 2 nd I	Edition, (Goyal Pı	ublisher	s & Distrik	outors Pvt. L	td., Ne	w De	lhi, 20 ⁻	17.
2. REFERENCES:										outors Pvt. L	td., Ne	w De	lhi, 201	17.
2. REFERENCES: 1. Marghe	rita Pezzopa	ne, "Try N	5", 2 nd Ed	dition, T	ankobo	n Softco	ver, Jap	an, 201	7.		td., Ne	w De	lhi, 201	17.
2. REFERENCES: 1. Marghe		ne, "Try N	5", 2 nd Ed	dition, T	ankobo	n Softco	ver, Jap	an, 201	7.		td., Ne	w De	lhi, 20 ⁻	17.
2. REFERENCES: 1. Marghe 2. Sayaka	rita Pezzopa Kurashina, "	ne, "Try N	5", 2 nd Ed	dition, T	ankobo	n Softco	ver, Jap	an, 201	7.		.td., Ne		lhi, 20°	
2. REFERENCES: 1. Marghe 2. Sayaka COURSE OUTCON completion	rita Pezzopa Kurashina, " COMES: of the cours	ne, "Try N Japanese se, the stu	5", 2 nd Eo Word Sp udents w	dition, T peedma vill be a	ankobo ester", 2 ^r e ble to	n Softco	ver, Jap	an, 201	7.		td., Ne	E (Hi	BT Map	pped Level)
2. REFERENCES: 1. Marghe 2. Sayaka COURSE OUTCOn completion	rita Pezzopa Kurashina, "	ne, "Try N Japanese se, the stu	5", 2 nd Eo Word Sp udents w	dition, T peedma vill be a	ankobo ester", 2 ^r e ble to	n Softco	ver, Jap	an, 201	7.		td., Ne	E (Hi	BT Map	pped Level)
2. Sayaka COURSE OUTCOn completion CO1 read an	rita Pezzopa Kurashina, " COMES: of the cours	ne, "Try Ne Japanese se, the stu d Relations	5", 2 nd Eo Word Sp udents w ship of a	dition, T peedma vill be a Person	ankobo ester", 2 ^r ble to	n Softco	ver, Jap	an, 201	7.			E (Hi	BT Map ghest ember	oped Level) ing (K1)
2. REFERENCES: 1. Marghe 2. Sayaka COURSE OUTCO COn completion read an CO2 underst	rita Pezzopa Kurashina, " COMES: of the cours d Understan	ne, "Try Na Japanese se, the stu d Relations ations Use	5", 2 nd Eo Word Sp udents w ship of a ed in Eve	dition, T peedma vill be a Person eryday A	ankobo ster", 2 ^r ble to	n Softco	ver, Jap	an, 201	7.			E (Hi Rem	BT Map ghest nember erstanc	oped Level) ing (K1)
2. Sayaka COURSE OUTCON completion CO1 read an CO2 underst CO3 compre	rita Pezzopa Kurashina, " COMES: of the cours d Understand and Convers	ne, "Try Na Japanese se, the stu d Relations sations Use	5", 2 nd Eo Word Sp udents w ship of a ed in Eve	dition, Topeedma vill be a Person eryday A	ankobo ster", 2 ^r ble to	n Softco	ver, Jap	an, 201	7.			E (Hii Rem Unde	BT Map ghest nember erstand	oped Level) ing (K1) ling (K2)
2. REFERENCES: 1. Marghe 2. Sayaka COURSE OUTO COn completion CO1 read an CO2 underst CO3 compre	rita Pezzopa Kurashina, " COMES: of the cours d Understan	ne, "Try Na Japanese se, the stu d Relations sations Use	5", 2 nd Eo Word Sp udents w ship of a ed in Eve	dition, Topeedma vill be a Person eryday A	ankobo ster", 2 ^r ble to	n Softco	ver, Jap	an, 201	7.			E (Hii Rem Unde	BT Map ghest nember erstand	oped Level) ing (K1) ling (K2)
2. REFERENCES: 1. Marghe 2. Sayaka COURSE OUTCON completion CO1 read an CO2 underst CO3 compre	rita Pezzopa Kurashina, " COMES: of the cours d Understand and Convers	ne, "Try Ne Japanese se, the stu d Relations actions Use ats at Near i's in Japan	5", 2 nd Ec Word Sp udents w ship of a ed in Eve Natural	dition, Topeedma vill be a Person eryday A Speed.	ankobo ster", 2 ^r ble to	n Softco	ver, Jap	an, 201	7.			E (Hi (Hi) Rem Unde	BT Map ghest nember erstand erstand	oped Level) ing (K1)
2. REFERENCES: 1. Marghe 2. Sayaka COURSE OUTCON completion CO1 read an CO2 underst CO3 compre	rita Pezzopa Kurashina, " COMES: of the cours d Understan and Convers hend Conter	ne, "Try Ne Japanese se, the stu d Relations actions Use ats at Near i's in Japan	5", 2 nd Ec Word Sp udents w ship of a ed in Eve Natural	dition, Topeedma vill be a Person eryday A Speed.	ankobo ster", 2 ^r ble to	n Softco	ver, Jap	an, 201	7.			E (Hi (Hi) Rem Unde	BT Map ghest nember erstand erstand	oped Level) ing (K1) ling (K2) ling (K2)
2. REFERENCES: 1. Marghe 2. Sayaka COURSE OUTCON completion CO1 read an CO2 underst CO3 compre	rita Pezzopa Kurashina, " COMES: of the cours d Understan and Convers hend Conter	ne, "Try Ne Japanese se, the stu d Relations actions Use ats at Near i's in Japan	5", 2 nd Ec Word Sp udents w ship of a ed in Eve Natural	dition, Topeedma vill be a Person eryday A Speed. ript	ankobo ster", 2 ^r ble to	n Softco	ver, Jap	an, 201 bon So	7. ftcover, Ja			E (Hi (Hi) Rem Unde	BT Map ghest nember erstand erstand	oped Level) ing (K1) ling (K2) ling (K2)
2. REFERENCES: 1. Marghe 2. Sayaka COURSE OUTCON completion read an cool read an cool underst cool compre cool underst cool compre cool compre	rita Pezzopa Kurashina, " COMES: of the cours d Understand and Convers hend Conter and the Kanj hend Orally I	ne, "Try Ne Japanese se, the stu d Relations rations Use ats at Near i's in Japan	5", 2 nd Ed Word Sp udents we ship of a ed in Eve Natural sinese Scr Materials	dition, Topeedma vill be a Person eryday A Speed. ript s.	cankobo ster", 2 ^r ble to cativities	n Softco	ver, Jap n, Tanko	an, 201 bon So	7. ftcover, Ja	apan, 2018.		E (Hi) Rem Unde	BT Map ghest nember erstance erstance	oped Level) ing (K1) ling (K2) ling (K2)
2. REFERENCES: 1. Marghe 2. Sayaka COURSE OUTCON completion CO1 read an CO2 underst CO3 compre CO4 underst CO4 compre	rita Pezzopa Kurashina, " COMES: of the cours d Understand and Convers hend Conter and the Kanj hend Orally I	ne, "Try Ne Japanese se, the stu d Relations actions Use ats at Near i's in Japan	5", 2 nd Ed Word Sp udents we ship of a ed in Eve Natural sinese Scr Materials	dition, Topeedma vill be a Person eryday A Speed. ript	ankobo ster", 2 ^r ble to	n Softco	ver, Jap	an, 201 bon So	7. ftcover, Ja			E (Hi) Rem Unde	BT Map ghest nember erstand erstand	oped Level) ing (K1) ling (K2) ling (K2)
2. REFERENCES: 1. Marghe 2. Sayaka COURSE OUTCON completion CO1 read an CO2 underst CO3 compre CO4 underst CO5 compre	rita Pezzopa Kurashina, " COMES: of the cours d Understand and Convers hend Conter and the Kanj hend Orally I	ne, "Try Ne Japanese se, the stu d Relations rations Use ats at Near i's in Japan	5", 2 nd Ed Word Sp udents we ship of a ed in Eve Natural sinese Scr Materials	dition, Topeedma vill be a Person eryday A Speed. ript s.	cankobo ster", 2 ^r ble to cativities	n Softco	ver, Jap n, Tanko n POs a PO8	an, 201 bon Sor	7. ftcover, Ja	apan, 2018.	PO12	E (Hi) Rem Unde	BT Map ghest nember erstance erstance	oped Level) ing (K1) ling (K2) ling (K2)
2. REFERENCES: 1. Marghe 2. Sayaka COURSE OUTCON completion CO1 read an CO2 underst CO3 compre CO4 underst CO5 compre	rita Pezzopa Kurashina, " COMES: of the cours d Understand and Convers hend Conter and the Kanj hend Orally I	ne, "Try Ne Japanese se, the stu d Relations rations Use ats at Near i's in Japan	5", 2 nd Ed Word Sp udents we ship of a ed in Eve Natural sinese Scr Materials	dition, Topeedma vill be a Person eryday A Speed. ript s.	cankobo ster", 2 ^r ble to cativities	n Softco	ver, Jap n, Tanko n POs a PO8	an, 201 bon Sor nd PSO PO9 2	7. ftcover, Ja	apan, 2018.	PO12 3	E (Hi) Rem Unde	BT Map ghest nember erstance erstance	oped Level) ing (K1) ling (K2) ling (K2)
2. REFERENCES: 1. Marghe 2. Sayaka COURSE OUTCON completion CO1 read an CO2 underst CO3 compre CO4 underst CO5 compre	rita Pezzopa Kurashina, " COMES: of the cours d Understand and Convers hend Conter and the Kanj hend Orally I	ne, "Try Ne Japanese se, the stu d Relations rations Use ats at Near i's in Japan	5", 2 nd Ed Word Sp udents we ship of a ed in Eve Natural sinese Scr Materials	dition, Topeedma vill be a Person eryday A Speed. ript s.	cankobo ster", 2 ^r ble to cativities	n Softco	ver, Jap n, Tanko n POs a PO8 1	an, 201 bon Sor nd PSO PO9 2 2	7. ftcover, Javes Polo 3 3 3	apan, 2018.	PO12 3 3	E (Hi) Rem Unde	BT Map ghest nember erstance erstance	oped Level) ing (K1) ling (K2) ling (K2)
2. REFERENCES: 1. Marghe 2. Sayaka COURSE OUTCON completion CO1 read an CO2 underst CO3 compre CO4 underst CO5 compre	rita Pezzopa Kurashina, " COMES: of the cours d Understand and Convers hend Conter and the Kanj hend Orally I	ne, "Try Ne Japanese se, the stu d Relations rations Use ats at Near i's in Japan	5", 2 nd Ed Word Sp udents we ship of a ed in Eve Natural sinese Scr Materials	dition, Topeedma vill be a Person eryday A Speed. ript s.	cankobo ster", 2 ^r ble to cativities	n Softco	POS a POS 1 1 1	an, 201 bon Sor nd PSO PO9 2 2 2	7. ftcover, Ja PS PO10 3 3 3	apan, 2018.	PO12 3 3 3 3	E (Hi) Rem Unde	BT Map ghest nember erstance erstance	oped Level) ing (K1) ling (K2) ling (K2)

		ASSESSMEN	IT PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	75	25					100
CAT2	25	75					100
CAT3	25	75					100
ESE	25	75					100
* ±3% may be varied (CAT 1,2,3 – 50 mark	s & ESE – 100 mar	ks)				-

										E LEVI						
					(Com	mon to A	II Engine	eering a	nd Tech	nology	Branches)		ı		
Progra Brancl		-&	All BE	/BTech E	Branche	s					Sem.	Category	L	T	Р	Credit
Prereq	quisit	es	Funda	mentals	of Frenc	ch Lang	uage				All	OE	4	0	0	4
Pream			lifestyl and ac learnin	e of Fran cquire bas ig proces	ce and o sic every	ther Fred	nch-spea abulary. I	aking na By follov	tions. The	ne stude structui	ent will be red curric	nderstandin learning ho ulum and pra spond to bas	w to int	rodu	ce him/ same a	herself is per the
Unit –			Introd			_:_+:			4	.		. (0-1-4	. 4		9
French Unit –		French		•	, pronun	ciation, a	iccents, i	ruies, ar	na terms	for pro	nunciatioi	n (mas-fem)	, Saluta	ations	s, numc	
		noun Fr	Daily L	.ıте nie's, adj	ectives -	- colors	week m	onths s	easons							9
Unit –		ilouii, i i		s and Ve		001013,	wook, iii	Oritino, o								9
Articles	s - Inc	definite,	definite,	partitive,	and cont	tracted, (example	s), intro	ductions	to verb	s, 1 st gro	up of verb				
Unit –			In the													9
2 nd gro	up of	verbs, ir	regular v	erbs (avo	ir, etre, fa	aire)	present	yourself	& nega	tive sen	tences. (fa	aire and Jou	er verb	with	the exp	ressions
Unit –	٧		Food a	and Cultu	ıre											9
		s – prepo	sition of	places (c	ountry, c	cities and	etc), Imp	perative	mode, i	nvitation	ns, culture	e – food (win	e, che	ese) Futu	ire (recei
future)																
																Total:4
ΤΕΧΤ Ι	BOOI	K:														
1.	A1 -	– saison	l													
			l													
	RENC	ES:		ais – 0 ar	nd 1											
REFEF	App	CES:	les franc	ais – 0 ar		, .										
REFE	App	CES:	les franc	ais – 0 ar e et de civ		francaise	es – Mau	uger G, I	Les idee	es – 0 ar	nd 1					
1. 2.	App Gra	ces: prenons mmaire	les franc			francaise	es – Mau	uger G, I	Les idee	es – 0 ar	nd 1					
1. 2.	App Gra	CES: prenons mmaire	les france	et de civ	vilization			uger G, I	Les idee	es – 0 ar	nd 1				BT Map	
1. 2. COUR	App Gra	ces: orenons mmaire UTCOM tion of t	les france – langue IES: he cours	et de civ	vilization	will be a	ıble to							(Hi	ghest	Level)
1. 2. COUR	App Gra	ces: orenons mmaire UTCOM tion of t	les france – langue IES: he cours	et de civ	vilization	will be a	ıble to							(Hi	ghest	
REFEF 1. 2. COUR: On coi	App Gra	ces: prenons mmaire UTCOM tion of t derstand	les france - langue IES: he cours the gran	et de civ	vilization tudents structure	will be a	ible to							(Hi	ghest ember	Level)
REFEF 1. 2. COUR: On coi	App Gra	ces: prenons mmaire UTCOM tion of t derstand	les france - langue IES: he cours the gran basic ve	se, the st nmatical strbs and a	vilization tudents structure	will be and of the late vocable	ible to inguage oulary.	and intro	oduce s					(Hi Rem Unde	ghest nember erstand	ing (K1)
REFEF 1. 2. COUR: On coi CO1 CO2	App Gra	ces: prenons mmaire UTCOM tion of t derstand	les france - langue IES: he cours the gran basic ve	et de civ	vilization tudents structure	will be and of the late vocable	ible to inguage oulary.	and intro	oduce s					(Hi Rem Unde	ghest nember erstand	Level) ing (K1)
REFEF 1. 2. COUR: On coil CO1 CO2 CO3	SE O mplet Unc	ces: orenons mmaire UTCOM tion of t derstand derstand	les france - langue IES: he cours the gran basic ve	se, the standard arrange	tudents structure appropria	will be and of the land	nble to inguage oulary. on, etc, a	and intro	oduce s					(Hi Rem Unde	ghest nember erstand	ing (K1)
REFEF 1. 2. COUR: On coil CO1 CO2 CO3	SE O mplet Und	DES: Department of the design	les france - langue lES: he cours the gran basic ve	se, the standard arrange habits of	tudents structure appropria	will be and of the land attention with the land ask	nble to inguage oulary. on, etc, a	and intro	oduce s					(Hi Rem Unde Unde	ghest nember erstand erstand	Level) ing (K1) ling (K2) ling (K2)
1. 2. COUR	SE O mplet Und	DES: Department of the design	les france - langue lES: he cours the gran basic ve	se, the standard arrange	tudents structure appropria	will be and of the land attention with the land ask	nble to inguage oulary. on, etc, a	and intro	oduce s					(Hi Rem Unde Unde	ghest nember erstand erstand	Level) ing (K1) ling (K2)
REFEF 1. 2. COUR: On coi CO1 CO2 CO3 CO4	SE O mplet Und	DES: Department of the design	les france - langue lES: he cours the gran basic ve	se, the standard arrange habits of	tudents structure appropria	will be and of the land attention with the land ask	nble to inguage oulary. on, etc, a	and intro	oduce s					(Hi Rem Unde Unde	ghest nember erstand erstand	Level) ing (K1) ling (K2) ling (K2)
REFEF 1. 2. COUR: On coi CO1 CO2 CO3 CO4	SE O mplet Und	DES: Department of the design	les france - langue lES: he cours the gran basic ve	se, the standard arrange habits of	tudents structure appropria	will be an end of the land ask	ible to inguage oulary. on, etc, a for appo	and intro	oduce s	elf to oth	ners.			(Hi Rem Unde Unde	ghest nember erstand erstand	Level) ing (K1) ling (K2) ling (K2)
REFEF 1. 2. COUR: On coi CO1 CO2 CO3 CO4 CO5	SE O mplet Unc	DES: Department of the stand of	les france - langue les: he cours the gran basic ve ctions an the food	se, the standard arrange habits of	tudents structure appropria e for tran f France speaking	will be and ask countrie	ible to inguage oulary. on, etc, a for appo	and intro	oduce sod.	elf to oth	ners.	DO44	POL	(Hi Rem Unde Unde Unde	ghest nember erstand erstand erstand	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2)
1. 2. COUR: On coil CO2 CO3 CO4 CO5	RENO App Gra SE O mplet Unc Ask Unc	DES: Department of the design	les france - langue lES: he cours the gran basic ve	se, the standard arrange habits of	tudents structure appropria	will be an end of the land ask	ible to inguage oulary. on, etc, a for appo	and intro	oduce so	elf to oth	ners.	PO11	PO1	(Hi Rem Unde Unde Unde	ghest nember erstand erstand	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2) ling (K2)
COUR: On coi CO1 CO2 CO3 CO4 CO5	SE O mplet Und Ask Und Lea	DES: Department of the stand of	les france - langue les: he cours the gran basic ve ctions an the food	se, the standard arrange habits of	tudents structure appropria e for tran f France speaking	will be and ask countrie	ible to inguage oulary. on, etc, a for appo	and intro	oduce so ded.	elf to oth	PS PO10 3	PO11	3	(Hi Rem Unde Unde Unde	ghest nember erstand erstand erstand	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2) ling (K2)
1. 2. COUR: On coil CO2 CO3 CO4 CO5	SE O mplet Und Ask Und Lea	DES: Department of the stand of	les france - langue les: he cours the gran basic ve ctions an the food	se, the standard arrange habits of	tudents structure appropria e for tran f France speaking	will be and ask countrie	ible to inguage oulary. on, etc, a for appo	and intro	oduce so	elf to oth	ners.	PO11		(Hi Rem Unde Unde Unde	ghest nember erstand erstand erstand	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2) ling (K2)
COUR: On coi CO1 CO2 CO3 CO4 CO5	RENO App Gra SE O mplet Unc Ask Unc Lea	DES: Department of the stand of	les france - langue les: he cours the gran basic ve ctions an the food	se, the standard arrange habits of	tudents structure appropria e for tran f France speaking	will be and ask countrie	ible to inguage oulary. on, etc, a for appo	and intro	oduce so ded.	elf to oth	PS PO10 3	PO11	3	(Hi Rem Unde Unde Unde	ghest nember erstand erstand erstand	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2) ling (K2)
COUR: 0n coi CO1 CO2 CO3 CO4 CO5 COs/P CO2	SE O mplet Unc Ask Unc Lea	DES: Department of the second	les france - langue les: he cours the gran basic ve ctions an the food	se, the standard arrange habits of	tudents structure appropria e for tran f France speaking	will be and ask countrie	ible to inguage oulary. on, etc, a for appo	and intro	oduce so ed. s POs a POS 1 1	elf to oth	Ps PO10 3 3 3	PO11	3	(Hi Rem Unde Unde Unde	ghest nember erstand erstand erstand	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2) ling (K2) ling (K2) 2
COUR: On col CO1 CO2 CO3 CO4 CO5 CO5/P CO5/CO5	RENO App Gra SE O mplet Unc Ask Unc Lea POs 1 2 3 4	DES: Department of the second	les france - langue les: he cours the gran basic ve ctions an the food	se, the standard arrange habits of	tudents structure appropria e for tran f France speaking	will be and ask countrie	ible to inguage oulary. on, etc, a for appo	and intro	POS a POS a 1 1 1	elf to oth	PS PO10 3 3 3 3 3	PO11	3 3 3	(Hi Rem Unde Unde Unde	ghest nember erstand erstand erstand	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2) ling (K2) 2 2

