KONGU ENGINEERING COLLEGE

(Autonomous Institution Affiliated to Anna University, Chennai)

PERUNDURAI ERODE – 638 060

TAMILNADU INDIA

Estd : 1984

REGULATIONS, CURRICULUM & SYLLABI – 2022

(CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION)

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

BACHELOR OF ENGINEERING DEGREE IN COMPUTER SCIENCE AND DESIGN

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

KONGU
Assuring the Best

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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) Degree programme

iv. "Branch" means specialization or discipline of BE/BTech Degree programme, like Civil Engineering, Information Technology, etc.

v. "Course" means a Theory / Theory cum Practical / Practical course that is normally studied in a semester like Mathematics, Physics etc.

vi. "Credit" means a numerical value allocated to each course to describe the candidate's workload required 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 to each course.

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 India Council for Technical Education, New Delhi are offered by the College.

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

3. ADMISSION REQUIREMENTS

3.1 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.

3.2 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

4.2.1. 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 Honours degree in emerging areas	To be offered as Honours, Only for the following branches mentioned against the specialization
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 Machine Learning	BE – Electronics and Communication Engineering
8.	System on Chip Design *	BE – Electronics and Communication Engineering
9.	Electric Vehicles	BE – Electrical and Electronics Engineering
10.	Microgrid Technologies	BE – Electrical and Electronics Engineering
11.	Intelligent Sensors Technology *	BE – Electronics and Instrumentation Engineering
12.	Smart Industrial Automation *	BE – Electronics and Instrumentation Engineering
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 Petrochemical Engineering *	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 Data Science
23.	Blockchain	BTech – Artificial Intelligence and Data Science
24.	Internet of Things (IoT)	BTech – Artificial Intelligence and Machine Learning
25.	Blockchain	BTech – Artificial Intelligence and Machine Learning

*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 up may 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 the

seventh 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 balance credits 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 entire programme. 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 due approval 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

5.1 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), but in 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.

6.4 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 be decided based on the credit weightage assigned to theory and practical components.)	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 decided based on the credit weightage assigned	---
7.	All other Courses		

7.2 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.

7.3 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.

7.3.1 The assessment pattern for awarding continuous assessment marks shall be as follows:

Sl. No.	Type	Max. Marks	Remarks
1.	Test - I	25	Average of best 2 tests (25 marks)
	Test - II	25	
	Test - III	25	
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.

7.3.2 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).

7.3.3 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.

7.4 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.

7.5 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.

7.5.1 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.

7.5.2 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.

7.6 Project Work II Phase I / Project Work II Phase II

7.6.1 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.

7.6.2 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.

7.6.3 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)						End Semester Examination (Max. 50 Marks)			
Zeroth Review		Review I (Max.. 20 Marks)		Review II (Max. 30 Marks)		Report Evaluation (Max. 20 Marks)	Viva - Voce (Max. 30 Marks)		
Rv. Com	Super visor	Review Committee (excluding supervisor)	Super visor	Review Committee (excluding supervisor)	Super visor	Ext. Exr.	Super visor	Exr.1	Exr.2
0	0	10	10	15	15	20	10	10	10

7.6.4 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.

7.6.5 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.

7.6.6 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.

7.6.7 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.

7.6.8 A copy of the approved project report after the successful completion of viva-voce examination shall be kept in the department library.

7.7 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		Review I (Max.. 20 Marks)		Review II Max.. 30 Marks)		Review III (Max. 50 Marks)		
						Report Evaluation (Max. 20 Marks)	Viva - Voce (Max. 30 Marks)	
Review Committee	Supervisor	Review Committee (excluding supervisor)	Supervisor	Review Committee (excluding supervisor)	Supervisor	Review Committee	Supervisor	Review Committee
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.

7.8 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 be approved by the board of the offering department and Principal.

7.9 Comprehensive Test and Viva

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

7.10 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 % (after rounding 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 indisciplined 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. REQUIREMENTS 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 higher semester.

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 maximum period 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
Based on the relative grading	O (Outstanding)	10
	A+ (Excellent)	9
	A (Very Good)	8
	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 course	SA	-

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

$$\text{GPA} = \frac{\sum[(\text{course credits})\times(\text{grade points})] \text{ for all courses in the specific semester}}{\sum(\text{course credits}) \text{for all courses in the specific semester}}$$

The Cumulative Grade Point Average (CGPA) is calculated from first semester (third semester for lateral entry candidates) to final semester using the formula

$$\text{CGPA} = \frac{\sum[(\text{course credits})\times(\text{grade points})] \text{ for all courses in all the semesters so far}}{\sum(\text{course credits}) \text{for all courses in all the semesters so far}}$$

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)

17.1.2 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 Board of 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.

17.4 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.

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B.E. COMPUTER SCIENCE AND DESIGN CURRICULUM – R2022

(For the students admitted from the academic year 2022-23 onwards)

CURRICULUM BREAKDOWN STRUCTURE										
Summary of Credit Distribution										
Category	**Semester**								**Total number of credits**	**Curriculum Content (% of total number of credits of the program)**
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**		
HS	3	5	3	1			3		15	8.92
BS	8	8	4						20	11.90
ES	8	12	4	4					28	16.66
PC	3		13	16	14	8			54	32.14
PE					3	3	9	3	18	10.71
OE					4	4	3	3	14	8.33
EC				2	2	6	5	4	19	11.30
Semester wise Total	22	25	24	23	23	21	20	10	168	**100.00**

Category	**Abbreviation**
Lecture hours per week	**L**
Tutorial hours per week	**T**
Practical, Project work, Internship, Professional Skill Training, Industrial Training hours per week	**P**
Credits	**C**

B.E. COMPUTER SCIENCE AND DESIGN CURRICULUM – R2022
(For the students admitted from the academic year 2023-24 onwards)

CURRICULUM BREAKDOWN STRUCTURE										
Summary of Credit Distribution										
Category	**Semester**								**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	8.92
BS	8	8	4						20	11.90
ES	7	11	4	4					26	15.47
PC	3		13	16	14	8	3		57	33.92
PE					3	3	6	3	15	8.92
OE					4	4	3	3	14	8.33
EC				2	2	7	6	4	21	12.5
Semester wise Total	22	24	23	23	23	22	21	10	168	**100.00**

Category	**Abbreviation**
Lecture hours per week	**L**
Tutorial hours per week	**T**
Practical, Project work, Internship, Professional Skill Training, Industrial Training hours per week	**P**
Credits	**C**

B.E. COMPUTER SCIENCE AND DESIGN CURRICULUM – R2022
(For the students admitted from the academic year 2022-23 onwards)

CATEGORISATION OF COURSES							
HUMANITIES AND SOCIAL SCIENCE INCLUDING MANAGEMENT (HS)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	22EGT11	Communication Skills I	3	0	0	3	I
2.	22TAM01	Heritage of Tamils	1	0	0	1	II
3.	22EGT21	Communication Skills II	3	0	0	3	II
4.	22TAM02	Tamils and Technology	1	0	0	1	III
5.	22VEC11	Yoga and Values for Holistic Development	1	0	1	1	II
6.	22GET31	Universal Human Values	2	0	0	2	III
7.	22EGL31	Communication Skills Development Laboratory	0	0	2	1	IV
8.	22GCT71	Engineering Economics and Management	3	0	0	3	VII
Total Credits to be earned						**15**	

BASIC SCIENCE (BS)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	22MAC11	Matrices and Ordinary Differential Equations	3	1*	2*	4	I
2.	22CYT12	Chemistry for Computer Systems	3	0	0	3	I
3.	22CYL12	Chemistry Laboratory for Computer Systems	0	0	2	1	I
4.	22MAC23	Probability and Statistics	3	1*	2	4	II
5.	22PHT22	Physics for Computer Systems	3	0	0	3	II
6.	22PHL22	Physics Laboratory for Computer Systems	0	0	2	1	II
7.	22MAT32	Discrete Mathematical Structures	3	1	0	4	III
Total Credits to be earned						**20**	

ENGINEERING SCIENCE (ES)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	22CSC12	Programming in C	3	0	2	4	I
2.	22EET12	Basics of Electrical and Electronics Engineering	3	0	0	3	I
3.	22EEL11	Basics of Electrical and Electronics Engineering Laboratory	0	0	2	1	I
4.	22CDC21	Programming and Linear Data Structures	3	0	2	4	II
5.	22CDC22	Digital Principles and Design	3	0	2	4	II
6.	22CDT21	Design Thinking	3	0	0	3	II
7.	22MEL11	Engineering Practices Laboratory	0	0	2	1	II
8.	22CDC31	Data Structures	3	0	2	4	III
9.	22CDC42	Python Programming and Frameworks	3	0	2	4	IV
		Total Credits to be earned				**28**	

PROFESSIONAL CORE (PC)								
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**	**Domain/ Stream**
1.	22CDT11	Human Computer Interaction	3	0	0	3	I	ID
2.	22CDC32	User Experience Design	3	0	2	4	III	ID
3.	22CDT31	Object Oriented Programming using Java	3	0	0	3	III	SD
4.	22CDT32	Computer Organization	3	1	0	4	III	SD
5.	22CDL31	Object Oriented Programming using Java Laboratory	0	0	2	1	III	SD
6.	22CDL32	Design Tools Laboratory	0	0	2	1	III	ID
7.	22CDC41	Operating Systems	3	0	2	4	IV	SD
8.	22CDT41	Database Management Systems	3	0	0	3	IV	SD
9.	22CDT42	User Interface Design	3	0	0	3	IV	ID
10.	22CDT43	Design and Analysis of Algorithms	3	1	0	4	IV	SD
11.	22CDL41	Database Management Systems Laboratory	0	0	2	1	IV	SD
12.	22CDL42	User Interface Design Laboratory	0	0	2	1	IV	ID
13.	22CDT51	IoT and Cloud Computing	3	0	0	3	V	SD
14.	22CDT52	Virtual Reality and Augmented Reality	3	0	0	3	V	ID
15.	22CDT53	Agile Methodologies	3	0	0	3	V	SDE
16.	22CDT54	Computer Networks	3	0	0	3	V	SD
17.	22CDL51	IOT and Cloud Computing Laboratory	0	0	2	1	V	SD
18.	22CDL52	Virtual Reality and Augmented Reality Laboratory	0	0	2	1	V	ID
19.	22CDT61	Machine Learning	3	0	0	3	VI	SD

20.	22CDT62	Game Design	3	0	0	3	VI	ID
21.	22CDL61	Machine Learning Laboratory	0	0	2	1	VI	SD
22.	22CDL62	Game Design	0	0	2	1	VI	ID
Total credits to be earned						**54**		

LIST OF PROFESSIONAL ELECTIVES (PEs)-2022 Batch							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Domain/ Stream**
Semester - V							
Elective – I							
1.	22CDE01	Data science	3	0	0	3	AI
2.	22CDE02	Artificial Intelligence	3	0	0	3	AI
3.	22CDE03	Introduction to 3D design	3	0	0	3	ID
4.	22CDE04	Animation Basics	3	0	0	3	ID
5.	22CDE05	Data Visualization Techniques	3	0	0	3	AI
6.	22CDE06	Designing Human Centered Systems	3	0	0	3	ID
Semester - VI							
Elective – II							
7.	22CDF01	Deep Learning	2	0	2	3	AI
8.	22CDF02	Big Data Analytics	2	0	2	3	AI
9.	22CDE07	Information Design	3	0	0	3	ID
10.	22CDE08	Mobile application Design System	3	0	0	3	ID
11.	22CDE09	Interactive Visual Data Analysis for Designer	3	0	0	3	ID
12.	22CDE10	Digital Marketing	3	0	0	3	ID
Semester - VII							
Elective - III							
13.	22CDE11	Design of Interactive Systems	3	0	0	3	ID
14.	22CDE12	Motion Graphics	3	0	0	3	ID
15.	22CDE13	Multimedia Tools and Applications	3	0	0	3	ID
16.	22CDE14	Web Mining	3	0	0	3	SDE
17.	22CDE15	Business Intelligence and its Applications	3	0	0	3	SDE
18.	22GEE02	Total Quality Management	3	0	0	3	GE
Elective – IV							
19.	22CDF03	Advanced Java Programming	2	0	2	3	SDE
20.	22CDE16	Software Quality and Testing	3	0	0	3	SDE
21.	22CDE17	Managing Design Process	3	0	0	3	ID
22.	22CDE18	Responsive Web Design	3	0	0	3	ID
23.	22CDE19	Block Chain Technologies	3	0	0	3	AI