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	75	25					100
CAT2	25	75					100
CAT3	25	75					100
ESE	25	75					100
* ±3% may be varied (0	CAT 1,2,3 – 50 mark	s & ESE – 100 marl	ks)				

						II Engine			E LEVE		<u> </u>				
Program	me&	All BE/E	BTech Br	`	11011 10 71	II Engine	cring an	ia recin	lology L	Sem.	Category	L	Т	Р	Credit
Branch Prerequi	isites	Fundan	nentals o	f French	Langua	age				all	OE	4	0	0	4
Preamble	e	Framev structur circums	vork of Re es as wel	ference I as the a he learn	for Lang acquisition er will be	uages at on of voca able to	t the A2 abulary develop	level. T necess	his cour ary to co	se will ai omprehei	ordance with d in the integ nd and respo sion of Frenc	ration nd in e	of ba	sic gra day	mmar
Jnit – I		French	and You		-										9
	trengths & egulars ar						Motivati	ons, ab	out favo	rite films	and Types o	f scree	ns in	the mo	vie world
Jnit – II	, , ,		Repeat					e:. 1	_						9
	foods, Re s, Present						e and K	kitchen,	Presen	tation of	the recipe,	Comp	aratıv	/es, P	ossessiv
Jnit – III		Vacatio	n												9
	is, present ours, Past					es on vac	ation, p	ast expe	eriences	, Describ	ing favorite p	olace, F	Recor	mmen	dations o
Jnit – IV		·	nd Views												9
					perience	, Moods	Illness	, Discoi	mforts. S	Symptom	s, Roleplay	(Docto	r & F	Patient	_
ourist, F	harmacis									, .p.10.11	, -:				,
Jnit – V		Then ar			<u></u>				<u></u>						9
	ustoms, cı nd Presen			past and	presen	t, Debate	es on pa	st and p	resent s	situations	and feelings	s. Past	ımpe	rtect te	ense, Pa
1. A	ООК: A2 – Saisc	n													
	NOTO														
REFERE	INCES:														
	Apprenons	les franca	ais – 0 an	d 1											
					rancaise	es – Mau	ger G .L	es idee	s – 0 an	d 1					
1. A	Apprenons	e – langue			rancaise	es – Mau	ger G .L	es idee	s – 0 an	d 1			В	ST Mar	pped
1. A 2. COURSE On comp	Apprenons Grammaire OUTCOI pletion of	e – langue MES: the cours	et de civi	ilization f	vill be a	ble to		es idee	s – 0 an	d 1			(Hi		Level)
1. A 2. C COURSE On comp	Apprenons Grammaire	e – langue MES: the cours	et de civi	ilization f	vill be a	ble to		es idee	s – 0 an	d 1			(Hi	ghest	
1. A 2. COURSE On comp	Apprenons Grammaire OUTCOI pletion of	e – langue MES: the cours d the Fren	e et de civi	ilization f udents v	will be a ep and i	ble to ts usage							(Hig Rem	ghest ember	Level) ing (K1)
1. A 2. COURSE On comp	Apprenons Grammaire OUTCOI pletion of Understan	e – langue MES: the cours d the Fren	se, the straction of the set of t	udents vage in de	vill be a ep and i	ble to ts usage Objects	used in						(High	ghest ember	Level) ing (K1) ling (K2)
1. A 2. COURSE On comp CO1 CO2 F CO3	Apprenons Grammaire OUTCOI pletion of Understan	MES: the cours d the Fren n of their F	se, the straction revacation	udents vage in deecipes, K	will be a ep and in the analysis of the analysis of the avorite D	ble to ts usage Objects estination	used in	Kitcher	and ho	use.			(High Rem Unde Unde	ghest ember erstand erstand	Level) ing (K1) ling (K2) ling (K2)
1. A 2. COURSE On comp CO1 CO2 CO3 CO4	Apprenons Grammaire E OUTCOI pletion of Understan Preparatio Converse a	MES: the cours d the Fren n of their f about their	se, the stunct languar avorite re r vacation	udents vage in deecipes, Kontre the the the the the the the the the th	will be a ep and i (now the avorite D	ble to ts usage Objects estination	used in n	Kitcher	and ho	use.			(High	ghest ember erstand erstand	Level)
1. A 2. COURSE On comp CO1 CO2 CO3 CO4	Apprenons Grammaire E OUTCOI pletion of Understan Preparatio Converse a	MES: the cours d the Fren n of their f about their	se, the stunct languar avorite re r vacation	udents vage in deecipes, Kontre the the the the the the the the the th	will be a ep and i (now the avorite D e to com	ble to ts usage Objects estination municate t and Con	used in n e about	Kitcher their pa	and ho	use. iences			(High	ghest ember erstand erstand	Level) ing (K1) ling (K2) ling (K2) ling (K2)
1. A 2. COURSE On comp CO1 CO2 CO3 CO4 CO5 F	Apprenons Grammaire E OUTCOI pletion of Understan Preparatio Converse a Understan Know the o	MES: the cours d the Fren n of their f about their	se, the stunct languar avorite re r vacation	udents vage in deecipes, Kontre the the the the the the the the the th	will be a ep and i (now the avorite D e to com	ble to ts usage Objects estination	used in n e about	Kitcher their pa	and ho	use. iences	PO11		(High	ghest ember erstand erstand	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2)
1. A 2. COURSE On comp CO1 CO2 CO3 CO4 CO5	Apprenons Grammaire E OUTCOI pletion of Understan Preparatio Converse a Understan Know the o	MES: the cours d the Fren n of their f about their d complex	se, the stunct languar avorite re r vacation c verbs an	udents vage in de ecipes, Kan their Fa	will be a sep and it for a worite D se to com	ble to ts usage Objects estination municate t and Con	used in n e about mpare tl	Kitcher their pathem.	and ho	use. iences	PO11		(High	ghest ember erstancerstancerstancerstancerstancerstance	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2)
1. A 2. COURSE On comp CO1 CO2 CO3 CO4 CO5 CO5/PO:	Apprenons Grammaire E OUTCOI pletion of Understan Preparatio Converse a Understan Know the o	MES: the cours d the Fren n of their f about their d complex	se, the stunct languar avorite re r vacation c verbs an	udents vage in de ecipes, Kan their Fa	will be a sep and it for a worite D se to com	ble to ts usage Objects estination municate t and Con	used in n e about mpare tl	Kitcher their pathem. POs at	and ho	use. iences s	PO11	PO1:	(High	ghest ember erstancerstancerstancerstancerstancerstance	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2)
1. A 2. COURSE On comp CO1 CO2 CO3 CO3 CO4 CO5 CO5/PO: CO1 CO2	Apprenons Grammaire E OUTCOI pletion of Understan Preparatio Converse a Understan Know the o	MES: the cours d the Fren n of their f about their d complex	se, the stunct languar avorite re r vacation c verbs an	udents vage in de ecipes, Kan their Fa	will be a sep and it for a worite D se to com	ble to ts usage Objects estination municate t and Con	used in n e about mpare tl	Kitcher their partnerm.	and ho	use. iences PO10 3	PO11	PO1:	(High	ghest ember erstancerstancerstancerstancerstancerstance	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2) ling (K2)
1.	Apprenons Grammaire E OUTCOI pletion of Understan Preparatio Converse a Understan Know the o	MES: the cours d the Fren n of their f about their d complex	se, the stunct languar avorite re r vacation c verbs an	udents vage in de ecipes, Kan their Fa	will be a sep and it for a worite D se to com	ble to ts usage Objects estination municate t and Con	used in n e about mpare tl	Kitcher their pathem.	and ho	use. iences PO10 3 3	PO11	PO12 3 3	(High	ghest ember erstancerstancerstancerstancerstancerstance	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2) ling (K2) 2 2
1.	Apprenons Grammaire E OUTCOI pletion of Understan Preparatio Converse a Understan Know the o	MES: the cours d the Fren n of their f about their d complex	se, the stunct languar avorite re r vacation c verbs an	udents vage in de ecipes, Kan their Fa	will be a sep and it for a worite D se to com	ble to ts usage Objects estination municate t and Con	used in n e about mpare tl	Kitcher their pa nem. POs ai PO8 1 1 1	and ho	use. iences PO10 3 3 3 3 3	PO11	PO1: 3 3 3 3 3 3 3	(High	ghest ember erstancerstancerstancerstancerstancerstance	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2) ling (K2) 2
1.	Apprenons Grammaire E OUTCOI pletion of Understan Preparatio Converse a Understan Know the o	MES: the cours d the Fren n of their f about their d complex difference	e et de civi	udents vage in de ecipes, Kan de he able Past and	will be a sep and it for a worite Detection to community and the set of the s	ble to ts usage Objects estination municate t and Con	used in n e about mpare the	Kitcher their pathem. POs air PO8 1 1 1 1 1 1	and ho	use. iences PO10 3 3 3 3	PO11	PO1: 3 3 3 3 3	(High	ghest ember erstancerstancerstancerstancerstancerstance	Level) ing (K1) ling (K2) ling (K2) ling (K2) ling (K2) ling (K2) 2 2 2 2
1.	Apprenons Grammaire E OUTCOI pletion of Understand Converse a Understand Know the converse a	MES: the cours d the Fren n of their f about their d complex difference	e et de civi	udents vage in de ecipes, Kan de he able Past and	will be a sep and in the sep and in	ble to ts usage Objects estination municate t and Cor PO6	used in n e about mpare ti Os with PO7	Kitcher their pathem. POS at POS 1 1 1 1 1 1 1	and ho	use. iences PO10 3 3 3 3 3	PO11	PO1: 3 3 3 3 3 3 3	(High	ghest ember erstancerstancerstancerstancerstancerstance	Level Img (K2) Img (K2) Img (K2) Img (K2) PSO2 2 2 2 2 2 2 2 2 2
1.	Apprenons Grammaire E OUTCOI pletion of Understand Converse a Understand Know the converse a	MES: the cours d the Fren n of their F about their d complex difference PO2 erate, 3 —	e et de civi	udents vage in de ecipes, Kan their Fad be able Past and PO4	will be a sep and in the sep and in	ble to ts usage Objects estination municate t and Con PO6 Faxonom	used in n e about mpare ti Os with PO7	Kitcher their pa hem. POs ai PO8 1 1 1 1 1	and ho	use. iences PO10 3 3 3 3 3	PO11 Evaluating	PO1: 3 3 3 3 3 3	(High	ghest ember erstand erstand erstand erstand	Level Img (K2) Img (K2) Img (K2) PSO2 2 2 2 2 2 2 2 2 2

CAT1	75	25				100
CAT2	25	75				100
CAT3	25	75				100
ESE	25	75				100
* +3% may be varied (0	AT 1 2 3 – 50 mark	s & FSF – 100 mark	·s)	1	"	