24.	22GEE01	Fundamentals of Research	3	0	0	3	GE
Elective - V							
25.	22CDE20	Optimization Techniques	3	0	0	3	SD
26.	22CDE21	Creative Thinking	3	0	0	3	ID
27.	22CDE22	Usability Studies and Evaluation	3	0	0	3	ID
28.	22CDE23	Cyber Security	3	0	0	3	NS
29.	22CDE24	Environmental Information Design	3	0	0	3	ID
30.	22CDE25	Theory of computation	3	0	0	3	SD
Semester - VIII							
Elective - VI							
31.	22CDE26	Compiler Design	3	0	0	3	SD
32.	22CDE27	Information Security	3	0	0	3	NS
33.	22CDE28	Computer Graphics	3	0	0	3	ID
34.	22CDE29	Software Defined Networks	3	0	0	3	SDE
35.	22CDE30	Visual Design and Communication	3	0	0	3	ID
36.	22CDE31	Special Effects	3	0	0	3	ID
Total Credits to be earned						**18**	

AI – Artificial Intelligence, SD-Systems Development, SDE – Software Development and Engineering, NS- Networks and Security, FCS – Formal Courses on Computer Science, GE – General Engineering, ID – Interface Design

EMPLOYABILITY ENHANCEMENT COURSES (EC)								
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**	**Domain/ Stream**
1.	22GEL41	Professional Skills Training I / Industrial Training I	0	0	0	2	IV	--
2.	22GEL51	Professional Skills Training II / Industrial Training II	0	0	0	2	V	--
3.	22GEP61	Comprehensive Test / Viva	0	0	0	2	VI	--
4.	22CDP61	Project Work I	0	0	8	4	VI	--
5.	22CDP71	Project Work II Phase I	0	0	10	5	VII	--
6.	22CDP81	Project Work II Phase II	0	0	8	4	VIII	--
Total Credits to be earned						**19**		

B.E. COMPUTER SCIENCE AND DESIGN CURRICULUM – R2022
(For the students admitted from the academic year 2023-24 onwards)

CATEGORISATION OF COURSES							
HUMANITIES AND SOCIAL SCIENCE INCLUDING MANAGEMENT (HS)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	22EGT11	Communication Skills I	3	0	0	3	I
2.	22TAM01	Heritage of Tamils	1	0	0	1	I
3.	22EGT21	Communication Skills II	3	0	0	3	II
4.	22TAM02	Tamils and Technology	1	0	0	1	II
5.	22VEC11	Yoga and Values for Holistic Development	1	0	1	1	II
6.	22GET31	Universal Human Values	2	0	0	2	III
7.	22EGL31	Communication Skills Development Laboratory	0	0	2	1	IV
8.	22GCT71	Engineering Economics and Management	3	0	0	3	VII
Total Credits to be earned						**15**	

BASIC SCIENCE (BS)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	22MAC11	Matrices and Ordinary Differential Equations	3	1*	2*	4	I
2.	22CYT12	Chemistry for Computer Systems	3	0	0	3	I
3.	22CYL12	Chemistry Laboratory for Computer Systems	0	0	2	1	I
4.	22MAC23	Probability and Statistics	3	1*	2	4	II
5.	22PHT22	Physics for Computer Systems	3	0	0	3	II
6.	22PHL22	Physics Laboratory for Computer Systems	0	0	2	1	II
7.	22MAT32	Discrete Mathematical Structures	3	1	0	4	III
Total Credits to be earned						**20**	

ENGINEERING SCIENCE (ES)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	22CSC12	Programming in C	3	0	2	4	I
2.	22GCL11	Foundation Engineering Laboratory I	0	0	6	3	I
3.	22CDC21	Programming and Linear Data Structures	3	0	2	4	II
4.	22CDT21	Design Thinking	3	0	0	3	II
5.	22CDL21	Design Thinking Laboratory	0	0	2	1	II
6.	22GCL12	Foundation Engineering Laboratory II	0	0	6	3	II
7.	22CDC31	Data Structures	3	0	2	4	III
8.	22CDC42	Python Programming and Frameworks	3	0	2	4	IV
Total Credits to be earned						**26**	

PROFESSIONAL CORE (PC)								
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**	**Domain/ Stream**
1.	22CDT11	Human Computer Interaction	3	0	0	3	I	ID
2.	22CDC32	User Experience Design	3	0	2	4	III	ID
3.	22CDT31	Object Oriented Programming using Java	3	0	0	3	III	SD
4.	22CDT32	Computer Organization	3	1	0	4	III	SD
5.	22CDL31	Object Oriented Programming using Java Laboratory	0	0	2	1	III	SD
6.	22CDL32	Design Tools Laboratory	0	0	2	1	III	ID
7.	22CDC41	Operating Systems	3	0	2	4	IV	SD
8.	22CDT41	Database Management Systems	3	0	0	3	IV	SD
9.	22CDT42	User Interface Design	3	0	0	3	IV	ID
10.	22CDT43	Design and Analysis of Algorithms	3	1	0	4	IV	SD
11.	22CDL41	Database Management Systems Laboratory	0	0	2	1	IV	SD
12.	22CDL42	User Interface Design Laboratory	0	0	2	1	IV	ID
13.	22CDT51	IOT and Cloud Computing	3	0	0	3	V	SD
14.	22CDT52	Virtual Reality and Augmented Reality	3	0	0	3	V	ID
15.	22CDT53	Agile Methodologies	3	0	0	3	V	SDE
16.	22CDT54	Computer Networks	3	0	0	3	V	SD
17.	22CDL51	IOT and Cloud Computing Laboratory	0	0	2	1	V	SD
18.	22CDL52	Virtual Reality and Augmented Reality Laboratory	0	0	2	1	V	ID

19.	22CDT61	Machine Learning	3	0	0	3	VI	SD
20.	22CDT62	Game Design	3	0	0	3	VI	ID
21.	22CDL61	Machine Learning Laboratory	0	0	2	1	VI	SD
22.	22CDL62	Game Design	0	0	2	1	VI	ID
23.	22CDT71	Cybernetics	3	0	0	3	VII	SD
Total credits to be earned						**57**		

LIST OF PROFESSIONAL ELECTIVES (PEs)- 2023 Batch							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Domain/ Stream**
Semester - V							
Elective – I							
1.	22CDE01	Data science	3	0	0	3	AI
2.	22CDE02	Artificial Intelligence	3	0	0	3	AI
3.	22CDE03	Introduction to 3D design	3	0	0	3	ID
4.	22CDE04	Animation Basics	3	0	0	3	ID
5.	22CDE05	Data Visualization Techniques	3	0	0	3	AI
6.	22CDE06	Designing Human Centered Systems	3	0	0	3	ID
Semester - VI							
Elective – II							
7.	22CDF01	Deep Learning	2	0	2	3	AI
8.	22CDF02	Big Data Analytics	2	0	2	3	AI
9.	22CDE07	Information Design	3	0	0	3	ID
10.	22CDE08	Mobile application Design System	3	0	0	3	ID
11.	22CDE09	Interactive Visual Data Analysis for Designer	3	0	0	3	ID
12.	22CDE10	Digital Marketing	3	0	0	3	ID
Semester - VII							
Elective - III							
13.	22CDE11	Design of Interactive Systems	3	0	0	3	ID
14.	22CDE12	Motion Graphics	3	0	0	3	ID
15.	22CDE13	Multimedia Tools and Applications	3	0	0	3	ID
16.	22CDE14	Web Mining	3	0	0	3	SDE
17.	22CDE15	Business Intelligence and its Applications	3	0	0	3	SDE
18.	22GEE02	Total Quality Management	3	0	0	3	GE
Elective – IV							
19.	22CDF03	Advanced Java Programming	2	0	2	3	SDE
20.	22CDE16	Software Quality and Testing	3	0	0	3	SDE
21.	22CDE17	Managing Design Process	3	0	0	3	ID

22.	22CDE18	Responsive Web Design	3	0	0	3	ID
23.	22CDE19	Block Chain Technologies	3	0	0	3	AI
24.	22GEE01	Fundamentals of Research	3	0	0	3	GE
25.	22CDE20	Optimization Techniques	3	0	0	3	SD
26.	22CDE21	Creative Thinking	3	0	0	3	ID
27.	22CDE22	Usability Studies and Evaluation	3	0	0	3	ID
28.	22CDE23	Cyber Security	3	0	0	3	NS
29.	22CDE24	Environmental Information Design	3	0	0	3	ID
30.	22CDE25	Theory of computation	3	0	0	3	SD
Semester - VIII							
Elective - V							
31.	22CDE26	Compiler Design	3	0	0	3	SD
32.	22CDE27	Information Security	3	0	0	3	NS
33.	22CDE28	Computer Graphics	3	0	0	3	ID
34.	22CDE29	Software Defined Networks	3	0	0	3	SDE
35.	22CDE30	Visual Design and Communication	3	0	0	3	ID
36.	22CDE31	Special Effects	3	0	0	3	ID
Total Credits to be earned						**15**	

*AI – Artificial Intelligence, SD-Systems Development, SDE – Software Development and Engineering, NS- Networks and Security, FCS – Formal Courses on Computer Science, GE – General Engineering, ID – Interface Design

EMPLOYABILITY ENHANCEMENT COURSES (EC)								
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**	**Domain/ Stream**
1.	22GEL41	Professional Skills Training I / Industrial Training I	0	0	0	2	IV	--
2.	22GEL51	Professional Skills Training II / Industrial Training II	0	0	0	2	V	--
3.	22GEP61	Comprehensive Test / Viva	0	0	0	2	VI	--
4.	22CDP62	Project Work I	0	0	4	5	VI	--
5.	22CDP72	Project Work II Phase I	0	0	8	6	VII	--
6.	22CDP81	Project Work II Phase II	0	0	14	4	VIII	--
Total Credits to be earned						**21**		

LIST OF OPEN ELECTIVE COURSES OFFERED TO OTHER DEPARTMENTS (OEs)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	22CDO01	Fundamentals of User Experience Design	3	1	0	4	V
2.	22CDX01	Fundamentals of User Interactive Design	3	0	2	4	VI
3.	22CDO02	Introduction to Mobile Game Design	3	0	0	3	VII
4.	22CDO03	Introduction to Graphics Design	3	0	0	3	VII
5.	22CDX02	Virtual Reality and Augmented Reality	3	0	0	3	VIII

OPEN ELECTIVE COURSES OFFERED BY OTHER DEPARTMENTS (OE)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**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 SCADA	3	1	0	4	EEE
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.	22ADO01	Data Warehousing and Data Mining	3	1	0	4	AIDS
27.	22ALO01	Business Intelligence	3	1	0	4	AIML
28.	22CHO01	Industrial Enzymology	3	1	0	4	CHEM
29.	22CHO02	Waste to Energy Conversion	3	1	0	4	CHEM
30.	22CHO03	Applied Nanotechnology	3	1	0	4	CHEM
31.	22FTX01	Baking Technology	3	0	2	4	FT
32.	22FTO01	Food Processing Technology	3	1	0	4	FT
33.	22MAO01	Mathematical Foundations for Machine Learning	3	1	0	4	MATHS
34.	22MAO02	Numerical Computing	3	1	0	4	MATHS
35.	22MAO03	Stochastic Processes and Queuing Theory	3	1	0	4	MATHS
36.	22MAO04	Statistics for Engineers	3	1	0	4	MATHS
37.	22PHO01	Thin Film Technology	3	1	0	4	PHYSICS
38.	22PHO02	High Energy Storage Devices	3	1	0	4	PHYSICS
39.	22PHO03	Structural and Optical Characterization of Materials	3	1	0	4	PHYSICS
40.	22CYO01	Instrumental Methods of Analysis	3	1	0	4	CHEMISTRY
41.	22CYO02	Chemistry Concepts for Competitive Examinations	3	1	0	4	CHEMISTRY
42.	22CYO03	Organic Chemistry for Industry	3	1	0	4	CHEMISTRY
		SEMESTER VI					
43.	22CEO01	Disaster Management	3	1	0	4	CIVIL
44.	22MEX02	Design of Experiments	3	0	2	4	MECH
45.	22MTO02	Robotics	3	1	0	4	MTS
46.	22MTO03	3D Printing and Design	3	1	0	4	MTS
47.	22AUO01	Automotive Electronics	3	1	0	4	ECE
48.	22ECX03	PCB Design and Fabrication	3	0	2	4	ECE
49.	22EEO07	Energy Conservation and Management	3	1	0	4	EEE
50.	22EEO08	Microprocessors and Microcontrollers Interfacing	3	1	0	4	EEE

51.	22EEO09	Electrical Safety	3	1	0	4	EEE
52.	22EEO10	VLSI System Design	3	1	0	4	EEE
53.	22EEO11	Automation for Industrial Applications	3	1	0	4	EEE
54.	22EIO04	PLC Programming with High Level Languages	3	1	0	4	EIE
55.	22EIO05	Virtual Instrumentation	3	1	0	4	EIE
56.	22CSX04	Foundations of Machine Learning	3	0	2	4	CSE
57.	22CSX05	Web Engineering	3	0	2	4	CSE
58.	22ITX02	Advanced Java Programming	3	0	2	4	IT
59.	22ITO02	Internet of Things	3	1	0	4	IT
60.	22ITO03	Fundamentals of Software Development	3	1	0	4	IT
61.	22ITO04	Mobile Application Development	3	1	0	4	IT
62.	22ADX01	Data Visualization	3	0	2	4	AIDS
63.	22ALX01	Data Exploration and Visualization Techniques	3	0	2	4	AIML
64.	22CHO04	Air Pollution Monitoring and Control	3	1	0	4	CHEM
65.	22CHO05	Paints and Coatings	3	1	0	4	CHEM
66.	22CHO06	Powder Technology	3	1	0	4	CHEM
	22FTX02	Processing of milk and milk products	3	0	2	4	FT
	22FTX03	Processing of Fruits and Vegetables	3	0	2	4	FT
67.	22MAO05	Graph Theory and its Applications	3	1	0	4	MATHS
68.	22MAX01	Data Analytics using R Programming	3	0	2	4	MATHS
69.	22MAO06	Operations Research	3	1	0	4	MATHS
70.	22MAO07	Number Theory and Cryptography	3	1	0	4	MATHS
71.	22PHO04	Synthesis, Characterization and Biological Applications of Nanomaterials	3	1	0	4	PHYSICS
72.	22PHO05	Techniques of Crystal Growth	3	1	0	4	PHYSICS
73.	22CYO04	Corrosion Science and Engineering	3	1	0	4	CHEMISTRY
74.	22CYO05	Chemistry of Cosmetics in Daily Life	3	1	0	4	CHEMISTRY
75.	22CYO06	Nanocomposite Materials	3	1	0	4	CHEMISTRY
		SEMESTER VII					
76.	22CEO02	Introduction to Smart Cities	3	0	0	3	CIVIL
77.	22CEO03	Environmental Health and Safety	3	0	0	3	CIVIL
78.	22MEO01	Fundamentals of Ergonomics	3	0	0	3	MECH
79.	22MEO02	Principles of Management and Industrial	3	0	0	3	MECH

		Psychology					
80.	22MEO03	Waste Heat Recovery System and Storage	3	0	0	3	MECH
81.	22MTO04	Drone System Technology	3	0	0	3	MTS
82.	22AUO02	Vehicle Maintenance	3	0	0	3	AUTO
83.	22ECO01	Wearable Devices	3	0	0	3	ECE
84.	22ECX04	Electronic Hardware and Troubleshooting	2	0	2	3	ECE
85.	22EEO12	Electric Vehicle	3	0	0	3	EEE
86.	22EEO13	E-Waste Management	3	0	0	3	EEE
87.	22EEO14	Embedded System Design	3	0	0	3	EEE
88.	22EEO15	Energy Storage Systems and Controllers	3	0	0	3	EEE
89.	22EEO16	AI Techniques for Engineering Applications	3	0	0	3	EEE
90.	22EIO06	Introduction to Distributed Control Systems	3	0	0	3	EIE
91.	22EIO07	Instrumentation in Aircraft Navigation and Control	3	0	0	3	EIE
92.	22EIO08	Industry 4.0 with Industrial IoT	3	0	0	3	EIE
93.	22EIO09	Industrial Data Communication	3	0	0	3	EIE
94.	22EIO10	Wireless Instrumentation	3	0	0	3	EIE
95.	22EIO11	Instrumentation Techniques in Agriculture	3	0	0	3	EIE
96.	22CSO03	Nature Inspired optimization techniques	3	0	0	3	CSE
97.	22ITO05	Fundamentals of Cloud Computing	3	0	0	3	IT
98.	22ADO02	Neural Networks and Deep Learning	3	0	0	3	AIDS
99.	22ALO02	Industrial Machine Learning	3	0	0	3	AIML
100.	22CHO07	Hydrogen Energy	3	0	0	3	CHEM
101.	22CHO08	Rubber Technology	3	0	0	3	CHEM
102.	22FTO02	Principles of Food safety	3	0	0	3	FT
103.	22FTO03	Fundamentals of Food Packaging and Storage	3	0	0	3	FT
104.	22MAO08	Non-Linear Optimization	3	0	0	3	MATHS
105.	22MAO09	Optimization for Engineers	3	0	0	3	MATHS
106.	22CYO07	Waste and Hazardous Waste Management	3	0	0	3	CHEMISTRY
107.	22CYO08	Chemistry in Every day Life	3	0	0	3	CHEMISTRY
		SEMESTER VIII					
108.	22CEO04	Infrastructure Planning and Management	3	0	0	3	CIVIL
109.	22CEO05	Environmental Laws and Policy	3	0	0	3	CIVIL

110.	22MEO04	Safety Measures for Engineers	3	0	0	3	MECH
111.	22MEO05	Energy Conservation in Thermal Equipments	3	0	0	3	MECH
112.	22MEO06	Climate Change and New Energy Technology	3	0	0	3	MECH
113.	22MTO05	Micro and Nano Electromechanical Systems	3	0	0	3	MTS
114.	22AUO03	Public Transport Management	3	0	0	3	ECE
115.	22AUO04	Autonomous Vehicles	3	0	0	3	ECE
116.	22ECO02	Optical Engineering	3	0	0	3	EEE
117.	22EEO17	Smart Grid Technologies	3	0	0	3	EEE
118.	22EEO18	Biomass Energy Systems	3	0	0	3	EEE
119.	22EIO12	Environmental Sensors	3	0	0	3	EIE
120.	22EIO13	Pollution Control and Management	3	0	0	3	EIE
121.	22CSO04	Machine Translation	3	0	0	3	CSE
122.	22CSO05	Fundamentals of Blockchain	3	0	0	3	CSE
123.	22ITO06	Introduction to Ethical Hacking	3	0	0	3	IT
124.	22ITO07	Business Continuity Planning	3	0	0	3	IT
125.	22ADO03	Business Analytics	3	0	0	3	AIDS
126.	22ALO03	Machine Learning for Smart Cities	3	0	0	3	AIML
127.	22CHO09	Industrial Accident Prevention and Management	3	0	0	3	CHEM
128.	22CHO10	Electrochemical Engineering	3	0	0	3	CHEM
129.	22CHO11	Smart and Functional Materials	3	0	0	3	CHEM
130.	22FTO04	Food Ingredients	3	0	0	3	FT
131.	22FTO05	Food and Nutrition	3	0	0	3	FT
132.	22CYO09	Chemistry of Nutrition for Women Health	3	0	0	3	CHEMISTRY

GENERAL OPEN ELECTIVE
(Common to All BE/BTech branches)

SNo	Course Code	**Course Title**	L	T	P	C	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	MBA	7

B.E. COMPUTER SCIENCE AND DESIGN CURRICULUM – R2022
(For the students admitted from the academic year 2022-23 onwards)
SCHEDULING OF COURSES – BE (Computer Science and design) Total Credits :168

Sem.	Course1	Course2	Course3	Course4	Course5	Course6	Course7	Course8	Course9	Course10	Credits
I	22EGT11 Communication Skills I	22MAC11 Matrices and Ordinary Differential Equations	22CYT12 Chemistry for Computer Systems	22CDT11 Human Computer Interaction	22CSC12 Programming in C	22EET12 Basics of Electrical and Electronics Engineering	22EEL11 Basics of Electrical and Electronics Engineering Laboratory	22CYL12 Chemistry Laboratory for Computer Systems	22MNT11 Student Induction Program		**22**
II	22EGT21 Communication Skills II	22MAC23 Probability and Statistics	22PHT22 Physics for Computer Systems	22CDC21 Programming and Linear Data Structures	22CDC22 Digital Principles and Design	22CDT21 Design Thinking	22TAM01 Heritage of Tamils	22MEL11 Engineering Practices Laboratory	22PHL22 Physics Laboratory for Computer Systems	22VEC11 Yoga and Values for Holistic Development	**25**
III	22MAT32 Discrete Mathematical Structures	22CDC31 Data Structures	22CDC32 User Experience Design	22CDT31 Object Oriented Programming using Java	22CDT32 Computer Organization	22CDL31 Object Oriented Programming using Java Laboratory	22CDL32 Design Tools Laboratory	22GET31 Universal Human Values	22TAM02 Tamils and Technology		**24**
IV	22CDC41 Operating Systems	22CDC42 Python Programming and Frameworks	22CDT41 Database Management Systems	22CDT42 User Interface Design	22CDT43 Design and Analysis of Algorithms	22CDL41 Database Management Systems Laboratory	22CDL42 User Interface Design Laboratory	22GEL41 Professional Skills Training I	22EGL31 Communication Skills Development Laboratory		**23**
V	22CDT51 IoT and Cloud Computing	22CDT52 Virtual Reality and Augmented Reality	22CDT53 Agile Methodologies	22CDT54 Computer Networks	Professional Elective - I	Open Elective – I	22CDL51 IOT and Cloud Computing Laboratory	22CDL52 Virtual Reality and Augmented Reality Laboratory	22GEL51/Professional Skills Training II		**23**
VI	22CDT61 Machine Learning	22CDT62 Game Design	Professional Elective - II	Open Elective - II	22CDL61 Machine Learning Laboratory	22CDL62 Game Design Laboratory	22GEP61 Comprehensive Test and Viva	22MNT31 Environmental Science	22CDP61 Project Work I		**21**
VII	22GCT71 Engineering Economics and Management	Professional Elective – III	Professional Elective – IV	Professional Elective – V	Open Elective – III	22CDP71 Project Work II Phase I					**20**

VIII	Professional Elective – VI	Open Elective - IV	22CDP81 Project Work II Phase II								**10**

B.E. COMPUTER SCIENCE AND DESIGN CURRICULUM – R2022

SCHEDULING OF COURSES -(For the students admitted from the academic year 2023-24 onwards) Total Credits :168

Sem	Course1	Course2	Course3	Course4	Course5	Course6	Course7	Course8	Course9	Course10	Credits
I	22EGT11 Communication Skills I	22MAC11 Matrices and Ordinary Differential Equations	22CYT12 Chemistry for Computer Systems	22CDT11 Human Computer Interaction	22CSC12 Programming in C	22TAM01- Heritage of Tamils (தமிழர் மரபு)	22GCL11-Foundation Engineering Laboratory I	22CYL12 Chemistry Laboratory for Computer Systems	22MNT11 Student Induction Program		**22**
II	22EGT21 Communication Skills II	22MAC23 Probability and Statistics	22PHT22 Physics for Computer Systems	22CDC21 Programming and Linear Data Structures	22CDT21 Design Thinking	22TAM02 Tamils and Technology	22CDL21 Design Thinking Laboratory	22GCL12- Foundation Engineering Laboratory II	22PHL22 Physics Laboratory for Computer Systems	22VEC11 Yoga and Values for Holistic Development	**24**
III	22MAT32 Discrete Mathematical Structures	22CDC31 Data Structures	22CDC32 User Experience Design	22CDT31 Object Oriented Programming using Java	22CDT32 Computer Organization	22CDL31 Object Oriented Programming using Java Laboratory	22CDL32 Design Tools Laboratory	22GET31 Universal Human Values			**23**
IV	22CDC41 Operating Systems	22CDC42 Python Programming and Frameworks	22CDT41 Database Management Systems	22CDT42 User Interface Design	22CDT43 Design and Analysis of Algorithms	22CDL41 Database Management Systems Laboratory	22CDL42 User Interface Design Laboratory	22GEL41 Professional Skills Training I	22EGL31 Communication Skills Development Laboratory		**23**
V	22CDT51 IoT and Cloud Computing	22CDT52 Virtual Reality and Augmented Reality	22CDT53 Agile Methodologies	22CDT54 Computer Networks	Professional Elective - I	Open Elective – I	22CDL51 IOT and Cloud Computing Laboratory	22CDL52 Virtual Reality and Augmented Reality Laboratory	22GEL51/Professional Skills Training II		**23**
VI	22CDT61 Machine Learning	22CDT62 Game Design	Professional Elective - II	Open Elective - II	22CDL61 Machine Learning Laboratory	22CDL62 Game Design Laboratory	22GEP61 Comprehensive Test and Viva	22MNT31 Environmental Science	22CDP62 Project Work I		**22**