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

					TIOD TO ALL	DOIDOOTING O		ا - امید	D '					
Programm	۵&			(Com	HOH TO All E	Ingineering a	na recn	nology	Branches					
Branch	ca	All BE/	BTech E	Branches	3				Sem.	Category	L	Т	Р	Credit
Prerequisi	tes	Funda	mentals	of Frenc	th Languaç	де			All	OE	3	0	0	3
Preamble		improv the abi gramm how Na	ing vocal lity to art atical str atives co	oulary an iculate yo uctures r	nd speaking ourself and needed to re	ding a variety abilities to re arrange appo espond confid	ply to a intment	nd seek s. With	informat persever	ion in those s ance, one ca	setting: n mast	s. It a ter all	lso giv of the	es you essentia idea of
			a day in		, problems	in the world,	Prediction	ons abo	ut the fut	ure (actions	and sit	uation	ns), Hy	9 pothetica
situations, I	mperfect												Т	
Jnit - II Prohibitions	. Ohlinat		itions ar		rial customs	s, Use of the	suhiunet	ive Des	crihe svr	onsis of Mov	ie and	its re	lation	9 to real life
						Direct and In		ivo, boo	oribe syr	lopoio oi iviov	ic and	113 10	iation	to rear inc
Jnit – III	!		e Creati							- D			1 0	9
						res and Nece egative, Use					endatio	ons a	na Su	ggestions
Jnit – IV			and Con		•		2,00	501,					Ţ	9
Talk about		ypes of to	ourism ar	nd comm	unication, S	Send messag		tions, Ta	alk to peo	ple on the te	lepho	ne, R	oleplay	y (Tourist
and Guide, Jnit – V	Tourists	and Trav		s), Past F	Pluscumper	fect, All Past	tenses.							9
						ons, Manias	etc. Ce	ertain su	uggestion	s to make	a bett	er fut	ure, t	he use o
			14565, 50	bjunctive	9S									Total:
1. B1	K: - Saisor				98.									Total:
1. B1 REFERENC 1. Ap	PK: - Saisor CES: prenons	n les franca	ais – 0 ar	nd 1		- Mauger G L	es idees	s – 0 an	d 1					Total:
1. B1 REFERENCE 1. App 2. Gra COURSE C	PK: - Saisor CES: prenons ammaire	les franca – langue	ais – 0 ar et de civ	nd 1	francaises -		es idees	s – 0 an	d 1				sT Map	oped
1. B1 REFERENCE 1. App 2. Gra COURSE COn comple	PK: - Saisor CES: prenons ammaire DUTCOM etion of t	les franca – langue	ais – 0 ar et de civ	nd 1			es idee:	s – 0 an	d 1			(Hi	ghest	
1. B1 REFERENCE 1. App 2. Gra COURSE COn comple	PK: - Saisor CES: prenons ammaire DUTCOM etion of tearn on Fu	les franca – langue IES: he cours	ais – 0 ar et de civ se, the st	nd 1 ilization t	francaises - will be able		es idee:	s – 0 an	d 1			(Hi	ghest embei	oped Level) ring (K1)
1. B1 REFERENCE 1. Apple 2. Gra COURSE COn comple CO1 Lea	PK: - Saisor CES: prenons ammaire DUTCOM etion of to arn on Funderstand	les franca – langue IES: he cours uture tens	ais – 0 ar et de civ se, the st se.	nd 1 ilization f	francaises - will be able ons.	e to						(High	ghest ember	oped Level) ring (K1) ding (K2)
1. App 2. Gra COURSE CO On comple CO1 Lea CO2 Un CO3 Kn	PK: - Saisor CES: prenons ammaire DUTCOM etion of tearn on Funderstand owing ab	les franca – langue les: he cours uture tens Permissi	et de civese, the stee. ions and	nd 1 ilization f udents v Prohibition	francaises - will be able ons.	e to	s, and lı					(High	ghest ember erstanderstand	Dped Level) ring (K1) ding (K2)
1. B1 REFERENCE 1. Apple 2. Grad COURSE CON comple CO1 Lead CO2 Known CO3 Un CO4 Un CO4	PK: - Saisor CES: prenons ammaire DUTCOM etion of tarn on Funderstand owing about derstand	les franca – langue les: he cours uture tens cout Lette	et de civese, the stee. ions and r writing,	nd 1 illization for the control of t	francaises - will be able ons. J Ads, Expre	eto essing Desire	s, and lı					(High	ghest ember erstanderst	Ded Level) ring (K1) ding (K2) ding (K2)
1. B1 REFERENCE 1. Apple 2. Grade COURSE CON comple CO1 Lea CO2 Un CO3 Known CO4 Un	PK: - Saisor CES: prenons ammaire DUTCOM etion of tarn on Funderstand owing about derstand	les franca – langue les: he cours uture tens cout Lette	et de civese, the stee. ions and r writing,	nd 1 illization for the control of t	francaises - will be able ons. J Ads, Expre	e to	s, and lı					(High	ghest ember erstanderst	ring (K1)
1. B1 REFERENCE 1. Apple 2. Gra COURSE CO CO1 Lea CO2 Un CO3 Kn CO4 Un	PK: - Saisor CES: prenons ammaire DUTCOM etion of tarn on Funderstand owing about derstand	les franca – langue les: he cours uture tens cout Lette	et de civese, the stee. ions and r writing,	Prohibition of Creating and Enhancetions	francaises - will be able ons. JAds, Expre	eto essing Desire	s, and li	nstructir nd PSO	ng Others			(High	ghest ember erstand erstand erstand	Ded Level) ring (K1) ding (K2) ding (K2)
1. B1 REFERENCE 1. Apple 2. Gra COURSE CO CO1 Lea CO2 Un CO3 Kn CO4 Un CO5 Exp CO5/POs	PK: - Saisor CES: prenons ammaire DUTCOM etion of tarn on Funderstand owing about derstand	les franca – langue les: he cours uture tens cout Lette	et de civese, the stee. ions and r writing,	nd 1 illization for the control of t	francaises - will be able ons. JAds, Expre	essing Desirent	s, and li	nstructir nd PSO PO9	ng Others	PO11	PO1	(High	ghest ember erstanderst	Diped Level) Fring (K1) Fring (K2) Fring (K2) Fring (K2) Fring (K2)
1. B1 REFERENCE 1. Apple 2. Gra COURSE CO CO1 Lea CO2 Un CO3 Kn CO4 Un CO5 Expl	PK: - Saisor CES: prenons ammaire DUTCOM etion of t arn on Fu derstand owing ab derstand pressing	les franca – langue les: he cours uture tens cout Lette ling rules the feeling	et de cives e, the state. ions and r writing, for travelengs and e	Prohibition of Creating and Enhancetions	francaises - will be able ons. JAds, Expre	essing Desirenmunications nced gramma	s, and li	nstructir nd PSO PO9	ng Others PO10 3		3	(High	ghest ember erstand erstand erstand	Diped Level) Tring (K1) Ding (K2) Ding (K2) Ding (K2) Ding (K2)
1. B1 REFERENCE 1. Apple 2. Gra COURSE CO CO1 Lea CO2 Un CO3 Kn CO4 Un CO5 Exp CO5/POs CO1 CO2	PK: - Saisor CES: prenons ammaire DUTCOM etion of t arn on Fu derstand owing ab derstand pressing	les franca – langue les: he cours uture tens cout Lette ling rules the feeling	et de cives e, the state. ions and r writing, for travelengs and e	Prohibition of Creating and Enhancetions	francaises - will be able ons. JAds, Expre	essing Desirenmunications nced gramma	s, and li POs a PO8 1 1	nstructir	ng Others PO10 3 3		3	(High	ghest ember erstand erstand erstand	Diped Level) Fring (K1) Fring (K2) Fring (K2) Fring (K2) Fring (K2) Fring (K2) Fring (K2)
1. B1 REFERENCE 1. Apple 2. Gra COURSE CON comple CON CON CON CON CON CON CON CON CON CON	PK: - Saisor CES: prenons ammaire DUTCOM etion of t arn on Fu derstand owing ab derstand pressing	les franca – langue les: he cours uture tens cout Lette ling rules the feeling	et de cives e, the state. ions and r writing, for travelengs and e	Prohibition of Creating and Enhancetions	francaises - will be able ons. JAds, Expre	essing Desirenmunications nced gramma	s, and li	nd PSO PO9 2 2 2	PO10 3 3 3		3 3 3	(High	ghest ember erstand erstand erstand	Diped Level) Fring (K1) Fring (K2) Fring (K2) Fring (K2) Fring (K2) Fring (K2) Fring (K2)
1. B1 REFERENCE 1. Apple 2. Gra COURSE CO CO1 Lea CO2 Un CO3 Kn CO4 Un CO5 Exp CO5/POs CO1 CO2	PK: - Saisor CES: prenons ammaire DUTCOM etion of t arn on Fu derstand owing ab derstand pressing	les franca – langue les: he cours uture tens cout Lette ling rules the feeling	et de cives e, the state. ions and r writing, for travelengs and e	Prohibition of Creating and Enhancetions	francaises - will be able ons. JAds, Expre	essing Desirenmunications nced gramma	s, and li POs a PO8 1 1	nstructir	ng Others PO10 3 3		3	(High	ghest ember erstand erstand erstand	pped Level) ring (K1) ding (K2) ding (K2) ding (K2)

		ASSESSMEN	IT PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	75	25					100
CAT2	25	75					100
CAT3	25	75					100
ESE	25	75					100

					22GEO1		_				`				
				(Com	mon to /	All Engin	eering a	nd Tech	nology	Branches	5)				
Programm Branch	ie&	All BE	/BTech I	3ranche	es					Sem.	Category	L	Т	Р	Credit
Prerequisi	tes	Funda	mentals	of Spar	nish Lan	nguage				All	OE	4	0	0	4
Preamble		compe	etence. T eciprocate	his cour e in daily	se will he life situ	elp to as: ations or	similate n a broad	the basi der sens	cgramn se. A tho	nar structi orough lea	eframework oures and gair arner will be a	n voca able to	bulary gain	to un a	derstand
Unit – I			sh and Y									,	,		9
Habits, Stre Verbs(Reg							, Motivat	ions, Ab	oout fav	orite films	and Types o	f scre	ens in	the m	ovie world
Unit – II		Eat an	d Repea	t (Com	er y rep	etir)									9
Favorite fo Present co						House a	and Kitch	en, Pre	sentatio	on of recip	oe, Compara	tives,	Posse	essive	pronouns
Unit – III	- Intili Godo		cation Ti			e vacaci	ones)								9
Invitations, various tou		tion, Gre	etings, G	oodbye	s, Activit	ies on va	acation, p		erience	s, Describ	oing favorite	olace,	Reco	mmen	dations o
Unit – IV		Likes	and Viev	v s (Gus	tasyvist	as)									9
Favorite pe	ersons &	things, (Giving ad	vices, E	xperienc	ce, Mood	ds, Illnes	s, Disco	omforts,	Symptor	ns, Roleplay	(Doct	or &	Patien	t, Guide (
Tourist, Ph	armacist		it), Past p and Now				perative	!							9
		cumstan	ces of the	•	•	•	tes on pa	ast and p	present	situations	s and feelings	s. Pas	t impe	erfect t	ense, Pas
perfect and	Present	compara	atives.												
															Total:4
TEXT BOO	K:														
										Sanchez,	Carmen So	riano	Goya	l Publ	shers an
Dis	stributors	PVt LTD	, 86, UB	Jawana	r Nagar,	Kamia N	iagar, De	eini-110	007.						
REFEREN	CES:														
1. <u>htt</u>	ps://nuev	adelhi.ce	ervantes.	es/en/sp	anish_c	ourses/s	tudents/s	spanish	genera	al_course	s/spanish_co	urses	leve	l_a1.h	<u>tm</u>
0011005		- 0												T 14 -	
COURSE (On comple			se, the s	tudents	will be	able to								BT Ma _l ghest	Level)
CO1 un	derstand	the Spa	nish lang	uage in	deep and	d its usad							Rem	embe	
	epare for	d : 🗆	orite reci			•	ge								ring (K1)
CO2 pre		tneir Fav	Office recti	pes, Kno	ow the C			tchen a	nd hous	se.			Unde	erstand	ring (K1)
CO2 ·	nverse ah			•)bjects u	sed in Ki	tchen a	nd hous	se.					ding (K2)
CO3 CO	nverse at	out thei	r vacation	, their F	avorite [Dbjects u	sed in Ki						Unde	erstand	ding (K2)
CO3 CO un	derstand	oout thei	r vacation	n, their F	avorite D	Objects us Destination	sed in Ki on te about	their pa					Unde	erstand	ding (K2)
CO3 CO4 Un		oout thei	r vacation	n, their F	avorite D	Objects us Destination	sed in Ki on te about	their pa					Unde	erstand	ding (K2)
CO2 CO3 CO Un	derstand	oout thei	r vacation	n, their F	avorite [le to con	Destination	sed in Ki on te about omparing	their pa	st expe	riences			Unde	erstand	ding (K2) ding (K2) ding (K2)
CO2 CO3 CO4 CO4 CO5 Kn	derstand	oout thei	r vacation	n, their F	avorite [le to con	Objects us Destination	sed in Ki on te about omparing	their pa	st expe	riences	PO11	PO1	Unde	erstand	ding (K2)
CO2 CO3 CO4 CO4 CO5 Kn	derstand ow the di	complex	r vacation x verbs ar between	n, their F nd be ab Past an	avorite E le to con d Preser	Destination The strain of the	sed in Ki on te about omparing	their pa them. POs a	st expe	riences	PO11	PO1 3	Unde	erstanderstand	ding (K2) ding (K2) ding (K2)
CO2 CO3 CO CO4 CO5 Kn	derstand ow the di	complex	r vacation x verbs ar between	n, their F nd be ab Past an	avorite E le to con d Preser	Destination The strain of the	sed in Ki on te about omparing	their pa them. POs a	st expe	riences Os PO10	PO11		Unde	erstanderstand	ding (K2) ding (K2) ding (K2) ding (K2)
CO2 CO3 CO4 CO4 CO5 Kn CO5 CO5/POS CO1	derstand ow the di	complex	r vacation x verbs ar between	n, their F nd be ab Past an	avorite E le to con d Preser	Destination The strain of the	sed in Ki on te about omparing	their pa them. POs a PO8	nd PSC	Ds PO10	PO11	3	Unde	erstanderstand	ding (K2) ding (K2) ding (K2) ding (K2) PSO2
CO2 CO3 CO CO4 CO5 Kn CO5 CO5/POS CO1 CO2	derstand ow the di	complex	r vacation x verbs ar between	n, their F nd be ab Past an	avorite E le to con d Preser	Destination The strain of the	sed in Ki on te about omparing	their pa them. POs a PO8	nd PSC PO9 2 2	PO10 3 3	PO11	3	Unde	erstanderstand	ding (K2) ding (K2) ding (K2) ding (K2) PSO2 2

		ASSESSMEN	NT PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	75	25					100
CAT2	25	75					100
CAT3	25	75					100
ESE	25	75					100

^{*} $\pm 3\%$ may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

								VEL 3					
			(Com	mon to All Engir	neering an	d Tech	nology	Branches)				
Programm Branch	e&	All BE/B	Tech Branches	S				Sem.	Category	L	Т	Р	Credit
Prerequisi	tes	Fundame	entals of Span	ish Language				All	OE	3	0	0	3
Preamble		enhances equips or	s the vocabular ne to express o	riching informati y and speaking a pinions and neg o answer confide	ability to re otiate app	espond ointmer	to and nts. Wit	also seel th diligent	information learning on	in thos e can ca	e siti aptur	uations e all ba	. It also isic
Jnit – I			er(Volver a En	npezar)									9
ituations, I Jnit – II Prohibitions Debate on I	mperfec s, Obliga	Prohibitions, Habions, use	e tense. ons and More(ts to change, s sage of connec	(Prohibiciones y ocial customs, Utors, Object Dire	y mas) Jse of sub	junctive							9 o real life
Jnit – III			Creative (Sear		and Nanan	:4:		!	- D	4: -		l C	9
				about desires a						enaatio	ms a	na Su(gestions
Guide, Tou Jnit – V Expression	rists and	ypes of tou Travel age Let's Tall ests, Sentin	rism and comnents), Past Plus k(Hablemos) nents, Feelings	ntion (Viajar y conunication, Send cumperfect, All F , Sensations, Ma	I message Past tense	es, petiti es.		•					9
EXT BOO	K:		s1) [Paperback]	Jaime Corpas, /				a Sanche	z, Carmen S	Soriano	Goya	al Publi	
1. Aul Dis	k: la Interna stributors	ational 3 (B Pvt LTD, 8	s1) [Paperback] 36, UB Jawahai	r Nagar, Kamla N	Nagar, Del	lhi-1100	007.						
1. Aul Dis	k: la Interna stributors	ational 3 (B Pvt LTD, 8	s1) [Paperback] 36, UB Jawahai		Nagar, Del	lhi-1100	007.						shers an
1. Aul Dis REFERENCE 1. http://doi.org/10.1001/10.1001/10.1001/10.10001/10	la Internativity of the Intern	ational 3 (B Pvt LTD, 8 radelhi.cerv	s1) [Paperback] 36, UB Jawahai vantes.es/en/sp	r Nagar, Kamla N panish_courses/s	Nagar, Del	lhi-1100	007.				level	a1.htı	shers an
1. Aul Dis REFERENCE 1. http: COURSE Con comple	DUTCON	ational 3 (B Pvt LTD, 8 radelhi.cerv IES: the course	s1) [Paperback] 36, UB Jawahai vantes.es/en/sp	r Nagar, Kamla N	Nagar, Del	lhi-1100	007.			ourses_	level B (Hi	_a1.htı T Map ghest l	shers an m ped _evel)
1. Aul Dis REFERENCE 1. http://doi.org/10.1001	DUTCOMetion of turn on Fu	ational 3 (B Pvt LTD, 8 radelhi.cerv IES: the course ture tense.	s1) [Paperback] 36, UB Jawahai vantes.es/en/sp	r Nagar, Kamla N vanish_courses/s will be able to	Nagar, Del	lhi-1100	007.			ourses_	level B (Hi	a1.hti T Map ghest I	shers an
1. Aul Dis REFERENCE 1. http://doi.org/10.1001	DUTCON etion of t	rational 3 (B Pvt LTD, 8 radelhi.cerv IES: the course ture tense.	(1) [Paperback] (36, UB Jawaha) (2) (vantes.es/en/sp	r Nagar, Kamla N vanish_courses/s will be able to	Nagar, Del	panish_	genera	al_course:		ourses_	level (Higher Rem	a1.htm	shers an
1. Aul Dis REFERENCE 1. http: COURSE COn complete CO1 lea CO2 known CO3 known CO3	DUTCON etion of terms on Funderstand	rational 3 (B Pvt LTD, 8 radelhi.cerv IES: the course ture tense. about Perr	(1) [Paperback] (36, UB Jawaha) (2) (vantes.es/en/spantes.es/en/spantes) (4) (the students) (5) (the students) (6) (the students) (7) (the students) (8) (the students)	r Nagar, Kamla N vanish_courses/s will be able to rohibitions.	Nagar, Del	panish_	genera	al_course:		Durses_	B (High	a1.hti	m ped _evel) ing (K1) ing (K2)
1. Aul Dis REFERENCE 1. http://doi.org/10.001/10.002/10.002/10.003/10.004	DUTCOMetion of to the country and the country	rational 3 (B Pvt LTD, 8 radelhi.cerv IES: the course ture tense. about Perr out Letter v	(1) [Paperback] (36, UB Jawahan (2) (vantes.es/en/sp. (3) (the students) (4) (the students) (5) (the students) (6) (the students) (7) (the students) (8) (the students) (9) (the students) (10) (the students) (10) (the students) (11) (the students) (12) (the students) (13) (the students) (14) (the students) (15) (the students) (16) (the students) (17) (the students) (18)	r Nagar, Kamla Nanish courses/s will be able to rohibitions. g Ads, Expressin	students/sp g Desires cations.	panish_	genera	al_course:		Durses_	B (High	a1.htm	ped _evel) ing (K1) ing (K2)
EXT BOO 1. Aul Dis EFFERENCE 1. http: COURSE CO On comple CO1 lea CO2 unc CO3 knc CO4 unc	DUTCONetion of turn on Fuderstand	rational 3 (B Pvt LTD, 8 radelhi.cerv IES: the course ture tense. about Perr out Letter v	(1) [Paperback] (36, UB Jawahan (2) (vantes.es/en/sp. (3) (the students) (4) (the students) (5) (the students) (6) (the students) (7) (the students) (8) (the students) (9) (the students) (10) (the students) (10) (the students) (11) (the students) (12) (the students) (13) (the students) (14) (the students) (15) (the students) (16) (the students) (17) (the students) (18)	vanish_courses/s will be able to rohibitions. g Ads, Expressin	students/sp g Desires cations.	panish_	genera	g Others.		Durses_	B (High	a1.htm	ped Level) ing (K1) ing (K2) ing (K2)
COS/POS	DUTCONetion of turn on Fuderstand	rational 3 (B Pvt LTD, 8 radelhi.cerv IES: the course ture tense. about Perr out Letter v ing rules fo the feelings	(1) [Paperback] (36, UB Jawahan (2) (vantes.es/en/sp. (3) (the students) (4) (the students) (5) (the students) (6) (the students) (7) (the students) (8) (the students) (9) (the students) (10) (the students) (10) (the students) (11) (the students) (12) (the students) (13) (the students) (14) (the students) (15) (the students) (16) (the students) (17) (the students) (18)	r Nagar, Kamla Nanish courses/s will be able to rohibitions. g Ads, Expressin hance communic	students/sp g Desires cations.	panish_	genera	g Others.		Durses_	B (Hi) Rem Unde	a1.htm	ped_evel) ing (K1) ing (K2) ing (K2) ing (K2)
EXT BOO 1. Aui Dis REFERENCE 1. http COURSE CO On comple CO1 lea CO2 unc CO3 knc CO4 unc CO5 exp	DUTCON etion of to derstand overstand overstand overstand	rational 3 (B Pvt LTD, 8 radelhi.cerv IES: the course ture tense. about Perr out Letter v ing rules fo the feelings	(a1) [Paperback] (a6, UB Jawaha) (vantes.es/en/spantes.es/	will be able to rohibitions. g Ads, Expressin hance communic	students/sp g Desires cations. I grammar	panish_ and Ins	genera	g Others.	s/spanish_co	Durses_	B (Hi) Rem Unde	a1.htm	ped evel) ing (K1) ing (K2) ing (K2) ing (K2)
EXT BOO 1. Aul Dis EFFERENCE 1. http CON COMPLE CO1 lea CO2 unc CO3 knc CO4 unc CO5 exp	DUTCON etion of to derstand overstand overstand overstand	rational 3 (B Pvt LTD, 8 radelhi.cerv IES: the course ture tense. about Perr out Letter v ing rules fo the feelings	(a1) [Paperback] (a6, UB Jawaha) (vantes.es/en/spantes.es/	will be able to rohibitions. g Ads, Expressin hance communic	students/sp g Desires cations. I grammar	panish_ and Ins	genera struction nd PSC PO9	g Others.	s/spanish_co	purses_	B (Hi) Rem Unde	a1.htm	ped _evel) ing (K1) ing (K2) ing (K2)
EXT BOO 1. Aui Dis EFFERENCE 1. http COURSE CO On comple CO1 lea CO2 unc CO3 knc CO4 unc CO5 exp CO5/POS CO1/POS CO1/POS	DUTCON etion of to derstand overstand overstand overstand	rational 3 (B Pvt LTD, 8 radelhi.cerv IES: the course ture tense. about Perr out Letter v ing rules fo the feelings	(a1) [Paperback] (a6, UB Jawaha) (vantes.es/en/spantes.es/	will be able to rohibitions. g Ads, Expressin hance communic	students/sp g Desires cations. I grammar	panish_ and Ins	genera struction and PSC PO9 2	g Others. PO10 3	s/spanish_co	PO12	B (Hi) Rem Unde	a1.htm	ped _evel) ing (K2) ing (K2) ing (K2) PSO 2
EXT BOO 1. Aul Dis EFFERENCE 1. http COURSE CO On comple CO1 lea CO2 unc CO3 knc CO4 unc CO5 exp COS/POS CO1 CO2	DUTCON etion of to derstand overstand overstand overstand	rational 3 (B Pvt LTD, 8 radelhi.cerv IES: the course ture tense. about Perr out Letter v ing rules fo the feelings	(a1) [Paperback] (a6, UB Jawaha) (vantes.es/en/spantes.es/	will be able to rohibitions. g Ads, Expressin hance communic	students/sp g Desires cations. I grammar	panish_ and Ins POs ar POs 1 1	genera struction nd PSC PO9 2 2	g Others. PO10 3 3	s/spanish_co	PO12 3 3	B (Hi) Rem Unde	a1.htm	ped _evel) ing (K1) ing (K2) ing (K2) PSO 2 2

		ASSESSMEN	NT PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	75	25					100
CAT2	25	75					100
CAT3	25	75					100
ESE	25	75					100
* ±3% may be varied (CAT 1,2,3 – 50 mark	s & ESE – 100 mar	ks)	-		1	

				22GE(017 - EN	NTREP	RENEUI	RSHIP I	DEVEL	OPMEN	Т				
				(Comm	on to Al	I Engine	ering ar	nd Tech	nology	Branche	s)				
Program Branch	nme &	All BE	/BTech E eering	Branche	s Excep	ot Mech	atronic	S		Sem.	Category	L	Т	Р	Credit
Prerequi	isites	22GET	71 - Eng	jineerin	g Econo	omics &	Manag	jement		8	OE	3	0	0	3
Preamble		The n	rnose of	this cou	rea to cr	eate en	trantana	urial av	varenes	se amono	g engineerin	a etua	lante		
Unit – I	<u> </u>		reneurs			cate em	пертепе	Juliai av	varence	s amon	gengineeni	y stut	Jenio		9
Entreprer		vs Intrap	reneursh	nip- Ent	reprene	urial M	otivatior	n factor			preneurship Entrepren				
Unit – II			reneuria						nent:						9
developm Opportun Unit – III Designing Business	ment stage nity, Evalua I g Business	s - Mode ation prod Busine s Model- echnical,	els of mai cess, Glo ess Plan Business Marketin	rket oppo bal oppo : s Model ig, Finar	ortunity- ortunities Canvas ncial Fea	Opports for ent	unity as reprene tives of assessn	sessme urs. a Busin nent - C	ent: Crit	ical Fact an - Busi	chising & sors In Oppo ness Plann ysis - Comi	rtunity ng Pr	/ Ass	essme	ent, Idea vs 9 ucture of a
Unit – IV	/	Financ	ing and	accoun	ting:										9
financing investors Taxation-Unit - V	g: Initial Pus, Micro-fina -Direct and	ublic offe ancing, F d indirect Small	ring (IPC eer-to-Potaxes, In Busines	0), Privat eer Lenc solvency s Mana q	te place ding, Cro y and Ba gement:	ment - wd fund ankrupto	Venture ding - Na cy- Case	e capita atural ca Study	lists - / apital. P	Angel inv reparing	ercial banks vestors-New Financial B ses: Sympt	form udget	s of , Brea	financi ak eve	ng: Impact n analysis, 9
Indian St	tartup Ecos	system –	Institutio	ns supp	orting sr	mall bus	siness e	nterpris	es, Bus	iness İn	cubators –	Gover	nmer	nt Polic	y for Small
Scale Ent	iterprises -	Growth	Strategies	s in smal	ll industr	у – Ехра	ansion,	Diversif	ication,	Joint Ve	nture, Merg	er, FD	I and	Sub-C	Contracting
															Total:45
TEXT BO	OOK:														Total:45
		Kuratko,"	Entrepre	neurship	o: Theory	v. Proce	ess, Prac	ctice", 1	1 th Editi	on, Cen	gage Learni	ng, Bo	oston	. 2020.	
1.	Donald F. I	Kuratko,"	Entrepre	neurship	o: Theory	y, Proce	ess, Prac	ctice", 1	1 th Editi	on, Cenç	gage Learni	ng, Bo	ston	, 2020.	
1. [REFERE	Donald F. I	Hisrich, N	<u> </u>	<u> </u>		<u> </u>					gage Learni epreneurshi				
1. [Fig. 1. Fig. Donald F. I ENCES: Robert D. I Hill, Noida, Charantima	Hisrich, N , 2020. ath Poorr	/lichael P	. Peters	& Dean	A. She	pherd, S	Sabyasa	achi Sin	ha "Entre		p", 11	th Edi	tion, N	cGraw	
1. [Fig. 1]	Donald F. I ENCES: Robert D. I Hill, Noida, Charantima Education,	Hisrich, N , 2020. ath Poorr Noida, 2	/lichael P nima .M, 018.	. Peters	& Dean	A. Shel	pherd, S	Sabyasa t and Si	achi Sin mall Bu	ha "Entre siness E	epreneurshi	p", 11	th Edi	tion, M	cGraw
1. EREFERE 1. FH	Donald F. I ENCES: Robert D. I Hill, Noida, Charantima Education,	Hisrich, N , 2020. ath Poorr Noida, 2 & Nataraj	/lichael P nima .M, 018. an K, "Er	". Peters "Entrepr	& Dean reneursh eurship	A. Shephip Deve	pherd, Selopmen	Sabyasa t and Si	achi Sin mall Bu	ha "Entre siness E	epreneurshi	p", 11	th Edidition	Pears pai, 20	cGraw son
1. EREFERE 1. From 1. Course Course On comp	Donald F. In ENCES: Robert D. In Hill, Noida, Charantima Education, Gordon E &	Hisrich, M , 2020. ath Poorr Noida, 2 & Nataraj MES: the cour	flichael P nima .M, 018. an K, "Er	Peters "Entreprenders	& Dean reneursh eurship	A. Shelip Develop	pherd, Selopmen	Sabyasa t and Si	achi Sin mall Bu on, Him	ha "Entro siness E alaya Pu	epreneurshi nterprises", ıblishing Ho	p", 11 3 rd Ec	th Edidition	Pears pai, 20	cGraw fron fron fron fron fron fron fron fron
1. EREFERE 1. F H 2. G E 3. C COURSE On comp	Donald F. HENCES: Robert D. Hender He	Hisrich, N., 2020. ath Poorr Noida, 2 & Nataraj MES: the cour	flichael P nima .M, 018. an K, "Er ese, the s	Entreprendents students of entrep	& Dean reneursh eurship s will be reneursh	A. Shelip Develop able to hip and	pherd, Selopmen	Sabyasa t and Sr 6 th Editio	achi Sin mall Bu on, Him	ha "Entro siness E alaya Pu	epreneurshi nterprises", ıblishing Ho	p", 11 3 rd Ed use, M	th Edi dition dumb (Hi pplyii	tion, M Pears pai, 20°	cGraw in the control of the control
1. EREFERE 1. F	Donald F. In ENCES: Robert D. In Hill, Noida, Charantima Education, Gordon E & E OUTCOM Pletion of Landarstand	Hisrich, N., 2020. ath Poorr Noida, 2 & Nataraj MES: the cour d the imp	flichael P nima .M, 018. an K, "Er rse, the s ortance c	Entreprendents students f entreprendents	& Dean reneursh eurship s will be reneursh	A. Shelip Develop able to hip and	pherd, Selopmen	Sabyasa t and Sr 6 th Editio	achi Sin mall Bu on, Him	ha "Entro siness E alaya Pu	epreneurshi nterprises", ıblishing Ho	p", 11 3 rd Ec	ith Edidition	Pears pai, 20	cGraw for a conclusion of the
1. EREFERE 1. F COURSE ON comp CO1 CO2 ico CO3 a	Donald F. In ENCES: Robert D. In Hill, Noida, Charantima Education, Gordon E & E OUTCOM pletion of understance identify suitens and the suiten	Hisrich, N., 2020. And Poorry Noida, 2 Nataraj MES: the cour d the importable ent	Alichael Phima .M, 018. an K, "Erese, the secontance correpreneuments of being the second sec	Entreprendictudents of entreprendictudents of entreprendictudents usiness	& Dean reneursh s will be reneursh ures and	A. Shelip Develop able to hip and	pherd, Selopment pment demons ess oppo	Sabyasa t and Sr 6 th Edition	mall Bu on, Him	ha "Entro siness E alaya Pu	epreneurshi nterprises", ıblishing Ho	p", 11 3rd Ed use, M	th Edition, //umb (Hi ppplyin	tion, M Pears pai, 20° BT Ma ighest ng (K3	cGraw in the control of the control
1. EREFERE 1. F H COURSE ON COMP CO1 CO2 ICCO3 CO3 CO4 Donald F. In ENCES: Robert D. In Hill, Noida, Charantima Education, Gordon E & E OUTCOM pletion of understance identify suit assess the	Hisrich, N., 2020. ath Poorr Noida, 2 & Nataraj MES: the cour d the importable ent e compon	dichael P nima .M, 018. an K, "Er se, the s ortance c repreneu ents of be	"Entreprendents of entreprendents ventre usiness	& Dean eneursh eurship s will be reneursh ures and plan interpret	A. Shelip Develop able to hip and dibusine	pherd, Selopment oment demons ass oppo	Sabyasa t and Si 6th Edition etrate the errunity	e traits	ha "Entre siness E alaya Pu of an ent	epreneurshi nterprises", ıblishing Ho	p", 11 3rd Ecc use, M A A	Ith Edition. If the Edition of the	pai, 20° BT Malighesting (K3) ling (K3)	cGraw in the control of the control	
1. E REFERE 1. F	Donald F. HENCES: Robert D. Hell, Noida, Charantima Education, Gordon E & E OUTCOM Pletion of understance identify suit assess the appraise the	Hisrich, N., 2020. ath Poorr Noida, 2 & Nataraj MES: the cour d the importable ent e compon	dichael P nima .M, 018. an K, "Er se, the s ortance c repreneu ents of be	"Entreprendents of entreprendents ventre usiness	& Dean reneursh eurship s will be reneursh ures and plan interpret	A. Shelip Develop able to hip and d busine	pherd, Selopment pment demons sess oppo	Sabyasa t and Si 6th Edition strate the ortunity	mall Bu on, Him e traits	ha "Entro	epreneurshi nterprises", ıblishing Ho	p", 11 3rd Ecc use, M A A	Ith Edition. If the Edition of the	pai, 20° BT Malighesting (K3) ling (K3)	cGraw fon 17. pped Level)) 1
1. EREFERE 1. F H C C C C C C C C C	Donald F. In ENCES: Robert D. In Hill, Noida, Charantima Education, Gordon E & E OUTCOM Pletion of Lidentify suit assess the Lappraise the Linterpret the Encept of Lidentify Suit assess the Lappraise the Linterpret the ENCEPT of Lidentify Suit assess the Linterpret the ENCEPT of Lidentify Suit assess the Linterpret the Linterpret the ENCEPT of Line EncePT of Line	Hisrich, N., 2020. ath Poorr Noida, 2 & Nataraj MES: the cour d the importable ent e compon	dichael P nima .M, 018. an K, "Er se, the s ortance c repreneu ents of be	"Entreprendents of entreprendents ventre usiness	& Dean reneursh eurship s will be reneursh ures and plan interpret	A. Shelip Develop able to hip and d busine	pherd, Selopment oment demons ass oppo	Sabyasa t and Si 6th Edition strate the ortunity	mall Bu on, Him e traits	ha "Entro	epreneurshi nterprises", ıblishing Ho	p", 11 3 rd Eccuse, N A A	dition. Mumb (Hi pplyii nalyz pplyii nders	pai, 20° BT Malighesting (K3) ling (K3)	cGraw fon 17. pped Level)) 1
1. EREFERE 1. F H COURSE ON COMP CO1 CO2 I CO3 E CO4 E CO4 E E	Donald F. In ENCES: Robert D. In Hill, Noida, Charantima Education, Gordon E & E OUTCOM Pletion of Lidentify suit assess the Lappraise the Linterpret the Encept of Lidentify Suit assess the Lappraise the Linterpret the ENCEPT of Lidentify Suit assess the Linterpret the ENCEPT of Lidentify Suit assess the Linterpret the Linterpret the ENCEPT of Line EncePT of Line	Hisrich, N., 2020. ath Poorr Noida, 2 & Nataraj MES: the cour d the imp table ent compon ne source	flichael P nima .M, 018. an K, "Er se, the s ortance of repreneu ents of books of finar	Entreprendiction of entrep	& Dean eneursh eurship s will be reneursh ures and plan interpret mall scal	A. Shelip Develop able to hip and dispusined accounting accountin	pherd, Selopment oment", of demons ass oppo	Sabyasa t and Sr 6th Edition strate the returnity tements and its re	mall Bu on, Him e traits	ha "Entre siness E alaya Pu of an ent	epreneurshi nterprises", ublishing Ho	p", 11 3rd Ecc use, M A A A U	dition. Mumb (Hi pplyii nalyz pplyii nders	tion, M Pears pai, 20° BT Ma ighest ang (K3 ang (K3 ang (K3 ang (K3 ang (K3	cGraw son 17. pped Level))) 4)
1. E REFERE 1. F	Donald F. In ENCES: Robert D. In Hill, Noida, Charantima Education, Gordon E & E OUTCOM Pletion of Lidentify suit assess the Lappraise the Linterpret the Encept of Lidentify Suit assess the Lappraise the Linterpret the ENCEPT of Lidentify Suit assess the Linterpret the ENCEPT of Lidentify Suit assess the Linterpret the Linterpret the ENCEPT of Line EncePT of Line	Hisrich, N., 2020. ath Poorr Noida, 2 & Nataraj MES: the cour d the imp table ent compon ne source	flichael P nima .M, 018. an K, "Er se, the s ortance of repreneu ents of books of finar	Entreprendiction of entrep	& Dean eneursh eurship s will be reneursh ures and plan interpret mall scal	A. Shepip Develop able to hip and dibusine account ac	pherd, Selopment oment, of demons assoppoonting star prises and one of the portion of the portio	Sabyasa t and Si t and Si 6th Edition strate the rtunity tements and its re	e traits achi Sin mall Bu on, Him e traits	ha "Entre siness E alaya Pu of an ent	epreneurshi nterprises", ublishing Ho repreneur	p", 11 3 rd Ecc use, M A A A	dition. Mumb (Hi pplyii nalyz pplyii nders	tion, M Pears pai, 20° BT Ma ighest ang (K3 ang (K3 ang (K3 ang (K3 ang (K3	cGraw son 17. pped Level))) 4)

CO4	1	1	2	1	2	1	1	1	2	3	2	
CO5	1	1	2	1	2	1	1	1	2	3	2	

 $1-Slight,\, 2-Moderate,\, 3-Substantial,\, BT\text{-}\,Bloom's\, Taxonomy$

		ASSESSMEN	T PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	30	30	20			100
CAT3	30	30	40				100
ESE	10	30	40	20			100

^{*} $\pm 3\%$ may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22GEX01 - NCC Studies(Army Wing) - I (Offered by Department of Electrical and Electronics Engineering)

	· •		•	- ,			
Programme & Branch	All BE/BTech Engineering and Technology Branches	Sem.	Category	L	Т	Р	Credit
Prerequisites	NIL	5/6	OE	3	0	2	4

Unit - I	NCC Organisation and National Integration:	a
reamble	camaraderie, discipline, secular outlook, the spirit of adventure, sportsman spirit and ideals of se service amongst cadets by working in teams, learning military subjects including weapon training	elfless
Preamble	This course is designed especially for NCC Cadets. This course will help develop char	racter

NCC Organisation – History of NCC- NCC Organisation- NCC Training- NCC Uniform – Promotion of NCC cadets – Aim and advantages of NCC Training- NCC badges of Rank- Honours and Awards – Incentives for NCC cadets by central and state govt. National Integration- Unity in diversity- contribution of youth in nation building- national integration council- Images and Slogans on National Integration.