VII	22GCT71 Engineering Economics and Management	22CDT71- Cybernetics	Professional Elective – III	Professional Elective – IV	Open Elective – III	22CDP72 Project Work II Phase I					**21**
VIII	Professional Elective – V	Open Elective - IV	22CDP81 Project Work II Phase II								**10**

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
I	22EGT11	Communication Skills I						✓			✓	✓	✓	✓		
I	22MAC11	Matrices and Ordinary Differential Equations	✓	✓	✓		✓									
I	22CYT12	Chemistry for Computer Systems	✓	✓	✓	✓			✓							
I	22CDT11	Human Computer Interaction	✓	✓	✓	✓									✓	✓
I	22CSC12	Programming in C	✓	✓	✓	✓	✓				✓	✓		✓	✓	✓
I	22EET12	Basics of Electrical and Electronics Engineering	✓	✓	✓	✓									✓	✓
I	22TAM01	Heritage of Tamils						✓		✓	✓	✓		✓		
I	22EEL11	Basics of Electrical and Electronics Engineering Laboratory	✓	✓	✓	✓										
I	22CYL12	Chemistry Laboratory for Computer Systems	✓	✓	✓	✓			✓							
I	22MNT11	Student Induction Program														
I	22GCL11	Foundation Engineering Laboratory-I	✓	✓	✓		✓				✓	✓		✓		
II	22EGT21	Communication Skills II						✓			✓	✓	✓	✓		
II	22MAC23	Probability and Statistics	✓	✓	✓	✓	✓								✓	
II	22PHT22	Physics for Computer Systems	✓	✓	✓						✓	✓			✓	✓
II	22CDC21	Programming and Linear Data Structures	✓	✓	✓	✓									✓	✓
II	22CDC22	Digital Principles and Design														
II	22CDT21	Design Thinking	✓	✓	✓	✓					✓	✓	✓		✓	✓
II	22TAM02	Tamils and Technology						✓		✓	✓	✓		✓		
II	22MEL11	Engineering Practices Laboratory	✓		✓	✓	✓	✓			✓	✓		✓	✓	✓
II	22PHL22	Physics Laboratory for Computer Systems	✓	✓	✓	✓					✓	✓		✓	✓	✓

II	22VEC11	Yoga and Values for Holistic Development						✓		✓	✓					
II	22CDL21	Design Thinking Laboratory	✓	✓	✓	✓					✓	✓	✓		✓	✓
II	22GCL11	Foundation Engineering Laboratory-II	✓	✓	✓	✓					✓				✓	✓
III	22MAT32	Discrete Mathematical Structures	✓	✓	✓										✓	
III	22CDC31	Data Structures	✓	✓	✓	✓									✓	✓
III	22CDC32	User Experience Design	✓	✓	✓	✓	✓				✓	✓	✓		✓	✓
III	22CDT31	Object Oriented Programming using Java	✓	✓	✓	✓									✓	✓
III	22CDT32	Computer Organization	✓	✓	✓	✓									✓	✓
III	22CDL31	Object Oriented Programming using Java Laboratory	✓	✓	✓	✓									✓	✓
III	22CDL32	Design Tools Laboratory	✓	✓	✓	✓	✓								✓	✓
III	22GET31	Universal Human Values						✓	✓	✓	✓	✓				
IV	22CDC41	Operating Systems	✓	✓	✓	✓									✓	✓
IV	22CDC42	Python Programming and Frameworks	✓	✓	✓	✓									✓	✓
IV	22CDT41	Database Management Systems	✓	✓	✓	✓									✓	✓
IV	22CDT42	User Interface Design	✓	✓	✓										✓	✓
IV	22CDT43	Design and Analysis of Algorithms	✓	✓	✓	✓									✓	✓
IV	22CDL41	Database Management Systems Laboratory	✓	✓	✓	✓									✓	✓
IV	22CDL42	User Interface Design Laboratory	✓	✓	✓	✓	✓				✓	✓	✓		✓	✓
IV	22GEL41	Professional Skills Training I / Industrial Training I	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	
IV	22EGL31	Communication Skills Development Laboratory									✓	✓		✓		
V	22CDT51	IOT and Cloud Computing	✓	✓	✓	✓									✓	✓
V	22CDT52	Virtual Reality and Augmented Reality	✓	✓	✓	✓									✓	✓
V	22CDT53	Agile Methodologies	✓	✓	✓	✓									✓	✓
V	22CDT54	Computer Networks	✓	✓	✓	✓									✓	✓

V		Professional Elective - I														
V		Open Elective – I														
V	22CDL51	IoT and Cloud Computing Laboratory	✓	✓	✓	✓									✓	✓
V	22CDL52	Virtual Reality and Augmented Reality Laboratory	✓	✓	✓	✓	✓								✓	✓
V	22GEL51	Professional Skills Training II / Industrial Training II	✓	✓				✓	✓		✓	✓	✓	✓		
VI	22CDT61	Machine Learning	✓	✓	✓	✓									✓	✓
VI	22CDT62	Game Design	✓	✓	✓	✓									✓	✓
VI		Professional Elective - II	✓	✓				✓	✓		✓	✓	✓	✓		
VI		Open Elective – II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
VI	22CDL61	Machine Learning Laboratory	✓	✓	✓	✓									✓	✓
VI	22CDL62	Game Design Laboratory	✓	✓	✓	✓									✓	✓
VI	22GEP61	Comprehensive Test and Viva	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
VI	22MNT31	Environmental Science	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
VI	22CDP61	Project Work I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
VI	22CDP62	Project Work I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
VII	22GCT71	Engineering Economics and Management	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
VII		Professional Elective – III														
VII		Professional Elective – IV														
VII		Professional Elective – V														
VII		Open Elective – III														
VII	22CDP71	Project Work II Phase I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
VII	22CDP72	Project Work II Phase I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
VIII		Professional Elective – VI														
VII		Open Elective - IV														

VII	22CDP81	Project Work II Phase II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
VII	22CDT71	Cybernetics	✓	✓	✓	✓									✓	✓
V	22CDE01	Data science	✓	✓	✓	✓									✓	✓
V	22CDE02	Artificial Intelligence	✓	✓	✓	✓									✓	✓
V	22CDE03	Introduction to 3D design	✓	✓	✓	✓									✓	✓
V	22CDE04	Animation Basics	✓	✓	✓	✓									✓	✓
V	22CDE05	Data Visualization Techniques	✓	✓	✓	✓									✓	✓
V	22CDE06	Designing Human Centered Systems	✓	✓	✓	✓									✓	✓
VII	22CDF01	Deep Learning	✓	✓	✓	✓									✓	✓
VII	22CDF02	Big Data Analytics	✓	✓	✓	✓									✓	✓
VII	22CDE07	Information Design	✓	✓	✓	✓									✓	✓
VII	22CDE08	Mobile application Design System	✓	✓	✓	✓									✓	✓
VII	22CDE09	Interactive Visual Data Analysis for Designer	✓	✓	✓	✓									✓	✓
VII	22CDE10	Digital Marketing	✓	✓	✓	✓									✓	✓
VII	22CDE11	Design of Interactive Systems	✓	✓	✓	✓									✓	✓
VII	22CDE12	Motion Graphics	✓	✓	✓	✓									✓	✓
VII	22CDE13	Multimedia Tools and Applications	✓	✓	✓	✓									✓	✓
VII	22CDE14	Web Mining	✓	✓	✓	✓									✓	✓
VII	22CDE15	Business Intelligence and its Applications	✓	✓	✓	✓									✓	✓
VII	22GEE02	Total Quality Management	✓	✓	✓	✓									✓	✓
VII	22CDF03	Advanced Java Programming	✓	✓	✓	✓									✓	✓
VII	22CDE16	Software Quality and Testing	✓	✓	✓	✓									✓	✓
VII	22CDE17	Managing Design Process	✓	✓	✓	✓									✓	✓
VII	22CDE18	Responsive Web Design	✓	✓	✓	✓									✓	✓

VII	22CDE19	Block Chain Technologies	✓	✓	✓	✓									✓	✓
VII	22GEE01	Fundamentals of Research	✓	✓	✓	✓									✓	✓
VII	22CDE20	Optimization Techniques	✓	✓	✓	✓									✓	✓
VII	22CDE21	Creative Thinking	✓	✓	✓	✓									✓	✓
VII	22CDE22	Usability Studies and Evaluation	✓	✓	✓	✓									✓	✓
VII	22CDE23	Cyber Security	✓	✓	✓	✓									✓	✓
VII	22CDE24	Environmental Information Design	✓	✓	✓	✓									✓	✓
VII	22CDE25	Theory of computation	✓	✓	✓	✓									✓	✓
VIII	22CDE26	Compiler Design	✓	✓	✓	✓									✓	✓
VIII	22CDE27	Information Security	✓	✓	✓	✓									✓	✓
VIII	22CDE28	Computer Graphics	✓	✓	✓	✓									✓	✓
VIII	22CDE29	Software Defined Networks	✓	✓	✓	✓									✓	✓
VIII	22CDE30	Visual Design and Communication	✓	✓	✓	✓									✓	✓
VIII	22CDE31	Special Effects	✓	✓	✓	✓									✓	✓

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
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	✓	✓	✓	✓	✓				✓	✓		✓		

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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	✓	✓	✓	✓	✓	✓			✓					
5	22EEO06	Sensors and Actuators	✓	✓	✓			✓						✓		
5	22EIO01	Measurements and Instrumentation	✓	✓	✓	✓	✓									
5	22EIO02	Biomedical Instrumentation and Applications	✓	✓	✓	✓	✓	✓		✓						
5	22EIO03	Industrial Automation	✓	✓	✓	✓	✓									
5	22CSX01	Fundamentals of Databases	✓	✓	✓											
5	22CSX02	Data science for Engineers	✓	✓	✓	✓	✓									
5	22CSX03	Enterprise Application Development Using Java	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
5	22CSO01	Computational science for Engineers	✓	✓	✓											
5	22CSO02	Formal Languages and Automata Theory	✓	✓	✓											
5	22ITO01	Artificial Intelligence	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓			
5	22ITX01	Next Generation Databases	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
5	22CDO01	Fundamentals of User Experience Design	✓	✓	✓	✓	✓				✓	✓	✓			
5	22ADO01	Data Warehousing and 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	✓	✓	✓	✓		✓				✓		✓		
5	22MAO01	Mathematical Foundations for Machine Learning	✓	✓	✓	✓	✓									
5	22MAO02	Numerical Computing	✓	✓	✓											
5	22MAO03	Stochastic Processes and Queuing Theory	✓	✓	✓											

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
5	22MAO04	Statistics for Engineers	✓	✓	✓											
5	22PHO01	Thin Film Technology	✓	✓	✓						✓	✓		✓		
5	22PHO02	High Energy Storage Devices	✓	✓	✓						✓	✓		✓		
5	22PHO03	Structural and Optical Characterization of Materials	✓	✓	✓						✓	✓		✓		
5	22CYO01	Instrumental Methods of Analysis	✓	✓	✓	✓										
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	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓			

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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	✓	✓	✓	✓	✓	✓	✓					✓		
7	22MEO02	Principles of Management and Industrial Psychology	✓					✓				✓	✓			
7	22MEO03	Waste Heat Recovery System and Storage	✓	✓	✓	✓			✓							
7	22GEO05	Entrepreneurship Development	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
7	22MTO04	Drone System Technology	✓	✓	✓	✓	✓							✓		

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
7	22AUO02	Vehicle Maintenance	✓	✓			✓		✓					✓		
7	22ECO01	Wearable Devices	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		
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	AI 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	✓	✓	✓	✓	✓		✓							
7	22EIO11	Instrumentation Techniques in Agriculture	✓	✓	✓	✓	✓									
7	22CSO03	Nature Inspired optimization techniques	✓	✓	✓											
7	22ITO05	Fundamentals of Cloud Computing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
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	✓	✓	✓											

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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	✓	✓	✓			✓		✓		✓		✓		

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
8	22FTO05	Food and Nutrition	✓	✓	✓			✓				✓		✓		
8	22CYO09	Chemistry of Nutrition for Women Health	✓	✓	✓											
		General Open Elective Courses														
ALL	22GEO01	German Language Level 1								✓	✓	✓		✓		
ALL	22GEO02	Japanese Language Level 1								✓	✓	✓		✓		
5	22GEO03	Design Thinking for Engineers	✓	✓	✓	✓										
6	22GEO04	Innovation and Business Model Development	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
ALL	22GEO05	German Language Level 2								✓	✓	✓		✓		
ALL	22GEO06	German Language Level 3								✓	✓	✓		✓		
ALL	22GEO07	German Language Level 4								✓	✓	✓		✓		
ALL	22GEO08	Japanese Language Level 2								✓	✓	✓		✓		
ALL	22GEO09	Japanese Language Level 3								✓	✓	✓		✓		
ALL	22GEO10	Japanese Language Level 4								✓	✓	✓		✓		
ALL	22GEO11	French Language Level 1								✓	✓	✓		✓		
ALL	22GEO12	French Language Level 2								✓	✓	✓		✓		
ALL	22GEO13	French Language Level 3								✓	✓	✓		✓		
ALL	22GEO14	Spanish Language Level 1								✓	✓	✓		✓		
ALL	22GEO15	Spanish Language Level 2								✓	✓	✓		✓		
ALL	22GEO16	Spanish Language Level 3								✓	✓	✓		✓		
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										✓	✓	✓		

B.E. COMPUTER SCIENCE AND DESIGN CURRICULUM – R2022
(For the students admitted from the academic year 2022-23 onwards)

SEMESTER – I									
Course Code	Course Title	Hours/ Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory 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
22CYT12	Chemistry for Computer Systems	3	0	0	3	40	60	100	BS
22CDT11	Human Computer Interaction	3	0	0	3	40	60	100	PC
22CSC12	Programming in C	3	0	2	4	100	0	100	ES
22EET12	Basics of Electrical and Electronics Engineering	3	0	0	3	40	60	100	ES
Practical / Employability Enhancement									
22EEL11	Basics of Electrical and Electronics Engineering Laboratory	0	0	2	1	60	40	100	ES
22CYL12	Chemistry Laboratory for Computer Systems	0	0	2	1	60	40	100	BS
22MNT11	Student Induction Program	---	---	---	0	100	0	100	MC
Total Credits to be earned					**22**				

*Alternate weeks

SEMESTER – II									
Course Code	Course Title	Hours/ Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
22EGT21	Communication Skills II	3	0	0	3	40	60	100	HS
22MAC23	Probability and Statistics	3	1*	2	4	50	50	100	BS
22PHT22	Physics for Computer Systems	3	0	0	3	40	60	100	BS
22CDC21	Programming and Linear Data Structures	3	0	2	4	50	50	100	ES
22CDC22	Digital Principles and Design	3	0	2	4	50	50	100	ES
22CDT21	Design Thinking	3	0	0	3	100	0	100	ES
22TAM01	Heritage of Tamils	1	0	0	1	100	0	100	HS
Practical / Employability Enhancement									
22MEL11	Engineering Practices Laboratory	0	0	2	1	60	40	100	ES
22PHL22	Physics Laboratory for Computer Systems	0	0	2	1	60	40	100	BS
22VEC11	Yoga and Values for Holistic Development	1	0	1	1	100	0	100	HS
Total Credits to be earned					**25**				

*Alternate weeks

B.E. COMPUTER SCIENCE AND DESIGN CURRICULUM – R2022
(For the students admitted in the academic year 2022-23 onwards)

SEMESTER – III									
Course Code	**Course Title**	**/ Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
22MAT32	Discrete Mathematical Structures	3	1	0	4	40	60	100	BS
22CDC31	Data Structures	3	0	2	4	50	50	100	ES
22CDC32	User Experience Design	3	0	2	4	50	50	100	PC
22CDT31	Object Oriented Programming using Java	3	0	0	3	40	60	100	PC
22CDT32	Computer Organization	3	1	0	4	40	60	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
Practical / Employability Enhancement									
22CDL31	Object Oriented Programming using Java Laboratory	0	0	2	1	60	40	100	PC
22CDL32	Design Tools Laboratory	0	0	2	1	60	40	100	PC
Total Credits to be earned					**24**				

SEMESTER – IV									
Course Code	**Course Title**	**/ Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
22CDC41	Operating Systems	3	0	2	4	50	50	100	PC
22CDC42	Python Programming and Frameworks	3	0	2	4	50	50	100	ES
22CDT41	Database Management Systems	3	0	0	3	40	60	100	PC
22CDT42	User Interface Design	3	0	0	3	40	60	100	PC
22CDT43	Design and Analysis of Algorithms	3	1	0	4	40	60	100	PC
Practical / Employability Enhancement									
22CDL41	Database Management Systems Laboratory	0	0	2	1	60	40	100	PC
22CDL42	User Interface Design Laboratory	0	0	2	1	60	40	100	PC
22GEL41	Professional Skills Training I / Industrial 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					**23**				

B.E. COMPUTER SCIENCE AND DESIGN CURRICULUM – R2022
(For the students admitted in the academic year 2022-23)

SEMESTER – V									
Course Code	**Course Title**	**/ Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
22CDT51	IOT and Cloud Computing	3	0	0	3	40	60	100	PC
22CDT52	Virtual Reality and Augmented Reality	3	0	0	3	40	60	100	PC
22CDT53	Agile Methodologies	3	0	0	3	40	60	100	PC
22CDT54	Computer Networks	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	2/0	4	40/ 50	60/ 50	100	OE
Practical / Employability Enhancement									
22CDL51	IOT and Cloud Computing Laboratory	0	0	2	1	60	40	100	PC
22CDL52	Virtual Reality and Augmented Reality Laboratory	0	0	2	1	60	40	100	PC
22GEL51	Professional Skills Training II / Industrial Training II	---	---	---	2	100	0	100	EC
Total Credits to be earned					**23**				

SEMESTER – VI									
Course Code	**Course Title**	**/ Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
22CDT61	Machine Learning	3	0	0	3	40	60	100	PC
22CDT62	Game Design	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/ 50	60/ 50	100	OE
Practical / Employability Enhancement									
22CDL61	Machine Learning Laboratory	0	0	2	1	60	40	100	PC
22CDL62	Game Design Laboratory	0	0	2	1	60	40	100	PC
22GEP61	Comprehensive Test and Viva	---	---	---	2	100	0	100	EC
22MNT31	Environmental Science	2	0	0	0	100	0	100	MC
22CDP61	Project Work I	0	0	8	4	50	50	100	EC
Total Credits to be earned					**21**				

B.E. COMPUTER SCIENCE AND DESIGN CURRICULUM – R2022
(For the students admitted in the academic year 2022-23)

SEMESTER – VII									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory 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									
22CDP71	Project Work II Phase I	0	0	10	5	50	50	100	EC
Total Credits to be earned					**20**				

SEMESTER – VIII									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory 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									
22CDP81	Project Work II Phase II	--	--	8	4	50	50	100	EC
Total Credits to be earned					**10**				

Total Credits : 168

LIST OF PROFESSIONAL ELECTIVES (PEs)-2022 Batch							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Domain/ Stream**
Semester - V							
Elective – I							
1.	22CDE01	Data science	3	0	0	3	AI
2.	22CDE02	Artificial Intelligence	3	0	0	3	AI
3.	22CDE03	Introduction to 3D design	3	0	0	3	ID
4.	22CDE04	Animation Basics	3	0	0	3	ID
5.	22CDE05	Data Visualization Techniques	3	0	0	3	AI
6.	22CDE06	Designing Human Centered Systems	3	0	0	3	ID
Semester - VI							
Elective – II							
7.	22CDF01	Deep Learning	2	0	2	3	AI
8.	22CDF02	Big Data Analytics	2	0	2	3	AI
9.	22CDE07	Information Design	3	0	0	3	ID
10.	22CDE08	Mobile application Design System	3	0	0	3	ID
11.	22CDE09	Interactive Visual Data Analysis for Designer	3	0	0	3	ID
12.	22CDE10	Digital Marketing	3	0	0	3	ID
Semester - VII							
Elective - III							
13.	22CDE11	Design of Interactive Systems	3	0	0	3	ID
14.	22CDE12	Motion Graphics	3	0	0	3	ID
15.	22CDE13	Multimedia Tools and Applications	3	0	0	3	ID
16.	22CDE14	Web Mining	3	0	0	3	SDE
17.	22CDE15	Business Intelligence and its Applications	3	0	0	3	SDE
18.	22GEE02	Total Quality Management	3	0	0	3	GE
Elective – IV							
19.	22CDF03	Advanced Java Programming	2	0	2	3	SDE
20.	22CDE16	Software Quality and Testing	3	0	0	3	SDE
21.	22CDE17	Managing Design Process	3	0	0	3	ID
22.	22CDE18	Responsive Web Design	3	0	0	3	ID
23.	22CDE19	Block Chain Technologies	3	0	0	3	AI
24.	22GEE01	Fundamentals of Research	3	0	0	3	GE
Elective - V							
25.	22CDE20	Optimization Techniques	3	0	0	3	SD
26.	22CDE21	Creative Thinking	3	0	0	3	ID
27.	22CDE22	Usability Studies and Evaluation	3	0	0	3	ID
28.	22CDE23	Cyber Security	3	0	0	3	NS

29.	22CDE24	Environmental Information Design	3	0	0	3	ID
30.	22CDE25	Theory of computation	3	0	0	3	SD
Semester - VIII							
Elective - VI							
31.	22CDE26	Compiler Design	3	0	0	3	SD
32.	22CDE27	Information Security	3	0	0	3	NS
33.	22CDE28	Computer Graphics	3	0	0	3	ID
34.	22CDE29	Software Defined Networks	3	0	0	3	SDE
35.	22CDE30	Visual Design and Communication	3	0	0	3	ID
36.	22CDE31	Special Effects	3	0	0	3	ID
Total Credits to be earned						**18**	

***** AI – Artificial Intelligence, SD-Systems Development, SDE – Software Development and Engineering, NS- Networks and Security, ID- Interface Design, GE – General Engineering

B.E. COMPUTER SCIENCE AND DESIGN CURRICULUM – R2022
(For the students admitted from the academic year 2023-24 onwards)

SEMESTER – I									
Course Code	**Course Title**	**Hours/ Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory 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
22CYT12	Chemistry for Computer Systems	3	0	0	3	40	60	100	BS
22CDT11	Human Computer Interaction	3	0	0	3	40	60	100	PC
22CSC12	Programming in C	3	0	2	4	100	0	100	ES
22TAM01	Heritage of Tamils	1	0	0	1	100	0	100	HS
Practical / Employability Enhancement									
22GCL11	Foundation Laboratory – Manufacturing, Design and Robotics	0	0	6	3	100	0	100	ES
22CYL12	Chemistry Laboratory for Computer Systems	0	0	2	1	60	40	100	BS
22MNT11	Student Induction Program	---	---	---	0	100	0	100	MC
Total Credits to be earned					**22**				