Unit - II Basic physical Training and Drill:

Basic physical Training – various exercises for fitness(with Demonstration)-Food – Hygiene and Cleanliness. Drill-Words of commands- position and commands- sizing and forming- saluting- marching- turning on the march and wheeling- saluting on the march- side pace, pace forward and to the rear- marking time- Drill with armsceremonial drill- guard mounting.(WITH DEMONSTRATION)

Unit - III Weapon Training:

Main Parts of a Rifle- Characteristics of 5.56mm INSAS rifle- Characteristics of .22 rifle- loading and unloading – position and holding- safety precautions – range procedure- MPI and Elevation- Group and Snap shooting-Long/Short range firing(WITH PRACTICE SESSION) - Characteristics of 7.62mm SLR- LMG- carbine machine gun.

Unit - IV Social Awareness and Community Development:

Aims of Social service-Various Means and ways of social services- family planning – HIV and AIDS- Cancer its causes and preventive measures- NGO and their activities- Drug trafficking- Rural development programmes - MGNREGA-SGSY-JGSY-NSAP-PMGSY-Terrorism and counter terrorism- Corruption – female foeticide -dowry –child abuse-RTI Act- RTE Act- Protection of children from sexual offences act- civic sense and responsibility

Unit - V Specialized Subject (ARMY):

Basic structure of Armed Forces- Military History – War heroes- battles of Indo-Pak war- Param Vir Chakra-Career in the Defence forces- Service tests and interviews-Fieldcraft and Battlecraft-Basics of Map reading including practical.

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1. "National Cadet Corps- A Concise handbook of NCC Cadets", Ramesh Publishing House, New Delhi, 2014.

REFERENCES:

- 1. "Cadets Handbook Common Subjects SD/SW", published by DG NCC, New Delhi.
- 2. "Cadets Handbook- Specialized Subjects SD/SW", published by DG NCC, New Delhi.
- 3. "NCC OTA Precise", published by DG NCC, New Delhi.

9

9

	RSE OUTCOMES: completion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	display sense of patriotism, secular values and shall be transformed into motivated youth who will contribute towards nation building through national unity and social cohesion.	Applying (K3)
CO2	demonstrate Health Exercises, the sense of discipline, improve bearing, smartness, turnout, develop the quality of immediate and implicit obedience of orders	Applying (K3)
CO3	basic knowledge of weapons and their use and handling.	Applying (K3)
CO4	understanding about social evils and shall inculcate sense of whistle blowing against such evils and ways to eradicate such evils	Applying (K3)
CO5	acquaint, expose & provide knowledge about Army/Navy/ Air force and to acquire information about expansion of Armed Forces, service subjects and important battles.	Applying (K3)

				М	apping	g of CC	Os with	n POs	and PS	SOs				
COs/POs	PO1	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3	3	3	3	3				
CO2					3									
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

		ASSESSMENT	PATTERN -	THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	-	-	-	-	-	-
CAT2	-	-	-	-	-	-	-
CAT3	-	-	-	-	-	-	-
ESE	India which inclu	n and award of ma des all K1 to K6 ki 500 marks. It will b	nowledge lev	els. The maxi	mum marks fo		

	22GEX02 - NCCSTUDIES (AIRWING)-I					
Programm	(Offered by Department of Information Technology) ne & All Engineering and Technology Branches Sem Ca					
Branch	All Engineering and Technology Branches Sem. Ca	ategory	L	Т	Р	Credit
Prerequisi	ites Nil 5/6	OE	3	0	2	4
Preamble	This course is designed especially for NCC Cadets. This course will help of discipline, secular outlook, the spirit of adventure, sportsman spirit and ide cadets by working in teams, honing qualities such as self-discipline, self-confidence in the cadets.	eals of self	less s	servic	e am	ongst
Unit-I	NCC Organization and National Integration					9+3
advantages History and of youth in	anization – History of NCC- NCC Organization- NCC Training- NCC Uniform – Prose of NCC Training - NCC badges of Rank - Honors' and Awards – Incentives for NC dorganization of IAF - Indo-Pak War-1971 - Operation Safed Sagar. National Integral nation building - national integration council - Images and Slogans on National Integ	CC cadets ation - Unit	by ce	entral	and	state gov
Unit-II	Drill and Weapon Training					9 + 3
- saluting of mounting.() holding - s PRACTICE	Is of commands - position and commands - sizing and forming - saluting - marching - on the march - side pace, pace forward and to the rear - marking time - Drill w (WITH DEMONSTRATION). Main Parts of a Rifle - Characteristics of .22 rifle - log safety precautions – range procedure - MPI and Elevation - Group and Snap shooting SESSION). Principles of Flight	with arms ading and ing - Long	- cer unlo: /Shor	emor ading t ran	nial dı ı – po ge firi	rill - guard psition and ng (WITH
Laws of mo	otion-Forces acting on aircraft – Bernoulli's theorem - Stalling - Primary control surfac cognition.	.ces – secc	ondar	y con	itrol si	urfaces -
Unit-IV	Aero Engines					9+3
trends. Unit-V	Aero Modeling Aero Modeling Aero Modeling					9+3
trends. Unit-V History of a						9+3
trends. Unit-V History of a	Aero Modeling aeromodeling - Materials used in Aero-modeling - Types of Aero-models – Static Mod	dels - Glid	ers -	Cont	rolline	9 + 3 models -
trends. Unit-V History of a	Aero Modeling aeromodeling - Materials used in Aero-modeling - Types of Aero-models – Static Models - Building and Flying of Aero-models.	dels - Glid	ers -	Cont	rolline	9 + 3 models -
trends. Unit-V History of a Radio Con	Aero Modeling aeromodeling - Materials used in Aero-modeling - Types of Aero-models – Static Models - Building and Flying of Aero-models.	dels - Glid	ers - 45, P	Conti	rolline	9 + 3 models -
trends. Unit-V History of a Radio Conf	Aero Modeling aeromodeling - Materials used in Aero-modeling - Types of Aero-models – Static Models - Building and Flying of Aero-models. DK:	dels - Glid	ers - 45, P	Conti	rolline	9 + 3 e models -
trends. Unit-V History of a Radio Con TEXT BOO 1. "N: REFERENCE	Aero Modeling aeromodeling - Materials used in Aero-modeling - Types of Aero-models – Static Models - Building and Flying of Aero-models. DK: ational Cadet Corps - A Concise handbook of NCC Cadets", Ramesh Publishing Hou	dels - Glid	ers - 45, P	Conti	rolline	9 + 3 e models -
trends. Unit-V History of a Radio Con TEXT BOO 1. "N: REFERENCE 1. "C	Aero Modeling aeromodeling - Materials used in Aero-modeling - Types of Aero-models – Static Models - Building and Flying of Aero-models. DK: lational Cadet Corps - A Concise handbook of NCC Cadets", Ramesh Publishing Hou	dels - Glid	ers - 45, P	Conti	rolline	9+3
TEXT BOO 1. "N: REFERENCE 2. "C	Aero Modeling aeromodeling - Materials used in Aero-modeling - Types of Aero-models – Static Models - Building and Flying of Aero-models. DK: lational Cadet Corps - A Concise handbook of NCC Cadets", Ramesh Publishing Hou CES/ MANUAL / SOFTWARE: Cadets Handbook – Common Subjects SD/SW", DGNCC, New Delhi.	dels - Glid	ers - 45, P	Conti	rolline	9 + 3 models -
TEXT BOO 1. "N REFERENCE 2. "C 3. "N	Aero Modeling aeromodeling - Materials used in Aero-modeling - Types of Aero-models – Static Models - Building and Flying of Aero-models. DK: lational Cadet Corps - A Concise handbook of NCC Cadets", Ramesh Publishing Hou CES/ MANUAL / SOFTWARE: Cadets Handbook – Common Subjects SD/SW", DGNCC, New Delhi. Cadets Handbook – Specialised Subjects SD/SW", DGNCC, New Delhi. CCOTA Precise", DGNCC, New Delhi.	dels - Glid	ers - 45, P	raction 2014.	rolline	9+3 models -
trends. Unit-V History of a Radio Con TEXT BOO 1. "N REFERENCE 1. "C 2. "C 3. "N	Aero Modeling aeromodeling - Materials used in Aero-modeling - Types of Aero-models – Static Models - Building and Flying of Aero-models. DK: ational Cadet Corps - A Concise handbook of NCC Cadets", Ramesh Publishing Hou CES/ MANUAL / SOFTWARE: Cadets Handbook – Common Subjects SD/SW", DGNCC, New Delhi. Cadets Handbook – Specialised Subjects SD/SW", DGNCC, New Delhi.	dels - Glid	ers - 45, P	Conti	rolline	9 + 3 models -
trends. Unit-V History of a Radio Con TEXT BOO 1. "N REFERENCE 2. "C 3. "N COURSE COn comple	Aero Modeling aeromodeling - Materials used in Aero-modeling - Types of Aero-models – Static Models - Building and Flying of Aero-models. DK: Lational Cadet Corps - A Concise handbook of NCC Cadets", Ramesh Publishing Houce CES/ MANUAL / SOFTWARE: Cadets Handbook – Common Subjects SD/SW", DGNCC, New Delhi. Cadets Handbook – Specialised Subjects SD/SW", DGNCC, New Delhi. DICCOTA Precise", DGNCC, New Delhi.	dels - Glid Lecture:	ers - 45, P	Conti	rolline cal:15	9+3 models -
trends. Unit-V History of a Radio Con TEXT BOO 1. "N REFERENCE 1. "C 2. "C 3. "N COURSE CON CON CON CON CON CON CON CON CON CON	Aero Modeling aeromodeling - Materials used in Aero-modeling - Types of Aero-models – Static Models - Building and Flying of Aero-models. DK: lational Cadet Corps - A Concise handbook of NCC Cadets", Ramesh Publishing House CES/ MANUAL / SOFTWARE: Cadets Handbook – Common Subjects SD/SW", DGNCC, New Delhi. Cadets Handbook – Specialised Subjects SD/SW", DGNCC, New Delhi. ICCOTA Precise", DGNCC, New Delhi. DUTCOMES: etion of the course, the students will be able to uild sense of patriotism, secular values and shall be transformed into motivated youth	dels - Glid Lecture: use, NewD	ers - 45, P	Conti	T Maghest	9 + 5 models - 5, Total:6
trends. Unit-V History of a Radio Con TEXT BOO 1. "N REFERENCE 2. "C 3. "N COURSE CON comple CO1 bu ca CO2 de the	Aero Modeling aeromodeling - Materials used in Aero-modeling - Types of Aero-models — Static Models - Building and Flying of Aero-models. DK: lational Cadet Corps - A Concise handbook of NCC Cadets", Ramesh Publishing Houce CES/ MANUAL / SOFTWARE: Cadets Handbook — Common Subjects SD/SW", DGNCC, New Delhi. Cadets Handbook — Specialised Subjects SD/SW", DGNCC, New Delhi. CICCOTA Precise", DGNCC, New Delhi. DUTCOMES: etion of the course, the students will be able to uild sense of patriotism, secular values and shall be transformed into motivated youth arry out nation building through national unity and social cohesion.	dels - Glid Lecture: use, NewD	ers - 45, P	raction 2014. Billian Ali	T Maghest	9 + models -
trends. Unit-V History of a Radio Con TEXT BOC 1. "N: REFERENCE 2. "C 3. "N COURSE CON comple CO1 bu ca CO2 de the CO3 illu	Aero Modeling aeromodeling - Materials used in Aero-modeling - Types of Aero-models — Static Models - Building and Flying of Aero-models. DK: lational Cadet Corps - A Concise handbook of NCC Cadets", Ramesh Publishing House CES/ MANUAL / SOFTWARE: Cadets Handbook — Common Subjects SD/SW", DGNCC, New Delhi. Cadets Handbook — Specialised Subjects SD/SW", DGNCC, New Delhi. ICCOTA Precise", DGNCC, New Delhi. DUTCOMES: etion of the course, the students will be able to uild sense of patriotism, secular values and shall be transformed into motivated youth arry out nation building through national unity and social cohesion. emonstrate the sense of discipline with smartness and have basic knowledge of weap eir use and handling	dels - Glid Lecture: use, NewD	ers - 45, P	Conti	T Maghest	pped: Level) g (K3)

	Mapping of COs with POs and PSOs													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3	3	3	3	3				
CO2					3									
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										
CO6														
CO7														
CO8														

1 - Slight, 2 - Moderate, 3 - Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	-	-	-	-	-	-
CAT2	-	-	-	-	-	-	-
CAT3	-	-	-	-	-	-	-
ESE	The examination and avincludes all K1 to K6 kn It will be converted to 10	owledge levels. The					

Programme& Branch		All BE/BTech branches								Sem.	Category	L	Т	Р	Credi
	uisites									5	OE	4	0	0	4
Preamb	ole						the Cost Ac nts to facilita				iques for iden	tifica	tion, a	nalys	is and
Unit – I						ccounti									1 1
											Accounting its assification of				
Unit – I	II	Co	st Asc	ertainn	nent –	Elemen	ts of cost								1
											oilage, defec				
scheme	es.		•				payroll – La onment and		·		methods of r	emur	neratio	n and	d incentiv
Unit – I				sting N			minorit and	anocation	or overnee	uus.					1
Operati	ing Costir						rating Cost	Sheet - Tra	ansport C	osting - P	ower Supply	Costi	ng - H	ospita	al Costing
Unit – I	IV	Ac	lvance	d Costi	ing Me	thods									1
							ation of Cos	t Sheet Und	der Job C	osting, ar	d Batch Cost	ing -	Proce	ss Co	osting -
Process	s Loss - N	· Norn	al and	Abnorm	nal Los:	s.									
Unit – \															
9111t — 1	V	Co	st Acc		g Tech	niques									1
Budget	t and Bu	udge	ary Co	ounting	Budgeta	ary conti		nagement 1	Tool – Ins	tallation o	f Budgetary o	ontro	ol syste	em	1
Budget classific	t and Bud cation of b	udge f budg	ary Co ets – F	ounting ntrol: B ixed an	Budgeta d Flexi	ary conti	geting.	•					-		
Budget classific Standa	t and Buc cation of b ord Costi	udget f budg ting a	ary Co ets – F nd Var	ounting ntrol: E ixed an iance A	Budgeta d Flexi Analysi	ary conti ble Bud is: Budg	geting. getary contro	ol and stan	ndard cost	ing – Suit	ability of stan	dard	costin	g – St	tandard
Budget classific Standa costing	t and Bud cation of b ard Costin as a mar	udge f budg ting a anage	ary Co ets – F nd Var ment T	ounting ntrol: E ixed an iance A	Budgeta d Flexi Analysi	ary conti ble Bud is: Budg	geting. getary contro	ol and stan	ndard cost	ing – Suit		dard	costin	g – St	tandard
Budget classific Standa costing	t and Buc cation of b ord Costi	udge f budg ting a anage	ary Co ets – F nd Var ment T	ounting ntrol: E ixed an iance A	Budgeta d Flexi Analysi	ary conti ble Bud is: Budg	geting. getary contro	ol and stan	ndard cost	ing – Suit	ability of stan	dard	costin	g – St	tandard
Budget classific Standa costing varianc	t and Bud cation of b ard Costin as a mar	udget f budg ting a anage lles va	ary Co ets – F nd Var ment T	ounting ntrol: E ixed an iance A	Budgeta d Flexi Analysi	ary conti ble Bud is: Budg	geting. getary contro	ol and stan	ndard cost	ing – Suit	ability of stan	dard	costin	g – St	tandard ead
Budget classific Standa costing varianc	t and Buccation of bard Costin as a mar es – Sale	udger f budg ting a anage ales va	ary Co lets – F nd Var ment T riance.	ounting ntrol: E ixed an iance A ool – Co	Budgeta d Flexil Analysi ost vari	ary conti ible Bud is: Budg iances -	geting. getary contro - Direct mat	ol and stan erial cost v	ndard costi variances -	ing – Suit – Direct la	ability of stan	dard iance	costin es – O	g – Si verhe	tandard ead Total:6
Budget classific Standa costing varianc	t and Buccation of It ard Costin as a mar ees – Sale RENCES: Jawahan Educatio	udger f budg ting a anage ales va S: arLal, tion, N	ary Co lets – F nd Var ment T riance. Seema lew De	ounting ntrol: E ixed an iance A ool – Co Srivast hi, 2020 nnon Ai	Budgeta d Flexil Analysi ost vari ava, M 0.	ary conti ible Bud is: Budg iances -	geting. getary contro - Direct mat Singh, " Cos	ol and stan erial cost v	ndard costi variances -	ing – Suit – Direct la Problems	ability of stan bour cost var	dard iance	costin es – O	g – Si verhe	tandard ead Total:6
Budger classific Standa costing varianc REFER	t and Buccation of It and Costin as a marries – Sale RENCES: Jawahar Education William Education Education	dgetf budgeting a anageales values va	ary Co ets – F nd Var ment T riance. Seema lew De	ounting ntrol: E ixed an iance A ool – Co Srivast hi, 2020 nnon Ai hi, 2020	Budgeta d Flexil Analysi ost vari ava, M 0. nderso 0.	ary controlled Budgis: Budgiances -	geting. getary contro - Direct mat Singh, " Cos ichael Mahe	ol and stan erial cost ve st Accountin	ndard costi variances - ing, Text, I	ing – Suit – Direct la Problems f cost Acc	ability of stan bour cost var and Cases",	dard iance	costin es – O	g – Si verhe	tandard ead Total:6
Budger classification costing variance REFER 1. 2. 3.	t and Buccation of It and Costin as a marres – Sale RENCES: Jawahan Education William Education M.N.Aro	udget f budg ting a anage ales va s: arLal, tion, N n Land tion, N	ary Co lets – F nd Var ment T riance. Seema lew De en, Sha lew De nd Priy	ounting ntrol: E ixed an iance A ool – Co Srivast hi, 2020 nnon Ai hi, 2020 ankaKa	Budgeta d Flexil Analysi ost vari ava, M 0. ndersol 0. tyal, "C	ary control ible Budg is: Budg iances - Ianisha S in and M Cost Acc	geting. getary control - Direct mat Singh, " Cost ichael Mahe ounting", 5t	ol and stan erial cost ve st Accountinger, "Fundar h Edition, V	ndard cost variances - ing, Text, I mentals of Vikas publ	ing – Suit – Direct la Problems f cost Acc lishing Ho	ability of stan bour cost var and Cases", ounting",7th E	dard iance	costin es – O	g – Si verhe	tandard ead Total:6
Budget classific Standa costing varianc	t and Buccation of bard Costinas a mares – Sale RENCES: Jawahar Educatio William Educatio M.N.Aro	udget f budg ting a anage ales va arLal, tion, N n Land tion, N rora a	Seemalew Deen, Shalew Dend Priyore, "C	ounting ntrol: E ixed an iance A ool – Co aSrivast hi, 2020 nnon Ai hi, 2020 ankaKa	Budgeta d Flexil Analysi ost vari ava, M 0. ndersol 0. tyal, "C	ary contible Budgis: Budgiances -	geting. getary control - Direct mat Singh, " Cost ichael Mahe ounting", 5t Accounting	ol and stan cerial cost vi st Accounting er, "Fundar h Edition, V	indard cost variances - ing, Text, I mentals of Vikas publ on, Taxma	ing – Suit – Direct la Problems f cost Acc lishing Ho	ability of stan bour cost var and Cases", ounting",7th E	dard iance 6th E Edition	costin es – O	g – Si verhe	tandard ead Total:6
Budger classification classification classification costing variance REFER 1. 2. 3. 4. 5.	t and Buccation of bard Costinas a mares – Sale RENCES: Jawahaa Educatio William Educatio M.N.Aro Ravi M.H.	udget f budg ting a anage ales va s: arLal, tion, N n Land tion, N rora a 1.Kish rora, "	Seemalew Deen, Shalew Dend Priyore, "Cost ar	ounting ntrol: E ixed an iance A ool – Co aSrivast hi, 2020 nnon Ai hi, 2020 ankaKa	Budgeta d Flexil Analysi ost vari ava, M 0. ndersol 0. tyal, "C	ary contible Budgis: Budgiances -	geting. getary control - Direct mat Singh, " Cost ichael Mahe ounting", 5t Accounting	ol and stan cerial cost ve st Accounting er, "Fundar h Edition, Ve ", 6th Edition	indard cost variances - ing, Text, I mentals of Vikas publ on, Taxma	ing – Suit – Direct la Problems f cost Acc lishing Ho	ability of stan bour cost var and Cases", ounting",7th E use, New Del Delhi, 2021	dard iance 6th E Edition	costines – O	g – Si verhe , McG	tandard ead Total:6
Budger classification classification classification costing variance REFER 1. 2. 3. 4. 5. COURS	t and Buccation of both the cation of both the cation of both the cation as a marries – Sale see –	udger f budg ting a anage ales va s: arLal, tion, N n Land tion, N rora a M.Kish rora, "	Seemalew Deen, Shalew Decore, "Cost ar	ounting ntrol: E ixed an iance A ool – Co nnon Ai hi, 2020 ankaKa ost and	Budgeta d Flexil Analysi ost vari ava, M 0. ndersol 0. tyal, "C I Manag	ary contrible Budgis: Budgiances - Ianisha San and Macost Accument Accounts	geting. getary control - Direct mat Singh, " Cost ichael Mahe ounting", 5t Accounting	ol and stan erial cost vi et Accountil er, "Fundar h Edition, V ", 6th Edition Edition, Vil	indard cost variances - ing, Text, I mentals of Vikas publ on, Taxma	ing – Suit – Direct la Problems f cost Acc lishing Ho	ability of stan bour cost var and Cases", ounting",7th E use, New Del Delhi, 2021	dard iance 6th E Edition	costines – O	g – Si verhe , McG Graw	tandard ead Total:6
Budger classific Standa costing varianc REFER 1. 2. 3. 4. 5. COURS On con	t and Buccation of burd Costinated As a mares — Sales RENCES: Jawahan Education William Education M.N.Aro Ravi M.H. M.N.Aro SE OUTC	udger f budg ting a anage ales va arLal, tion, h n Land tion, h rora a f. Kish rora, "	Seemalew Deen, Shalew Decore, "Cost ar	ounting ntrol: E ixed an iance A ool – Co aSrivast hi, 2020 nnon Ai hi, 2020 ankaKa ost and ad Mana	Budgeta d Flexil Analysi ost vari ava, M 0. nderso 0. tyal, "C I Managemer	ary contrible Budgis: Budgiances - Ilanisha Son and M Cost Accogement Int Account	geting. getary control Direct mat Singh, " Cos ichael Mahe ounting", 5t Accounting'	ol and stan erial cost vi est Accountil er, "Fundar h Edition, V ", 6th Edition Edition, Vil	indard cost variances - ing, Text, I mentals of Vikas publ on, Taxma	ing – Suit – Direct la Problems f cost Acc lishing Ho	ability of stan bour cost var and Cases", ounting",7th E use, New Del Delhi, 2021	dard iance 6th E Edition	costines – O	g – Si verhe , McG Graw BT Ma lighes	tandard rad Total:6 Graw Hill Hill
Budger classification of the classification	t and Buccation of burd Costinas a marries – Sales RENCES: Jawahan Education William Education M.N.Aro Ravi M.H. M.N.Aro SE OUTC mpletion	dudger f budger f bud	Seemalew De cond Priyore, "Cost ar	ounting ntrol: E ixed an iance A ool – Co iSrivast hi, 2020 nnon Ai hi, 2020 ankaKa ost and id Mana se, the	Budgeta d Flexil Analysi ost vari ava, M 0. nderso 0. tyal, "C I Manag agemer	ary contrible Budgis: Budgiances - lanisha Son and M Cost Acc gement nt Accou	geting. getary control Direct mat Singh, " Costichael Mahe ounting", 5t Accounting unting",11th	ol and stan erial cost vi et Accountil er, "Fundar h Edition, Vi ", 6th Edition Edition, Vil	indard costivariances -	Problems f cost Acc lishing Ho ann, New	ability of stan bour cost var and Cases", ounting",7th E use, New Del Delhi, 2021	dard iance 6th E Edition	costines – O	g – Si verhe , McG Graw BT Ma lighes	tandard sad Total:6 Graw Hill Hill apped st Level)
Budger classification of the classification	t and Buccation of bard Costinas a marries – Sale RENCES: Jawahan Education William Education M.N.Aro Ravi M.H. M.N.Aro SE OUTC mpletion understa	dudger f budger f bud	Seemalew Deen, Shalew Decore, "Cost ar	ounting ntrol: E ixed an iance A cool – Co instrict and i	Budgeta d Flexil Analysi ost vari eava, M 0. nderso 0. tyal, "C I Managemer e stude I frame epts an	ary contrible Budgis: Budgiances - lanisha San and Man	geting. getary control Direct mat Singh, " Cos ichael Mahe ounting", 5t Accounting' unting",11th be able to	ol and stan erial cost vi et Accounting er, "Fundar h Edition, Vi ", 6th Edition Edition, Vil	indard costivariances -	Problems f cost Acc lishing Ho ann, New	ability of stan bour cost var and Cases", ounting",7th E use, New Del Delhi, 2021	dard iance 6th E Edition	costines – O dition n, Mcc 23. (H Und	g – Si verhe , McG Graw BT Ma lighes erstar	Total:6 Graw Hill Hill apped st Level)
Budger Classific Standa costing varianc REFER 1. 2. 3. 4. 5. COURS On con CO1 CO2	t and Buccation of burd Costinated as a markes — Sale EENCES: Jawahara Education William Education M.N.Aro M.N.Aro M.N.Aro M.N.Aro understated use the	udger f budg ting a anage ales va S: arLal, tion, N n Land tion, N rora a M.Kish rora, " COM n of tl stand e basi	seemalew Deen, Shalew Deen, Shalew Deen, Cost ar	ounting ntrol: E ixed an iance A ool – Co aSrivast hi, 2020 nnon Ai hi, 2020 ankaKa ost and ad Mana se, the aceptual c conce g metho	Budgeta d Flexil Analysi ost vari ava, M 0. nderso 0. tyal, "C I Manaç agemer e stude I frame epts an	ary contrible Budgis: Budgiances - lanisha San and Man	geting. getary control Direct mat Singh, " Cos ichael Mahe ounting", 5t Accounting' unting",11th be able to foost accounts ss in determ	ol and standerial cost vistal	ing, Text, I mentals of Vikas publion, Taxma	Problems f cost Acc lishing Ho ann, New shing, New	ability of stan bour cost var and Cases", ounting",7th E use, New Del Delhi, 2021	dard iance 6th E Edition	costings – O	g – Siverhe	tandard rad Total:6 Graw Hill Hill apped st Level) anding (K2 anding (K2

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1										2	3	1		
CO2										2	3	1		
CO3										2	3	1		
CO4										2	3	1		
CO5										2	3	1		

1 - Slight, 2 - Moderate	e, 3 - Substantial,	BT- Bloom's Tax	onomy
--------------------------	---------------------	-----------------	-------

	ASSESSMENT PATTERN - THEORY						
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	35	65					100
CAT2	15	35	50				100
CAT 3	15	15	70				100
ESE	25	25	50				100
* ±3% may be varied	I (CAT 1,2 & 3 – 50	marks & ESE – 100) marks)				

_	22MBO02 - Economic Analysis for	Decision Makir	g	, ,			Г
Programme& Branch		Sem.	Category	L	Т	Р	Credit
Prerequisites	Basic understanding of differential calculus	6	OE	4	0	0	4
Preamble	The course aims at introducing a few vital techniques requinformed managerial decisions.	uired for carrying	out economic	ana	ysis	for m	aking
Unit – I	Economic Optimization						1
Economic Open Theory of firm incremental co	- Business versus Economic profit - Revenue relations - Cos	st relations – Pro	ofit relations –	Marg	inal	versu	S
Unit – II	Forecasting						1
Linear Trend –	Forecasting applications – Techniques –Naire method – Movi Growth Trend – Sales, cost and revenue forecasting.	ng average – Ex	ponential smo	othin	g - 1	rend	
Unit – III	Production and Cost Analysis roduction function – Returns to scale and returns to factor – 1						1
Cost Analysis volume – profit Unit – IV Competitive N	Competitive Market Analysis arket Analysis: Characteristics of competitive markets – Pro	ofit maximisation	– Marginal ar	nalysi			1
•	rket supply curve – Equilibrium in competitive markets - Mon	opoly – Monopo	listic competit	ion.			
Unit - V	Game theory and Competitive Strategy Basics - Prisoner's Dilemma - Saddle Point - Two Person Zero	o Sum Camo (Camac without	Sad	dia E	Points	1
	le - Mixed Strategies.	o Sum Game - C	James Williout	Jau	ule r	OIIIIS	-
							Total:6
REFERENCES);						
1. Mark H	lirschey, "Managerial Economics", 12th Edition, Cengage Lea	rning, New Delh	i, 2022.				
2. Geetik	a, PiyaliGhosh, Purba Roy Choudhury, "Managerial Economi	cs", 3rd Edition,	McGraw Hill E	duca	tion	, New	Delhi,
3. Gupta	G, "Managerial Economics", 2nd Edition, McGraw Hill Educa	tion, New Delhi	2019.				
4. Ahuja.	H. L, "Principles of Microeconomics", 22nd Edition, S. Chand	Publishing, Nev	v Delhi, 2019.				
5. Panne Delhi,	erSelvam R, P. Sivasankaran, P. Senthilkumar., "Managerial 2018.	Economics", 1s	t Edition, Cenç	gage	Lear	ning,	New
COURSE OUT	COMES: n of the course, the students will be able to				(H		apped st Level)
CO1 Under	stand revenue, cost and profit relations and apply techniques	to find best cour	se of action.			Applyi	ing (K3)
CO2 Apply	appropriate forecasting techniques for estimating sales, cost a	and revenue.				Applyi	ing (K3)
	stand the relation between inputs and output of production sys nalysis	stem and perforr	n cost – volum	e –		Applyi	ing (K3)
CO4 Apply	market equilibrium concepts in monopoly and monopolistically	/ competitive ma	ırkets.			Applyi	ing (K3)
CO5 Under	stand game theory and apply in different strategic decisions				,	Applyi	ing (K3)

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1					2					1	3			
CO2					2					1	3			
CO3					2					1	3			
CO4					2					1	3			
CO5					2					1	3			
1 – Slight, 2	– Mode	rate, 3 –	Substanti	al, BT- I	3loom's	Taxono	my							

ASSESSMENT PATTERN - THEORY							
Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %	
15	55	30				100	
15	45	40				100	
15	45	40				100	
5	40	55				100	
	(K1) % 15 15 15	Remembering (K1) % Understanding (K2) % 15 55 15 45 15 45	Remembering (K1) % Understanding (K2) % Applying (K3) % 15 55 30 15 45 40 15 45 40	Remembering (K1) % Understanding (K2) % Applying (K3) % Analyzing (K4) % 15 55 30 15 45 40 15 45 40	Remembering (K1) % Understanding (K2) % Applying (K3) % Analyzing (K4) % Evaluating (K5) % 15 55 30	Remembering (K1) % Understanding (K2) % Applying (K3) % Analyzing (K4) % Evaluating (K5) % Creating (K6) % 15 55 30	

^{* ±3%} may be varied (CAT 1,2 & 3 – 50 marks & ESE – 100 marks)

22MBO03 - MARKETING ANALYTICS

Programme& Branch	BE / B.Tech Programme	Sem	Category	L	Т	P	Credit
Prerequisites	Nil	7	OE	4	0	0	4

Preamble	Marketing analytics enables marketers to measure, manage and analyze marketing performance to maxi	
	effectiveness and optimize return on investment (ROI). This course exposes the students with the tools to customer value and apply analytic tools to various marketing decisions.	measure
Unit – I	Market & Marketing Analytics	12
Introduction	n - Introduction to marketing analytics, Models & Metrics	
Market Insi	ght - Market sizing.	
Market Seg	mentation –Segmentation, Targeting & Positioning	
Unit – II	Business & Competition	12
Competitive	Analysis - Competitor identification, analysis, and actions	
Business Str	rategy – Scenarios, Decision Model, Metrics	
Business Op	perations - Forecasting	
Unit – III	Product and Price	12
Product and	l Service Analytics - Conjoint analysis and product/service metrics	
Price Analy	tics - Pricing techniques and assessment	
Unit – IV	Distribution & Promotion	12
Distribution	Analytics – Characteristics, Channel evaluation and selection, Multichannel distribution and metrics.	
Promotion A	Analytics - Promotion budget estimation and allocation, Metrics	
Unit – V	Sales	12
Sales Analy	tics - Metrics for sales, profitability, and support	

Total:60

REFERENCES:

	(025)
1.	Stephen Sorger, "Marketing Analytics: Strategic Models and Metrics", 1st Edition, Admiral Press, UK, 2016.
2.	Wayne L. Winston, "Marketing Analytics: Data-Driven Techniques with Microsoft Excel", 1st Edition, Wiley, New Delhi, 2018.
3.	Tommy Blanchard, "Data Science for Marketing Analytics", 1st Edition, Packt Publishing, UK, 2019.
4.	Mike Grigsby, "Marketing Analytics", 2nd Edition, Kogan Page, UK, 2018.
5.	David A. Aaker, V. Kumar, Robert P. Leone, George S. Day., "Marketing Research", 1st Edition, Wiley, New Delhi, 2019.