*Alternate weeks

SEMESTER – II									
Course Code	**Course Title**	**Hours/ Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
22EGT21	Communication Skills II	3	0	0	3	40	60	100	HS
22MAC23	Probability and Statistics	3	1*	2	4	50	50	100	BS
22PHT22	Physics for Computer Systems	3	0	0	3	40	60	100	BS
22CDC21	Programming and Linear Data Structures	3	0	2	4	50	50	100	ES
22CDT21	Design Thinking	3	0	0	3	100	0	100	ES
22TAM02	Tamils and Technology	1	0	0	1	100	0	100	HS
Practical / Employability Enhancement									
22CDL21	Design Thinking Laboratory	0	0	2	1	60	40	100	ES
22GCL12	Foundation Laboratory – Electrical, Web and IoT	0	0	6	3	100	0	100	ES
22PHL22	Physics Laboratory for Computer Systems	0	0	2	1	60	40	100	BS
22VEC11	Yoga and Values for Holistic Development	1	0	1	1	100	0	100	HS
Total Credits to be earned					**24**				

*Alternate weeks

B.E. COMPUTER SCIENCE AND DESIGN CURRICULUM – R2022
(For the students admitted in the academic year 2023-24 onwards)

SEMESTER – III									
Course Code	**Course Title**	**/ Week**			**Credit**	**Maximum Marks**			Category
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
22MAT32	Discrete Mathematical Structures	3	1	0	4	40	60	100	BS
22CDC31	Data Structures	3	0	2	4	50	50	100	ES
22CDC32	User Experience Design	3	0	2	4	50	50	100	PC
22CDT31	Object Oriented Programming using Java	3	0	0	3	40	60	100	PC
22CDT32	Computer Organization	3	1	0	4	40	60	100	PC
22GET31	Universal Human Values	2	0	0	2	100	0	100	HS
Practical / Employability Enhancement									
22CDL31	Object Oriented Programming using Java Laboratory	0	0	2	1	60	40	100	PC
22CDL32	Design Tools Laboratory	0	0	2	1	60	40	100	PC
Total Credits to be earned					**23**				

SEMESTER – IV									
Course Code	**Course Title**	**/ Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
22CDC41	Operating Systems	3	0	2	4	50	50	100	PC
22CDC42	Python Programming and Frameworks	3	0	2	4	50	50	100	ES
22CDT41	Database Management Systems	3	0	0	3	40	60	100	PC
22CDT42	User Interface Design	3	0	0	3	40	60	100	PC
22CDT43	Design and Analysis of Algorithms	3	1	0	4	40	60	100	PC
Practical / Employability Enhancement									
22CDL41	Database Management Systems Laboratory	0	0	2	1	60	40	100	PC
22CDL42	User Interface Design Laboratory	0	0	2	1	60	40	100	PC
22GEL41	Professional Skills Training I / Industrial 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					**23**				

B.E. COMPUTER SCIENCE AND DESIGN CURRICULUM – R2022
(For the students admitted in the academic year 2023-24)

SEMESTER – V									
Course Code	**Course Title**	**/ Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
22CDT51	IOT and Cloud Computing	3	0	0	3	40	60	100	PC
22CDT52	Virtual Reality and Augmented Reality	3	0	0	3	40	60	100	PC
22CDT53	Agile Methodologies	3	0	0	3	40	60	100	PC
22CDT54	Computer Networks	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	2/0	4	40/ 50	60/ 50	100	OE
Practical / Employability Enhancement									
22CDL51	IoT and Cloud Computing Laboratory	0	0	2	1	60	40	100	PC
22CDL52	Virtual Reality and Augmented Reality Laboratory	0	0	2	1	60	40	100	PC
22GEL51	Professional Skills Training II / Industrial Training II	---	---	---	2	100	0	100	EC
Total Credits to be earned					**23**				

SEMESTER – VI									
Course Code	**Course Title**	**/ Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
22CDT61	Machine Learning	3	0	0	3	40	60	100	PC
22CDT62	Game Design	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/ 50	60/ 50	100	OE
Practical / Employability Enhancement									
22CDL61	Machine Learning Laboratory	0	0	2	1	60	40	100	PC
22CDL62	Game Design Laboratory	0	0	2	1	60	40	100	PC
22GEP61	Comprehensive Test and Viva	---	---	---	2	100	0	100	EC
22MNT31	Environmental Science	2	0	0	0	100	0	100	MC
22CDP62	Project Work I	0	0	4	5	50	50	100	EC
Total Credits to be earned					**22**				

B.E. COMPUTER SCIENCE AND DESIGN CURRICULUM – R2022
(For the students admitted in the academic year 2023-24)

SEMESTER – VII									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
22GCT71	Engineering Economics and Management	3	0	0	3	40	60	100	HS
22CDT71	Cybernetics	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									
22CDP72	Project Work II Phase I	0	0	12	6	50	50	100	EC
Total Credits to be earned					**21**				

SEMESTER – VIII									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory 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									
22CDP81	Project Work II Phase II	--	--	8	4	50	50	100	EC
Total Credits to be earned					**10**				

Total Credits : 168

LIST OF PROFESSIONAL ELECTIVES (PEs)- (2023 Batch)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Domain/ Stream**
Semester - V							
Elective – I							
1.	22CDE01	Data Science	3	0	0	3	AI
2.	22CDE02	Artificial Intelligence	3	0	0	3	AI
3.	22CDE03	Introduction to 3D design	3	0	0	3	ID
4.	22CDE04	Animation Basics	3	0	0	3	ID
5.	22CDE05	Data Visualization Techniques	3	0	0	3	AI
6.	22CDE06	Designing Human Centered Systems	3	0	0	3	ID
Semester - VI							
Elective – II							
7.	22CDF01	Deep Learning	2	0	2	3	AI
8.	22CDF02	Big Data Analytics	2	0	2	3	AI
9.	22CDE07	Information Design	3	0	0	3	ID
10.	22CDE08	Mobile application Design System	3	0	0	3	ID
11.	22CDE09	Interactive Visual Data Analysis for Designer	3	0	0	3	ID
12.	22CDE10	Digital Marketing	3	0	0	3	ID
Semester - VII							
Elective - III							
13.	22CDE11	Design of Interactive Systems	3	0	0	3	ID
14.	22CDE12	Motion Graphics	3	0	0	3	ID
15.	22CDE13	Multimedia Tools and Applications	3	0	0	3	ID
16.	22CDE14	Web Mining	3	0	0	3	SDE
17.	22CDE15	Business Intelligence and its Applications	3	0	0	3	SDE
18.	22GEE02	Total Quality Management	3	0	0	3	GE
Elective – IV							
19.	22CDF03	Advanced Java Programming	2	0	2	3	SDE
20.	22CDE16	Software Quality and Testing	3	0	0	3	SDE
21.	22CDE17	Managing Design Process	3	0	0	3	ID
22.	22CDE18	Responsive Web Design	3	0	0	3	ID
23.	22CDE19	Block Chain Technologies	3	0	0	3	AI
24.	22GEE01	Fundamentals of Research	3	0	0	3	GE
25.	22CDE20	Optimization Techniques	3	0	0	3	SD
26.	22CDE21	Creative Thinking	3	0	0	3	ID
27.	22CDE22	Usability Studies and Evaluation	3	0	0	3	ID
28.	22CDE23	Cyber Security	3	0	0	3	NS

29.	22CDE24	Environmental Information Design	3	0	0	3	ID
30.	22CDE25	Theory of computation	3	0	0	3	SD
Semester - VIII							
Elective - V							
31.	22CDE26	Compiler Design	3	0	0	3	SD
32.	22CDE27	Information Security	3	0	0	3	NS
33.	22CDE28	Computer Graphics	3	0	0	3	ID
34.	22CDE29	Software Defined Networks	3	0	0	3	SDE
35.	22CDE30	Visual Design and Communication	3	0	0	3	ID
36.	22CDE31	Special Effects	3	0	0	3	ID
Total Credits to be earned						**15**	

***** AI – Artificial Intelligence, SD-Systems Development, SDE – Software Development and Engineering, NS- Networks and Security, ID- Interface Design, GE – General Engineering

LIST OF OPEN ELECTIVE COURSES OFFERED TO OTHER DEPARTMENTS (OEs)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	22CDO01	Fundamentals of User Experience Design	3	1	0	4	V
2.	22CDX01	Fundamentals of User Interactive Design	3	0	2	4	VI
3.	22CDO02	Introduction to Mobile Game Design	3	0	0	3	VII
4.	22CDO03	Introduction to Graphics Design	3	0	0	3	VII
5.	22CDX02	Virtual Reality and Augmented Reality	3	0	0	3	VIII

New -- 22EGT11 - COMMUNICATION SKILLS I							
(Common to All Engineering and Technology Branches)							
Programme & Branch	**All B.E./B.Tech. Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**I**	**HS**	**3**	**0**	**0**	**3**

Preamble	This course is designed to impart required levels of Communication Skills and Proficiency in English language necessary for different professional contexts.	
Unit – I	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**	**9**
Grammar: Parts of speech **-** Tenses **-** Types of sentences**:** Assertive, Imperative, Interrogative & Exclamatory **–** Affirmative & Negative **-** Gerunds & Infinitives **- Vocabulary:** Affixes **-** Synonyms & Antonyms **- Listening:** Types of listening **-** Barriers to listening **-** Listening to short talks **-** TV shows **- Speaking:** Verbal & Non-verbal communication **-** Pair conversation **-** Role play **- Reading:** Types of Reading **–** Intensive: scanning, word by word, survey **- Writing:** Dialogue writing, Informal Letters **-** Paragraph writing		
Unit – II	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**	**9**
Grammar: Voices **-** Impersonal passives **- Vocabulary:** Homonyms, Homophones & Homographs **- Listening:** Importance of listening **-** Listening to announcements & radio broadcasts **- Speaking:** Persuasive & Impromptu talks **-** Narrating a story **- Reading:** Reading comprehension **-** Articles from Newspapers/Magazines **-** Cloze exercises **- Writing:** Essay writing, Jumbled sentences		
Unit – III	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**	**9**
Grammar: Prepositions **- Vocabulary:** Compound Nouns **- Listening:** Listening to TED Talks, Commentaries **- Speaking:** Self Introduction **- Reading:** Extensive: speed, skimming **-** Identifying lexical & contextual meanings **- Writing:** Instructions & Warnings **-** Formal letters: Seeking permission for Industrial visits & Inviting guests		
Unit – IV	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**	**9**
Grammar: Articles & Determiners **- Vocabulary:** Technical Vocabulary **-** Analogy **-** Unscrambling words **-** Logical reasoning **- Listening:** Listening to conversations - **Speaking:** Tongue twisters **-** Skill Sharing **-** Note-taking **- Reading:** Note making **-** Paraphrasing & Summarizing **- Writing:** Recommendations & Suggestions **-** Business letters: Enquiry, Calling for quotations & placing orders		
Unit – V	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**	**9**
Grammar: Cause and effect expressions **- Vocabulary:** Abbreviations & acronyms, Definitions **Listening:** Listening to eminent personalities **- Speaking:** Commonly mispronounced words **-** Welcome address, Chief guest address & Vote of thanks **- Reading -** IELTS type passages **- Writing:** Preparing transcript for a speech **-** Interpreting news articles & advertisements		
		Total:45

TEXT BOOK:

1.	Sanjay Kumar & Pushp Lata, “Communication Skills”, 2nd Edition, Oxford University Press, New Delhi, 2018.

REFERENCES:

1.	Ashraf Rizvi, "Effective Technical Communication", 2nd Edition, McGraw-Hill India, 2017.
2.	S. P. Dhanavel, "English and Communication Skills for Students of Science and Engineering", Orient BlackSwan Publishers, Hyderabad, 2009.
3.	Jack C. Richards and Chuck Sandy, “Passages” Student’s Book 1, 3rd Edition, Cambridge University Press, New York, 2014.