	SE OUTCOMES: unpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1:	Understand the importance of Analytics in Marketing, size and segment the market	Understanding (K2)
CO2:	Understand the Business, competition and its related decisions.	Understanding (K2)
CO3:	Identify important features of a product and suitable pricing methods.	Applying (K3)
CO4:	Assess Channel performance and Promotion Metrics.	Applying (K3)
CO5:	Assess sales performance.	Applying (K3)

	Mapping of COs with POs and PSOs													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1										2	3	1		
CO2										2	3	1		
CO3										2	3	1		
CO4										2	3	1		
CO5										2	3	1		
1 – Slight, 2	- Mode	rate, 3 –	Substant	ial, BT- I	Bloom's	Taxono	my							

	ASSESSMENT PATTERN - THEORY													
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %							
CAT1	35	65					100							
CAT2	15	35	50				100							
CAT 3	15	15	70				100							
ESE	25	25	50				100							
* ±3% may be varied	d (CAT 1,2 & 3 – 50	marks & ESE - 100) marks)			•	•							

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE-638060 (AUTONOMOUS) BOARD OF FOOD TECHNOLOGY

DEGREE & PROGRAMME: BTECH & FOOD TECHNOLOGY

HONOURS DEGREE TITLE: FOOD PROCESSING AND MANAGEMENT

The following courses are identified to earn additional 18 credits to get a Honours degree with specialization in **Food Processing and Management**

S.No	Course Code	Course Title	Credits	Prerequisites	Semester
1.	22FTH01	Food Supply Chain Management	4	Nil	5
2.	22FTH02	Entrepreneurship	3	Nil	5
3.	22FTH03	International Food Safety Regulations	4	Nil	6
4.	22FTH04	Project Management	3	Nil	6
5.	22FTH05	Food Safety Management System	4	Nil	7
		TOTAL	18		

	22FTH01- FOOD SUPPLY CH	IAIN MANAGEMENT											
Programme & Branch	B.Tech & Food Technology	Sem.	Category	L	т	Р	Credi						
Prerequisites	Nil	5/6/7	HN	3	1	0	4						
Preamble	This course addresses the theory and practices of supply chain management within the context of the food system.												
Unit – I	Introduction and overview of Food Supply Ch	ain Management					9+3						
Inbound and Out I Vendor developm	verview of Food Supply Chain Management, present cound logistics, Supply Chain as a source of competent and evaluation, Reduced sourcing and supplies control, Inventory control systems of stock replenishmerials function.	etitive advantage. Buy er partnership - benefi	er-Vendor co- ts, Risks and	ordin	atior	n, Pro ucces	curemer ss factor						
Unit – II	System view of logistics, Coordination and m						9+3						
services, Characte processing, Purch		election, contracting ar nd customer service stansportation infrastructu	nd evaluation andards, Phys	meth sical o	ods, distril	inven oution	tory ord						
Unit – III	Logistics/Supply Chain (SC) Strategy and Pla	nning					9+3						
Logistics/SC Plani Performance. The Characteristics, W	gy, Logistics/SC Strategy, Logistics/SC Planning, Le ning Problems, Guidelines for Strategy Formulation, Logistics/Supply Chain Product: Nature and Cl eight-Bulk Ratio, Value-Weight Ratio, Substitutabilit g Methods, Legal Concerns.	, Selecting the Proper lassification of Produc	Channel Stratets, The Proc	tegy, duct	Mea Life	surino Cycle	g Strateg e, Produ						
Unit – IV	Order Processing and Information Systems												
	rocessing, Order Preparation, Order Transmittal,						9+3						
Processing Example Order Planning, Ot	oles, Industrial Order Processing, Retail Order Proher Factors Affecting Order-processing Time, Proces	ocessing, Customer O	rder Processi	ng, V	Veb-	Base	ng, Orde d Chann						
Processing Example Order Planning, Ot Filling Accuracy, C	oles, Industrial Order Processing, Retail Order Proher Factors Affecting Order-processing Time, Proces	ocessing, Customer O	rder Processi	ng, V	Veb-	Base	ng, Orde d Chann						
Processing Examporder Planning, Ot Filling Accuracy, Cunit – V Strategic consider Supply stream strengineering. Operations of the process of	oles, Industrial Order Processing, Retail Order Processing Factors Affecting Order-processing Time, Procesorder Batching. Strategic considerations for supply chain ations for supply chain, Porter's industry analysis at ategies, Classification and development guidelines ations Research Models for operational and strategic	ocessing, Customer Or ssing Priorities, Paralle and value-chain mode s, Measuring effectiven	rder Processi I versus Sequ Is, Concept oness of supply	ng, V entia f tota / mai	Veb- I Prod I cos	Based cessing st of d ment,	ng, Orde d Chann ng, Order 9+3 ownershi Logistic						
Processing Examporder Planning, Ot Filling Accuracy, Cunit – V Strategic consider Supply stream strengineering. Operations of the process of	oles, Industrial Order Processing, Retail Order Processing Factors Affecting Order-processing Time, Procesorder Batching. Strategic considerations for supply chain ations for supply chain, Porter's industry analysis at ategies, Classification and development guidelines ations Research Models for operational and strategic	ocessing, Customer Or ssing Priorities, Paralle and value-chain mode s, Measuring effectiven	rder Processi I versus Sequ Is, Concept oness of supply	f tota mai, The	Veb- I Prod I cos nage Bull	Based cessir at of c ment, whip E	ng, Orde d Chann ng, Order 9+3 ownershi Logistic Effect an						
Processing Exam Order Planning, Ot Filling Accuracy, C Unit – V Strategic consider Supply stream str engineering. Oper supply-chain mana	oles, Industrial Order Processing, Retail Order Processing Factors Affecting Order-processing Time, Procesorder Batching. Strategic considerations for supply chain ations for supply chain, Porter's industry analysis at ategies, Classification and development guidelines ations Research Models for operational and strategic	ocessing, Customer Or ssing Priorities, Paralle and value-chain mode s, Measuring effectiven	rder Processi I versus Sequ Is, Concept o less of supply management	f tota mai, The	Veb- I Prod I cos nage Bull	Based cessir at of c ment, whip E	ng, Orded Channing, Orded 9+3 Dewnershi Logistic Effect an						
Processing Examporder Planning, Ot Filling Accuracy, Counit – V Strategic consider Supply stream strengineering. Operasupply-chain mana	oles, Industrial Order Processing, Retail Order Procher Factors Affecting Order- processing Time, Procesorder Batching. Strategic considerations for supply chain ations for supply chain, Porter's industry analysis a ategies, Classification and development guidelines ations Research Models for operational and strategic agement game.	and value-chain modes, Measuring effectivents in supply chain	rder Processi I versus Sequ Is, Concept o less of supply management Lecture:	ng, V entia f tota / mai , The	Veb- I Prod I cos nage Bull	Based cessing at of coment, whip I	ng, Orde d Chanr ng, Orde 9+3 ownershi Logistic						
Processing Examporder Planning, Ot Filling Accuracy, Counit – V Strategic consider Supply stream strengineering. Operation of the Supply-chain management o	oles, Industrial Order Processing, Retail Order Procher Factors Affecting Order- processing Time, Procesorder Batching. Strategic considerations for supply chain ations for supply chain, Porter's industry analysis a ategies, Classification and development guidelines ations Research Models for operational and strategic agement game.	and value-chain modes, Measuring effectivents in supply chain	rder Processi I versus Sequ Is, Concept o less of supply management Lecture:	ng, V entia f tota / mai , The	Veb- I Prod I cos nage Bull	Based cessing at of coment, whip I	ng, Orde d Chanr ng, Orde 9+3 ownershi Logistic						
Processing Exam Order Planning, Ot Filling Accuracy, C Unit – V Strategic consider Supply stream str engineering. Opersupply-chain mana TEXT BOOK: 1. Chopra, S Education REFERENCES:	oles, Industrial Order Processing, Retail Order Procher Factors Affecting Order- processing Time, Procesorder Batching. Strategic considerations for supply chain rations for supply chain, Porter's industry analysis a rategies, Classification and development guidelines rations Research Models for operational and strategic ragement game. A, and P. Meindl, "Supply Chain Management – Strates, 2016. The processing Retail Order Processing, Retail Order Processing Retail Order Processing Time, Proc	and value-chain modes, Measuring effectivents issues in supply chain egy, Planning and Ope	Is, Concept of the second seco	f tota f tota mai The	Veb- I Prod I cos nage Bull utor	Based cessing at of coment, whip E	ng, Orded Channing, Order 9+3 where the Logistic Effect are the Channing of th						

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	outline Food Supply Chain Management in India.	Understanding (K2)
CO2	classify the Coordination and management of transportation services.	Understanding (K2)
CO3	infer suitable Logistics/Supply Chain (SC) Strategy and Planning for products.	Understanding (K2)
CO4	utilize the Order Processing and factors affecting order processing.	Applying (K3)
CO5	Summarize the supply chain strategies	Understanding (K2)

Mapping	of COs	with POs	and PSOs
---------	--------	----------	----------

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2				2						1	1	2
CO2	3	2		1		2						2	2	3
CO3	3	3		2		3						2	2	3
CO4	3	2		1		2						2	2	3
CO5	3	3		3		3						2	2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	40	60					100
CAT3	30	50	20				100
ESE	30	50	20				100

^{*} $\pm 3\%$ may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22FTH02 - ENTREPRENEU	IKSHIP					
Programme & Branch	B.Tech & Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	5/6/7	HN	3	0	0	3
Preamble	This course provides a detailed overview of entrepre value creation in the national economy.	neurship as th	e foundation (of bus	sines	s gro	wth and
Unit – I	Entrepreneurship Journey and Discovery						9
entrepreneurial of	repreneurial Journey-Different types of entrepreneurs origins, entrepreneurial and start up firms, stages of ccelerators. Entrepreneurial Discovery- Triggers for ent	start up journe	ey at corpora	te ar	nd Pi		
Unit – II	Ideathon and prototyping						9
thinking on des entrepreneurship	start up, Demand supply match, Design thinking as an ign, manufacture and delivery, Emotional drivers of stages of ideathon and prototyping in the entreprers for ideathon, Characteristics of ideathon, Prototype, Technological Innovation and Entrepreneurship	f design think eneurial journ	ing, design tey, Different	thinki idea	ng أ thon	mpor app	tance ir roaches
the next Industrial Model of five Tea	yramid, types of technological innovation, unique role of al Revolution, Pioneering Leadership Model, Technolochnology forces, Elements of customised product designation, trends of technological development, framework	ogy Competen In, Facets of T	ce framework echnological	t, Inn behav	ovat	or St	rategies
Unit – IV	Financial resources, Education and Entrepreneu	ırship					9
, medium scale Entrepreneurship benchmarks in st at Industrial revol	res-Financing Staircase, Startup funding and investment entreprises, Financial strategy, role of finance manals-India's development pathway-Innovation, efficiency, coudent educational proficiency, role of India's science are ution, Beyond founders and founder families- Entreprene founders/management, Issues in founder, co-founders and firms	agement, Fina competitiveness nd technology, eurs and leade	ncial ratio ar s and collabor Education ar rs, Co-foundir	nalysi ative nd Ma ng as	s. E fram inage a po	duca ewoi emer werfi	tion and rk, globa nt, STEM ul leader
Unit – V	Entrepreneurial culture and Employment						9
	-up Nation, National Entrepreneurial Culture, Entrepr irt-up Case Studies.	reneurial Theri	modynamics,	Entre	eprei	neurs	ship and
							Total:4
ТЕХТ ВООК:							
1. Donald F. K	uratko,"Entrepreneurship: Theory, Process, Practice", 1	11th Edition, Ce	engage Learn	ing, E	Bosto	n, 20	020.
REFERENCES:							
1. Robert D. H Hill, Noida,	isrich, Michael P. Peters & Dean A. Shepherd, Sabyasa 2020.	chi Sinha "Entı	repreneurship	", 11 ^t	^h Edi	tion,	McGraw
	th Poornima .M, "Entrepreneurship Development and	Small Busines	s Enterprises	", 3rd	Edi	tion,	Pearsor

3.

Education, Noida, 2018.

Barringer and Ireland, "Entrepreneurship", 3rd Edition, Pearson Education, 2012.

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1:	outline the importance of entrepreneurship journey and discovery	Understanding (K2)
CO2:	make use of ideathon and prototyping	Applying (K3)
CO3:	identify suitable technological innovation and entrepreneurship	Applying (K3)
CO4:	Infer the importance of financial resources and entrepreneurship	Understanding (K2)
CO5:	Utilize the entrepreneurial culture and employment	Applying (K3)

	Mapping of COs with POs and PSOs													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1					2		2	1	1	1	3	2		1
CO2	1	2	2		2		2	1	1	1	3	2		2
CO3	2	2	2	2	2		2	2	2	1	3	2		1
CO_4	1	1	2		2		1	1	1	1	3	2		1

^{1 –} Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

CO5

		ASSESSMEN ⁻	Γ PATTERN	- THEORY			
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100
* +3% may be varie	d (CAT 1 2 3 _ 50	marks & ESE _ 10	0 marke)				

Programme & Branch	B.Tech & Food Technology	Sem.	Category	L	Т	Р	Credi
Prerequisites	Nil	5/6/7	HN	3	1	0	4
Preamble	This course deals about international agencies and intersafety	national fo	od laws and r	egul	atior	ns on	food
Unit – I	Regulations on Food Import and Export						9+3
	on system, Product/Ingredient Approval, Export & Import licy, Food Import Clearance System (FICS).	Laws and	Regulations,	FTD	R A	ct, 19	992 and
Unit – II	World Trade Organization (WTO)						9+3
European Comm Agreement - WT0	NTO - The WTO Framework - Introduction to OIE and IP ission, USFDA etc). Introduction to WTO agreement: SPS Dispute Settlement - Functioning of the SPS Agreement						the SP
Unit – III	Codex Alimentarius Commission (CAC)						9+3
Standards in effe Harmonisation Of Standards - Euro	dex – development and use – Standard setting and Advi- ect - Implications on trade in light of SPS and TBT, Of India's Food Standards with Codex Standards and Other pean Committee for Standardization (CEN), PAN America	ther Internation Internation an Standar	ational Stand al Best Pract ds Commiss	lards ices,	Se Cou	tting ıntry	Bodies Specifi
Asian Council for	Standardization, FDA, EPA, EU, ASEAN, EFSA (Europea	n Food Sat	ety Authority) `			
Unit – IV Regulation Of Fo Regulation Of Co	Standardization, FDA, EPA, EU, ASEAN, EFSA (Europea Regulation of Food Additives, Contaminants And Peod Additives Contaminants And Pesticides In The United Statement and Pesticides European Community Legislatic Advisory Committees - Pesticide Residues - Veteri	sticides States: The ion on Lim	Food Additivits for Additiv	∕e A _l es a	oprov	val P	minant
Unit – IV Regulation Of Fo Regulation Of Co in Food: Scientil Development Of A of Food Additives	Regulation of Food Additives, Contaminants And Period Additives Contaminants And Pesticides In The United Sontaminants And Pesticides European Community Legislatic Advisory Committees - Pesticide Residues - Veteri Australia New Zealand Standards: Food Regulation in New A — The Regulation of Contaminants and Other Restricted Standards:	sticides States: The ion on Lim nary Drug Zealand – Substances	Food Additivits for Additiv Residues - WTO Obligat	/e Apes a Oth ions	oprov nd C	val P Conta	rocess minant minant egulatio
Unit – IV Regulation Of Fo Regulation Of Co in Food: Scientif Development Of of of Food Additives Unit – V Development Of Food - The Cont International Stan Meeting on Pestic Limits - Internat	Regulation of Food Additives, Contaminants And Person Additives Contaminants And Pesticides In The United Sontaminants And Pesticides European Community Legislate ic Advisory Committees - Pesticide Residues - Veteria Australia New Zealand Standards: Food Regulation in New A — The Regulation of Contaminants and Other Restricted Sontaminants and Other Restricted Sontaminants and Principles of the General The GSCTF — Scope, Purpose and Principles of the General of The General Standard Status and Future Codex and Standards For Pesticide Residues - Selection of Pesticides for Cide Residues - Safety of Pesticide Residues - Good Agricianal Regulatory Practices Involving Pesticide Residues Radiation Protection - International Commission on Radiation	sticides States: The ion on Lim nary Drug Zealand – Substances ants And T eral Standa Standards Elaboration cultural Pra s Develop	Food Additivits for Additive Residues - WTO Obligate For Posticide of Codex MF ctice - Codex ment of Radditive Residues	/e Apes a Oth ions od nina e Re RLS c Ext diolo	oprov nd C er C – Th nts a sidua - Joir rance	val F Conta Conta ie Re und T es: N es: N	egulatio 9+3 Toxins In Need for Need for Need for Need for Nesidue
Unit – IV Regulation Of Fo Regulation Of Co in Food: Scientif Development Of of of Food Additives Unit – V Development Of Food - The Cont International Stan Meeting on Pestic Limits - Internat Radioactivity And	Regulation of Food Additives, Contaminants And Person Additives Contaminants And Pesticides In The United Sontaminants And Pesticides European Community Legislate ic Advisory Committees - Pesticide Residues - Veteria Australia New Zealand Standards: Food Regulation in New A — The Regulation of Contaminants and Other Restricted Sontaminants and Other Restricted Sontaminants and Principles of the General The GSCTF — Scope, Purpose and Principles of the General of The General Standard Status and Future Codex and Standards For Pesticide Residues - Selection of Pesticides for Cide Residues - Safety of Pesticide Residues - Good Agricianal Regulatory Practices Involving Pesticide Residues Radiation Protection - International Commission on Radiation	sticides States: The ion on Lim nary Drug Zealand – Substances ants And T eral Standa Standards Elaboration cultural Pra s Develop	Food Additivits for Additive Residues - WTO Obligate For Posticide of Codex MF ctice - Codex ment of Radditive Residues	ve Apes a Oth other of Otherof of Other of Other of Other of Other of Other of Other of Other	oprov nd C er C – Th nts a sidu - Join rane gica	val F Contactonta ind T es: N nt F ous I Sta	9+3 Toxins I Need for O/WHG Residu andards f Code
Unit – IV Regulation Of Fo Regulation Of Co in Food: Scientif Development Of of of Food Additives Unit – V Development Of Food - The Cont International Stan Meeting on Pestic Limits - Internat Radioactivity And	Regulation of Food Additives, Contaminants And Person Additives Contaminants And Pesticides In The United Sontaminants And Pesticides European Community Legislate ic Advisory Committees - Pesticide Residues - Veteria Australia New Zealand Standards: Food Regulation in New A — The Regulation of Contaminants and Other Restricted Sontaminants and Other Restricted Sontaminants and Principles of the General The GSCTF — Scope, Purpose and Principles of the General of The General Standard Status and Future Codex and Standards For Pesticide Residues - Selection of Pesticides for Cide Residues - Safety of Pesticide Residues - Good Agricianal Regulatory Practices Involving Pesticide Residues Radiation Protection - International Commission on Radiation	sticides States: The ion on Lim nary Drug Zealand – Substances ants And T eral Standa Standards Elaboration cultural Pra s Develop	Food Additivits for Additive Residues - WTO Obligate For Posticide of Codex Mictice - Codex ment of Rarotection. Es	ve Apes a Oth other of Otherof of Other of Other of Other of Other of Other of Other of Other	oprov nd C er C – Th nts a sidu - Join rane gica	val F Contactonta ind T es: N nt F ous I Sta	9+3 oxins li Need fo O/WHO Residue andards f Code:
Unit – IV Regulation Of Fo Regulation Of Co in Food: Scientif Development Of / of Food Additives Unit – V Development Of Food - The Cont International Stan Meeting on Pestic Limits - Internat Radioactivity And Microbiological C TEXT BOOK:	Regulation of Food Additives, Contaminants And Person Additives Contaminants And Pesticides In The United Sontaminants And Pesticides European Community Legislate ic Advisory Committees - Pesticide Residues - Veteria Australia New Zealand Standards: Food Regulation in New A — The Regulation of Contaminants and Other Restricted Sontaminants and Other Restricted Sontaminants and Principles of the General The GSCTF — Scope, Purpose and Principles of the General of The General Standard Status and Future Codex and Standards For Pesticide Residues - Selection of Pesticides for Cide Residues - Safety of Pesticide Residues - Good Agricianal Regulatory Practices Involving Pesticide Residues Radiation Protection - International Commission on Radiation	sticides States: The ion on Lim nary Drug Zealand – Substances ants And Teral Standards Elaboration cultural Pra s Develop liological P	Food Additivits for Additivits for Additivits for Additivities for Additivities for Additivities for Obligate for Interest for Pesticide of Codex Medice - Codex ment of Raprotection. Es	ve Aperson and Ape	pprovind Control of Co	val F Contactonta ind T es: N nt F ous I Sta	9+3 Toxins I Need for O/WHG Residu andards f Code
Unit – IV Regulation Of Fo Regulation Of Co in Food: Scientif Development Of / of Food Additives Unit – V Development Of Food - The Cont International Stan Meeting on Pestic Limits - Internat Radioactivity And Microbiological C TEXT BOOK:	Regulation of Food Additives, Contaminants And Period Additives Contaminants And Pesticides In The United Sontaminants And Pesticides European Community Legislatic Advisory Committees - Pesticide Residues - Veteria Australia New Zealand Standards: Food Regulation in New A — The Regulation of Contaminants and Other Restricted Sontaminants and Other Restricted Sontaminants and Principles of the General The GSCTF — Scope, Purpose and Principles of the General of The General Standard Status and Future Codex and Standards For Pesticide Residues - Selection of Pesticides for Ecide Residues - Safety of Pesticide Residues - Good Agricianal Regulatory Practices Involving Pesticide Residues and Radiation Protection - International Commission on Radiation Foods	sticides States: The ion on Lim nary Drug Zealand – Substances ants And Teral Standards Elaboration cultural Pra s Develop liological P	Food Additivits for Additivits for Additivits for Additivities for Additivities for Additivities for Obligate for Interest for Pesticide of Codex Medice - Codex ment of Raprotection. Es	ve Aperson and Ape	pprovind Control of Co	val F Contactonta ind T es: N nt F ous I Sta	9+3 Toxins I Need for O/WHG Residuandards f Code
Unit – IV Regulation Of Foregulation Of Company of Property of Food Additives Unit – V Development Of Property of Food - The Control International Stand Meeting on Pestivation of Property of Prop	Regulation of Food Additives, Contaminants And Period Additives Contaminants And Pesticides In The United Sontaminants And Pesticides European Community Legislatic Advisory Committees - Pesticide Residues - Veteria Australia New Zealand Standards: Food Regulation in New A — The Regulation of Contaminants and Other Restricted Sontaminants and Other Restricted Sontaminants and Principles of the General The GSCTF — Scope, Purpose and Principles of the General of The General Standard Status and Future Codex and Standards For Pesticide Residues - Selection of Pesticides for Ecide Residues - Safety of Pesticide Residues - Good Agricianal Regulatory Practices Involving Pesticide Residues and Radiation Protection - International Commission on Radiation Foods	sticides States: The ion on Lim nary Drug Zealand – Substances ants And Teral Standards Elaboration cultural Pra s Develop liological P	Food Additivits for Additivits for Additivits for Additivits for Additivits for Additivits for Additivits for Obligated for Contant for Pesticide of Codex Mictice - Codex ment of Rarotection. Es	/e Apes a Oth Other Othe	pprovind Cer C— The sidu. - The sidu Join rane gica shame prial:	val F Contactonta ind T es: N nt F ous I Sta ent o	9+3 Toxins I Need for O/WHG Residu andards f Code
Unit – IV Regulation Of Fo Regulation Of Co in Food: Scientif Development Of A of Food Additives Unit – V Development Of Food - The Cont International Stan Meeting on Pestic Limits - Internat Radioactivity And Microbiological C TEXT BOOK: 1. Naomi Rees REFERENCES: 1. Neal D. Fort	Regulation of Food Additives, Contaminants And Period Additives Contaminants And Pesticides In The United Standards And Pesticides European Community Legislate In Experimental Community Legislate In Experimenta	sticides States: The ion on Lim nary Drug Zealand – Substances ants And T eral Standa Standards Elaboration cultural Pra s Develop liological P	Food Additivits for Additivits for Additivits for Additivities for Additivities for Additivities for Additivities for Additivities for Contant for Pesticide of Codex Mictice - Codex ment of Rarotection. Es	/e Apes a Oth Other Othe	pprovind Cer C— The sidu. - The sidu Join rane gica shame prial:	val F Contactonta ind T es: N nt F ous I Sta ent o	9+3 Toxins I Need for COVHI Residuandards of Code

	SE OUTCOMES: empletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	infer the regulations on Food Import and Export	Understanding (K2)
CO2	explain the role of World Trade Organization in food law and policies	Understanding (K2)
CO3	outline about codex and global perspectives on the challenges and opportunities in the international food trade, including the steps being taken towards international harmonization	Understanding (K2)
CO4	apply the Regulation of Food Additives, Contaminants and Pesticides in various countries while involving in international trade	Applying (K3)
CO5	make use of the Codex Standards for Contaminants and Toxin Evaluation in Food	Applying (K3)

Mapping of	COs with	POs and	PSOs
------------	----------	---------	-------------

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
003/1 03		1 02	1 00	1 04	1 03	1 00	. 07	1 00	1 03	1 0 10	-	1 012	1 001	1 002
CO1	1	1	3			3	2	3				3	1	3
CO2	1	1	3			3	2	3				3	1	3
CO3	1	1	3			3	2	3				3	1	3
CO4	1	1	3			3	2	3				3	1	3
CO5	1	1	3			3	2	3				3	1	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	40	60					100
CAT3	30	40	30				100
ESE	40	50	10				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

			T		ı	1 ,	
Programme Branch	& B.Tech & Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisite	s Nil	5/6/7	HN	3	0	0	3
Preamble	This course deals about the general and adv demand in the market from a variety of fields		ject Managei	ment	to n	neet	the
Unit – I	Project Management Fundamentals						9
	to Project Management, Project success, Types management.		ations, Proje	ct m	ana	geme	ent office
Unit – II	Project Life cycle and selection methods						9
	ect and Project life cycle, Project life cycle phases a analysis, Financial analysis, capital budgeting tech		Methods of pr	rojec	t sel	ectio	n , marke
Unit – III	Risk Management and technical analysis						9
	ment , Stand alone risk analysis , Hillier model, sim	ulation analysis ,Decis	ion analysis,	abar	ndon	ment	t analysis
technicai ana	llysis, Product mix and Plant capacity analysis. Resources management and Probability						
Hoit IV		madala					
			Project time	. m	naa	omor	9 of DEDI
Project team	building , Conflict and Negotiation, HRM Issues a PM, Probability model in networks, simulation of net	and time management					
Project team	building, Conflict and Negotiation, HRM Issues a	and time management tworks, Slacks and floa					
networks , CF Unit - V Introduction t	building, Conflict and Negotiation, HRM Issues a PM, Probability model in networks, simulation of net	and time management tworks, Slacks and floa agement techniques, cost estim	nts, Crashing	of no	n to	rks quali	nt- PERT
Project team networks , CF Unit – V Introduction t	building, Conflict and Negotiation, HRM Issues a PM, Probability model in networks, simulation of net Cost management and procurement mana o project cost management, Cost control-tools and	and time management tworks, Slacks and floa agement techniques, cost estim	nts, Crashing	of no	n to	rks quali	9 ity
Project team networks , CF Unit – V Introduction t	building , Conflict and Negotiation, HRM Issues a PM, Probability model in networks, simulation of networks and procurement management control cost management, Cost control and so project cost management, Cost control and so project cost management, Six Sigma, Six Sigma tools,	and time management tworks, Slacks and floa agement techniques, cost estim	nts, Crashing	of no	n to	rks quali	nt- PERI
Project team networks , CF Unit – V Introduction t management TEXT BOOK	building , Conflict and Negotiation, HRM Issues a PM, Probability model in networks, simulation of networks and procurement management control cost management, Cost control and so project cost management, Cost control and so project cost management, Six Sigma, Six Sigma tools,	and time management tworks, Slacks and floa agement techniques, cost estim Procurement Manager	nation, Introdu	of no	n to Tern	quali quali	9 ity ion. Total:4
Project team networks , CF Unit – V Introduction t management TEXT BOOK Bang	building, Conflict and Negotiation, HRM Issues a PM, Probability model in networks, simulation of networks and procurement management and procurement management cost cost management, Cost control-tools and a Source of variability, Six Sigma, Six sigma tools, and a T.R., Agarwal, N.K., Sharma, S.C., "Industrial Enga Publishers, New Delhi 2007.	and time management tworks, Slacks and floa agement techniques, cost estim Procurement Manager	nation, Introdument and Pro	of no	n to Tern	quali quali	9 ity ion. Total:4
Project team networks , CF Unit – V Introduction t management TEXT BOOK 1. Bang Khan REFERENCE	building, Conflict and Negotiation, HRM Issues a PM, Probability model in networks, simulation of networks and procurement management and procurement management cost cost management, Cost control-tools and a Source of variability, Six Sigma, Six sigma tools, and a T.R., Agarwal, N.K., Sharma, S.C., "Industrial Enga Publishers, New Delhi 2007.	and time management tworks, Slacks and float agement techniques, cost estim Procurement Manager gineering and Manage	nation, Introdu ment and Pro	of nouction	n to Tern	quali quali ninati	9 ity ion. Total:4
Project team networks , CF Unit – V Introduction t management TEXT BOOK 1. Bang Khan REFERENCE 1. C F G Jack	building, Conflict and Negotiation, HRM Issues a PM, Probability model in networks, simulation of networks and procurement management and procurement management cost cost management, Cost control-tools and a Source of variability, Six Sigma, Six sigma tools, and a T.R., Agarwal, N.K., Sharma, S.C., "Industrial Enga Publishers, New Delhi 2007.	and time management tworks, Slacks and float agement techniques, cost estime Procurement Manager and Manager and Manager and The Managerial Function of the	nation, Introdument and Proment Science	of nounction	n to Tern th Ec	qualininati	9 ity ion. Total:4

	SE OUTCOMES: mpletion of the course, the students will be able to	BT Mapped (Highest Level)
CO1:	summarize the Project management fundamentals	Understanding (K2)
CO2:	identify the project life cycle and selection methods	Applying (K3)
CO3:	Identify the risk management and technical analysis	Applying (K3)
CO4:	Infer the role resources management and probability models	Understanding (K2)
CO5:	Make use of cost management technique and procurement management	Applying (K3)

COs/POs	PO1	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1					1	1	1	3	2	1	2
CO2	3	1	2	2				1	3	1	3	2	1	2
CO3	3	3	3					1	3	1	3	3	1	3
CO4	3	1	2					1	2	1	3	3	1	3
CO5	3	2	3	3				1	1	1	3	2	1	3

^{1 –} Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

		,					
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	40	60					100
CAT3	20	40	40				100
ESE	20	40	40				100

^{* ±3%} may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Programme &	D Table 6 Facilities to the	0-	0-1		-	_	0
Branch	B.Tech & Food Technology	Sem.	Category	L	Т	Р	Credit
Prerequisites	Nil	5/6/7	HN	3	1	0	4
Preamble	This course will provide students with an under management systems	rstanding of the princip	oles and prac	tices	of fo	ood s	afety
Unit – I	Introduction and PRP						9+3
	stem. Introduction to PRPs, The different type. Ps in a HACCP system, Challenges to PRPs GMP and HACCP	s of PRPs, Impleme	nting and ma	ainta	ining) PR	Ps, The
Good Manufactu	ring Practices (GMPs), Principles of GMPs, In rinciples of HACCP, developing a HACCP plan,						iction to
	ACCP plan, Challenges to HACCP.	p.oo.	g			, .	aa.a
Unit – III	ISO22000 and FSSC 22000						9+3
of ISO22000 cer	rements of ISO 22000, Implementation of ISO 22 tification, Challenges to ISO 22000. FSSC 22 22000, benefits of FSSC 22000 certification, Cl	2000, requirements of	FSSC 2200	00, li	t sys mple	item, men	benefits ting and
Unit – IV	BRCGS						9+3
	RCGS, The requirements of BRCGS, Implement	nting and maintaining	BRCGS, The	e be	nefit	s of	BRCGS
certification, Chal	lenges to BRCGS certification.						
	Training, Documentation, and Management	t Commitment					9+3
Unit – V The importance of	Training, Documentation, and Management of training in food safety, different types of food mportance of management commitment to food s	safety training, Devel					d safety
Unit – V The importance of documentation, ir	Training, Documentation, and Management of training in food safety, different types of food mportance of management commitment to food s	safety training, Devel		aining	g, do	cume	d safety entation,
Unit – V The importance of documentation, ir and management	Training, Documentation, and Management of training in food safety, different types of food mportance of management commitment to food s	safety training, Devel	ood safety tra	aining	g, do	cume	d safety entation,
Unit – V The importance of documentation, ir and management	Training, Documentation, and Management of training in food safety, different types of food mportance of management commitment to food s	safety training, Devel safety, Challenges to fo	Lecture:45,	Tute	g, do orial	:15,	d safety entation, Total:60
Unit – V The importance of documentation, ir and management TEXT BOOK: 1. David A.	Training, Documentation, and Management of training in food safety, different types of food importance of management commitment to food strommitment	safety training, Devel safety, Challenges to fo	Lecture:45,	Tute	g, do orial	:15,	d safety entation, Total:60
Unit – V The importance of documentation, ir and management TEXT BOOK: 1. David A. REFERENCES: "HARPO	Training, Documentation, and Management of training in food safety, different types of food importance of management commitment to food strommitment	safety training, Devel safety, Challenges to for ement Systems: Princip	Lecture:45,	Tute	g, do orial	:15, 'iley,	d safety entation, Total:60

COURS On com	BT Mapped (Highest Level)		
CO1	outline the basics of food safety importance and PRP	Understanding (K2)	
CO2	apply the GMP and HACCP in the food industry	Applying (K3)	
CO3	develop ISO22000 and FSSC 22000 in the food industry	Applying (K3)	
CO4	make use of BRCGS in the food sector	Applying (K3)	
CO5	Summarize the different types of food safety training	Applying (K3)	

Mapping o	f COs	with POs	and PSOs
-----------	-------	----------	----------

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	3			3	2	3				2	1	3
CO2	1	1	3			3	2	3				2	1	3
CO3	1	1	3			3	2	3				2	1	3
CO4	1	1	3			3	2	3				2	1	3
CO5	1	1	3			3	2	3				2	1	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

ASSESSMENT I ATTEM - ITLESKT										
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %			
CAT1	40	50	10				100			
CAT2	20	40	40				100			
CAT3	20	40	40				100			
ESE	20	40	40				100			

 $^{^{\}star}$ ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)