COURSE OUTCOMES: On completion 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	PO7	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)

22MAC11 - MATRICES AND ORDINARY DIFFERENTIAL EQUATIONS							
(Common to all Engineering and Technology branches)							
Programme & Branch	**All BE/BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1**	**BS**	**3**	**1***	**2***	**4**

Preamble	To provide the skills to the students for solving different real time problems by applying matrices and ordinary differential equations.	
Unit – I	**Matrices:**	**9+3**
Introduction **–** Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors (without proof) – Cayley – Hamilton theorem (Statement and applications only) - Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Nature of Quadratic forms - Reduction of quadratic form to canonical form by orthogonal transformation – Applications of Eigen values and Eigen vectors: Stretching of an elastic membrane.		
Unit – II	**Ordinary Differential Equations:**	**9**
Introduction – Solutions of First order differential equations: Exact differential equations – Leibnitz's Linear Equation – Bernoulli's equation –Clairaut's equation - Applications: Law of natural growth and decay.		
Unit – III	**Ordinary Differential Equations of Higher Order:**	**9**
Linear differential equations of second and higher order with constant coefficients - Particular Integrals for the types: e^{ax} – cosax / sinax – x^n – $e^{ax}x^n$, e^{ax} sinbx and e^{ax} cosbx – x^n sinax and x^n cosax – Differential Equations with variable coefficients: Euler-Cauchy's equation – Legendre's equation.		
Unit – IV	**Applications of Ordinary Differential Equations:**	**9**
Method of variation of parameters – Simultaneous first order linear equations with constant coefficients – Applications of differential equations: Simple harmonic motion – Electric circuits (Differential equations and associated conditions need to be given).		
Unit – V	**Laplace Transform:**	**9**
Laplace Transform: Conditions for existence – Transform of elementary functions – Basic properties – Derivatives and integrals of transforms –Transforms of derivatives and integrals – Transform of unit step function – Transform of periodic functions. Inverse Laplace transform: Inverse Laplace transform of elementary functions – Partial fraction method – Convolution theorem (Statement only) – Applications: Solution of linear ODE of second order with constant coefficients.		

LIST OF EXPERIMENTS / EXERCISES:

1.	Introduction to MATLAB
2.	Computation of eigen values and eigen vectors
3.	Plotting and visualizing single variable functions
4.	Solving first and second order ordinary differential equations
5.	Solution of Simultaneous first order ODEs
6.	Solving second order ODE by variation of parameters
7.	Determining Laplace and inverse Laplace transform of basic functions
8.	Solution of Second order ODE by employing Laplace transforms

Lecture:45, Tutorials and Practical:15, Total:60

TEXT BOOK:

1.	Ramana B V, "Higher Engineering Mathematics", 1st Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2018.

REFERENCES/ MANUAL / SOFTWARE:

1.	Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India, 2016.
2.	Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics For First Year B.E/B.Tech", Reprint Edition 2014, S.Chand and Co., New Delhi.
3.	Duraisamy C., Vengataasalam S., Arun Prakash K. and Suresh M., "Engineering Mathematics - I", 2nd Edition, Pearson India Education, New Delhi, 2018.
4.	Grewal B.S., "Higher Engineering Mathematics" 44thEdition, Khanna Publishers, New Delhi, 2018.

5.	Matrices and Ordinary Differential Equations Laboratory Manual.

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	solve engineering problems which needs matrix computations.	Applying (K3), Manipulation (S2)
CO2	identify the appropriate method for solving first order ordinary differential equations.	Applying (K3), Manipulation (S2)
CO3	solve higher order linear differential equations with constant and variable coefficients.	Applying (K3), Manipulation (S2)
CO4	apply the concept of ordinary differential equations for modeling and finding solutions to engineering problems.	Applying (K3), Manipulation (S2)
CO5	apply Laplace Transform to find solutions of Linear Ordinary Differential Equations	Applying (K3), Manipulation (S2)

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	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

22CYT12 – CHEMISTRY FOR COMPUTER SYSTEMS							
(Common to CSE, CSD, AIDS and AIML branches)							
Programme & Branch	**B.E & Computer Science and Engineering & Computer Science and Design, BTech – Artificial Intelligence and Data Science & Artificial Intelligence and Machine Learning branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1 / 2****	**BS**	**3**	**0**	**0**	**3**

Preamble	This course aims to equip the engineering students to realize the importance of chemistry in electrochemistry, corrosion and its control methods, electrochemical storage devices, insulating materials and the need for e-waste management.	
Unit – I	**ELECTROCHEMISTRY**	**9**
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 standard hydrogen electrode, standard calomel electrode, glass electrode – EMF series and its applications - potentiometric titrations (redox) – conductometric titrations – mixture of weak and strong acid vs strong base.		
Unit – II	**CORROSION AND ITS CONTROL METHODS**	**9**
Corrosion: Introduction - chemical corrosion – Pilling-Bedworth rule - electrochemical corrosion and it's types – galvanic corrosion – differential aeration corrosion with examples - galvanic series - factors influencing rate of corrosion – measurement of corrosion (wt. loss method only). **Control methods** – sacrificial anodic protection method - corrosion inhibitors - protective coatings - pretreatment of metal surface – metallic coating: electroplating, electroless plating and hot dipping (tinning and galvanizing) methods – non-metallic coating: anodizing - organic coating: paints, constituents and functions - ceramic coatings.		
Unit – III	**ELECTROCHEMICAL STORAGE DEVICES**	**9**
Batteries: Introduction**-** types of batteries - discharging and charging of battery - characteristics of battery - battery rating - various tests on battery -– primary battery: silver button cell - secondary battery: Ni-Cd battery -modern battery: lithium-ion battery - maintenance of batteries - choice of batteries for electric vehicle applications. **Fuel Cells:** Introduction-Importance and classification of fuel cells - description, principle, components and applications of fuel cells: H_2-O_2 fuel cell, alkaline fuel cell, molten carbonate fuel cell and direct methanol fuel cell.		
Unit – IV	**INSULATING MATERIALS**	**9**
Introduction - requirements - classification (solid, liquid & gas) - preparation, properties and applications of : solid inorganic insulators: glass, ceramic products - solid organic insulator: epoxy resin - liquid insulator: transformer oil - gas insulator: SF_6 - electrical resistivity - factors influencing electrical resistivity of materials - composition, properties and applications of high resistivity materials: constantan, molybdenum disilicide and nichrome - polymers as electrical insulators - non-polar polymers - polar polymers - polarization of polymers.		
Unit – V	**E-WASTE AND ITS MANAGEMENT**	**9**
Introduction-E- Waste – definition - sources of e-waste– hazardous substances in e-waste - effects of e-waste on environment and human health- need for e-waste management– e-waste handling rules - waste minimization techniques for managing e-waste – recycling of e-waste - disposal treatment methods of e- waste- mechanism of extraction of precious metal from leaching solution – global scenario of E-waste – E-waste in India- case studies.		
		Total:45

TEXT BOOK:

1.	Wiley Editorial Board,"Wiley Engineering Chemistry", 2nd Edition, Wiley India Pvt. Ltd, New Delhi, Reprint 2019,for Unit-I, II, III, IV.
2.	Palanisamy P.N., Manikandan P., Geetha A., Manjula Rani K. & Kowshalya V.N., "Environmental Science", Revised Edition, Pearson Education, New Delhi, 2019, for Unit-III, IV, V.

REFERENCES:

1.	Palanisamy P.N., Manikandan P., Geetha A.& Manjula Rani K., "Applied Chemistry", 6th Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2019.
2.	Payal B. Joshi, Shashank Deep, "Engineering Chemistry", Oxford University Press, New Delhi, 2019.
3.	Palanna O., "Engineering Chemistry", McGraw Hill Education, New Delhi, 2018.

**** for 2022 batch 1st sem for CSE, CSD, AIML & AIDS, for 2023 batch 1st sem for CSE & CSD & 2nd sem for AIML & AIDS**

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the principle of electrochemistry for various applications	Applying (K3)
CO2	make use of corrosion control methods to solve corrosion related issues.	Applying (K3)
CO3	use the concepts of batteries, fuel cells and their applications in various fields.	Applying (K3)
CO4	apply the knowledge of insulators to make different insulating materials for various applications	Applying (K3)
CO5	utilize the knowledge to handle the e-waste and reduce its impacts on environment	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			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	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)

22CDT11 - HUMAN COMPUTER INTERACTION							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1**	**PC**	**3**	**0**	**0**	**3**

Preamble	This course enables to design user interfaces for system based on the capabilities of computer technology and the needs of human factors.	
Unit – I	**The Human and Computer:**	**9**
The Human: Introduction – Input – output Channels – Human memory – Thinking: reasoning and problem – solving – Individual differences – Psychology and the design of interactive systems – The computer: Introduction – Text entry devices – Positioning – pointing and drawing – Display devices – Devices for VR and 3D interactive - Paper: printing and scanning – Memory – Processing and networks.		
Unit – II	**Interaction and Interfaces:**	**9**
The Interaction: Introduction – Models of interaction – Frameworks and HCI – Ergonomics – Interaction styles – Elements of the WIMP interface – Interactivity – The context of the interaction – Experience – Engagement and fun – Paradigms: Introduction – Paradigm for interaction.		
Unit – III	**Design Process:**	**9**
Interaction design basics: Introduction – The process of design – User focus – Scenarios – Navigation design – Screen design and layout – Iteration and Prototyping – HCI in the software process: Introduction – The software life cycle – Usability engineering – Iterative design and prototyping – Design rationale – Design rules: Introduction – Principles to support usability – Standards – Guidelines – Golden rules and heuristics – HCI patterns.		
Unit – IV	**Design Models:**	**9**
Cognitive models: Introduction – Goal and task hierarchies – Linguistics models – The challenge of display – based systems – Physical and device models – cognitive architecture – Communication and collaboration model: Introduction – Face-to-face communication — Conversation — Text-based communication – Group Working.		
Unit – V	**Task Analysis, Dialog Notations and Design:**	**9**
Task Analysis: Introduction - Differences Between Task Analysis and other Techniques - Task Decomposition - Knowledge-Based Analysis - Entity–Relationship-based Techniques - Dialog Notations and Design: What is Dialog? - Dialog Design Notations - Diagrammatic Notations: State Transition Networks – Hierarchical STN Concurrent Dialogs and Combinatorial Explosion Of States - Escapes and Help - Petri Nets - State Charts - Flow Charts - JSD Diagrams.		
		Total:45

TEXT BOOK:

1. Alan Dix, Janet Finlay, Gregory D.Abowd and Russell Beale, “Human-Computer Interaction”, Pearson Education , 3rd Edition, 2009

REFERENCES:

1. Andrew Sears, Julie A. Jacko, “The Human-Computer Interaction Handbook Fundamentals, Evolving Technologies, and Emerging Applications”, 2nd Edition, Taylor & Francis Group, 2008.
2. J. Preece, Y. Rogers, H. Sharp, D. Benyon, S. Holland and T. Carey, “Human-Computer Interaction”, Addison Wesley, 1994.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	organize capabilities of both humans and computers from the viewpoint of human information processing.	Applying (K3)
CO2	build the typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms.	Applying (K3)
CO3	apply an interactive design process, standards, guidelines and universal design principles to designing HCI systems.	Applying (K3)
CO4	identify user models, user support, design models and requirements of HCI systems.	Applying (K3)
CO5	analyze the communication between user and system by using task analysis and dialog description techniques	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	3	2	1									3	2
CO2	3	3	2	1									3	2
CO3	3	3	2	1									3	2
CO4	3	3	2	1									3	2
CO5	3	3	2	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	15	35	50				100
CAT2	10	30	60				100
CAT3	10	30	60				100
ESE	10	30	60				100

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

22CSC12 - PROGRAMMING IN C							
(Common to Computer Science and Engineering, Information Technology & Computer Science and Design branches)							
Programme& Branch	**BE - Computer Science and Engineering, BTech - Information Technology & BE - Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1**	**BS**	**3**	**0**	**2**	**4**

Preamble	The course aims to provide exposure to problem-solving through programming. It introduces all the fundamental concepts of C Programming. This course provides adequate knowledge to solve problems in various domains.	
Unit - I	**Introduction to C and Control Statements:**	**9**
The life cycle of a C program – features of C - Data - Variables – Declaring, assigning, and printing variables – Data Classification: integer, float, and character types – constants – operators and expressions – Control Structures: decision making and looping statements – Input and output functions.		
Unit - II	**Arrays and Functions:**	**9**
Arrays: Declaring and initializing 1D array – Two-dimensional arrays – Multidimensional arrays **Functions:** Basics, The anatomy of a function – Types of functions based on arguments and return types – Passing 1D and 2D arrays as arguments to functions – Calling function from another function – recursive functions -Variable scope and lifetime - Storage classes		
Unit - III	**Pointers and Strings:**	**9**
Pointers:: Memory access and pointers, pointer basics, declaring, initializing, and dereferencing a pointer, parameter passing mechanisms, operations on pointers **Strings**: Basics, declaring and initializing strings – pointers for string manipulation – string handling functions: standard and user-defined functions – character oriented functions, Two-dimensional array of strings		
Unit - IV	**User-defined data types:**	**9**
Structure basics –declaring and defining a structure - attributes of structures – nested structures – arrays as structure members – arrays of structure – Passing structures as arguments to functions - Unions – Bit Fields -Enumerated type		
Unit - V	**File handling :**	**9**
Basics – Opening and closing files -File pointers and buffer – File read/write functions: fgetc, fputc, fgets, fputs, fscanf, fprintf – File error handling functions - Text and Binary File – Reading and Writing binary files – Manipulating file position – other file handling functions : remove and rename. Pre-processor directives: #define: macros with and without arguments, # include directive		

LIST OF EXPERIMENTS / EXERCISES:	
1.	Programs for demonstrating the use of different types of operators like arithmetic, logical, relational, and ternary operators (Sequential structures)
2.	Programs to Illustrate the different formatting options for input and output
3.	Programs using decision making statements like ‘if’, ‘else if’, ‘switch’, conditional and unconditional ‘goto’ (Selective structures)
4.	Programs for demonstrating repetitive control statements like ‘for’, ‘while’, and ‘do-while’ (Iterative structures)
5.	Programs for demonstrating one-dimensional arrays
6.	Programs for demonstrating two-dimensional arrays
7.	Programs to demonstrate modular programming concepts using functions (Using built-in and user-defined functions)
8.	Programs to implement various character and string operations with and without built-in library functions.
9.	Programs to demonstrate the use of pointers
10.	Programs to illustrate the use of user-defined data types
11.	Programs to implement various file operations
12.	Programs to demonstrate the use of pre-processor directives

Lecture:45, Practical:30, Total:75

TEXT BOOK:	
1.	Sumitabha Das, Computer Fundamentals and C Programming, 1st Edition, McGraw Hill, 2018

REFERENCES/ MANUAL / SOFTWARE:	
1.	Yashavant Kanetkar, "Let us C", 16th ,BPB publications,2018.

2.	Reema Thareja., “Programming in C ”, 2nd Edition, Oxford University Press, New Delhi, 2018
3.	E.Balagurusamy, "Programming in ANSI C", seventh edition, Mc Graw Hill Education,2017.

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	Identify the appropriate looping and control statements in C and develop applications using these statements	Applying (K3), Precision(S3)
CO2	Develop simple C programs using the concepts of arrays and modular programming	Applying (K3), Precision(S3)
CO3	Recall the basic concepts of pointers and develop C programs using strings and pointers	Applying (K3), Precision(S3)
CO4	Make use of user-defined data types to solve given problems	Applying (K3), Precision(S3)
CO5	Explain various file operations and develop applications using files and pre-processor directives	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	2	2	1				1	1		1	3	1
CO2	3	2	2	2	1				1	1		1	3	1
CO3	3	2	2	2	1				1	1		1	3	1
CO4	3	2	2	2	1				1	1		1	3	1
CO5	3	2	2	2	1				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	10	30	60				100
CAT2	10	30	60				100
CAT3	10	30	60				100
ESE	10	30	60				100

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

22EET12 - BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING							
(Common to Information Technology and Computer Science and Design branches)							
Programme& Branch	**BTech – Information Technology & BE - Computer Science and Design branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1**	**ES**	**3**	**0**	**0**	**3**

Preamble	To provide comprehensive ideas about power Systems, AC and DC circuits, working principles and applications of basic machines in electrical engineering.

Unit – I	**Introduction to Power Systems:**	**9**
Fundamentals of Electricity: Definition, Symbol and Unit of Quantities - Work, Power and Energy - Renewable and Non-Renewable Sources of Energy - Structure of Electric Power System - Transmission and Distribution Voltages - Comparison of Overhead and Underground Systems - Phase, Neutral - Electrical Safety Aspects - Principles of Earthing - Types of Earthing.		
Unit – II	**DC Circuits and AC Circuits:**	**9**
Ohm's Law - Kirchoff's laws - Resistances in Series and Voltage Division Technique - Resistances in Parallel and Current Division Technique - Mesh Analysis of Simple Resistive Networks - Star to Delta and Delta to Star Transformations. **AC Circuits:** Alternating (Sinusoidal) Voltage and Current, R.M.S and Average Value, Power Factor, Form Factor and Peak Factor.AC Series Circuits (RL, RC & RLC).		
Unit – III	**DC Machines:**	**9**
Construction, Principle of Operation of DC generator and DC Motor - DC Generator: EMF Equation, Types and Applications, DC Motor: Torque Equation, Types and Applications - Need for starter - DC Motor Starter Types and Construction.		
Unit – IV	**AC Machines and Transformers:**	**9**
Construction and Working Principle of Single Phase Transformer, Three Phase AC Generator, Single Phase Induction Motor (Split Phase and Capacitor Start Induction Motor), Three Phase Induction Motor - Starting of Three Phase Induction Motor - DOL and Star-Delta starter- Applications.		
Unit – V	**Basic Electronics:**	**9**
Theory of PN Junction Diode - Operation of Rectifiers (Half wave, Full wave) and Filters - Zener Diodes - Zener Diode as Voltage Regulator - Transistors: Types - Operation of NPN Transistor - Transistor as an Amplifier - Operation and Characteristics of SCR - UPS and SMPS (Block Diagram approach).		
		Total:45

TEXT BOOK:

1. Muthusubramanian R. and Salivahanan S., "Basics of Electrical and Electronics Engineering", 18th Reprint, Tata McGraw Hill, 2014

REFERENCES:

1. Jegathesan V., Vinoth Kumar K. and Saravanakumar R., "Basic Electrical and Electronics Engineering", 1st Edition, Wiley India, 2011.
2. Sukhija M.S. and Nagsarkar T.K., "Basics of Electrical and Electronics Engineering", 1st Edition, Oxford University Press, 2012.
3. Smarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", 2nd Edition, PHI Learning, 2007

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	interpret the basic concepts of electrical power systems and Identify the various electrical parameters in circuits	Understanding (K2)
CO2	analyze the DC and AC Circuits	Applying (K3)
CO3	interpret the construction and working of different types of DC machines	Applying (K3)
CO4	illustrate the working of different types of AC machines and transformers	Understanding (K2)
CO5	demonstrate the basic functions of semiconductor devices and analyze the characteristics of semiconductor devices	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	1									2	1
CO2	3	1	2										2	1
CO3	3	1	2										2	1
CO4	3	2	2										2	1
CO5	3	1	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	10	60	30				100
CAT2	10	60	30				100
CAT3	10	60	30				100
ESE	10	60	30				100

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

22EEL11 - BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY							
(Common to Information Technology and Computer Science and Design branches)							
Programme& Branch	**BTech – Information Technology & BE - Computer Science and Design branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1**	**ES**	**0**	**0**	**2**	**1**

Preamble	This course is designed to impart practical knowledge about AC and DC circuits, machines and electronic devices with its characteristics.

LIST OF EXPERIMENTS / EXERCISES:

1.	Resistor color coding and verification of Ohm‘s Law and Kirchhoff‘s Laws
2.	Computation of Current in a Loop using Mesh analysis
3.	Measurement of Power in RL, RCand RLC circuits
4.	Speed control of DC shunt motor
5.	Load test on DC shunt motor
6.	Load test on single phase induction motor
7.	Load test on single phase transformer
8.	Implementation of Half wave and Full wave Rectifier
9.	VI characteristics of PN junction diode
10.	Voltage Regulator using Zener diode

Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	select and apply various laws for the specific electric circuits	Applying (K3), Manipulation (S2)
CO2	perform suitable tests and analyze the performance of AC,DC Machines and transformers	Analyzing (K4), Manipulation (S2)
CO3	sketch the characteristics of power electronic devices and Interpret various applications	Analyzing (K4), Manipulation (S2)

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	1										
CO2	3	3	2	1										
CO3	3	2	2	1										

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

22CYL12 – CHEMISTRY LABORATORY FOR COMPUTER SYSTEMS							
(Common to CSE, CSD, IT, AIDS and AIML branches)							
Programme & Branch	**B.E & Computer Science and Engineering & Computer Science and Design, BTech – Information Technology, Artificial Intelligence and Data Science & Artificial Intelligence and Machine Learning branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1 / 2****	**BS**	**0**	**0**	**3**	**1**

Preamble	This course aims to impart the basic concepts of volumetric, conductometric, potentiometric, spectrophotometric and pH metry experiments for the estimation of given samples and thereby, to improve the analytical capability. It also aims to impart the knowledge on importance of water quality parameters (Ca, Mg & alkalinity) and the toxic substances (Cu, Cr) that we come across in day to day life.

LIST OF EXPERIMENTS / EXERCISES:

1.	Determination of strength of an unknown solution using pH meter.
2.	Analysis and comparison of the strength of acids in the given mixture using conductivity meter.
3.	Potentiometric approach using a Pt electrode for the estimation of iron in the given sample.
4.	Spectrophotometric method for the determination of nickel.
5.	Iodometric analysis of Cu content from discarded PCBs.
6.	Volumetric analysis of chromium prepared from electroplating sludge.
7.	Determination of Dissolved Oxygen in the given wastewater sample.
8.	Assessment of the given water sample for the suitability of drinking / industrial purpose by estimating the calcium, magnesium and total hardness by EDTA method.
9.	Estimation of alkalinity of river and borewell water collected from different places.
10.	Determination of molecular weight of a polymer / liquid by Ostwald viscometer.
11.	Construction and working of Zinc -Copper Electrochemical Cell (Demonstration).
12.	Electroplating process (Demonstration).

Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Palanisamy P.N., Manikandan P., Geetha A. and Manjula Rani K., "Chemistry Laboratory Manual", 1st Edition, Rajaganapathy Publishers, Erode, 2022.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	demonstrate the conductivity meter and pH meter to analyze the strength of the given solution.	Applying (K3), Precision (S3)
CO2	analyze the amount of Cu, Cr, DO, hardness and alkalinity present in the given sample.	Applying (K3), Precision (S3)
CO3	demonstrate the potentiometric and spectrophotometric method for the estimation of Fe & Ni and Viscometer for the determination of molecular weight of a polymer.	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	1	3			3							
CO2	3	2	1	3			3							
CO3	3	2	1	3			2							

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

**** for 2022 batch 1st sem for CSE, CSD, AIML & AIDS & 2nd sem for IT,**
for 2023 batch 1st sem for CSE, CSD, IT & 2nd sem for AIML & AIDS

22EGT21 - COMMUNICATION SKILLS II							
(Common to All Engineering and Technology Branches)							
Programme & Branch	**All B.E./B.Tech. Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Communication Skills I**	**2**	**HS**	**3**	**0**	**0**	**3**

Preamble	This course is designed to equip students with the necessary skills to listen, read, write and speak so as to develop their linguistic and communicative competencies.	
Unit – I	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**	**9**
Grammar: Sentence Patterns **-** Simple, Compound & Complex sentences **- Vocabulary:** Portmanteau words **-** One word substitution **- Listening:** Speeches from company CEOs **-** TV debates **Speaking:** Just-a-minute talk **-** Group discussion **- Reading:** Reading for Gist **- Writing:** Job application letter with resume **–** Transcoding		
Unit – II	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**	**9**
Grammar: Concord **- Vocabulary:** Phrasal verbs **-** Idioms & Phrases - **Listening:** Listening to celebrity talks - **Speaking:** Talking about celebrities - Practicing Pronunciation through web tools - **Reading:** Company correspondence, technical texts/working principles of a machine - **Writing:** Description: Person, Place**,** Process, Product and Picture		
Unit – III	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**	**9**
Grammar: Discourse markers **-** Transitional words and phrases **- Vocabulary:** Commonly confused words **- Listening:** Listening to guest lectures **- Speaking:** Technical & Non-technical presentations **-** Workshop presentations **- Reading:** Reputed company profiles, Business Plans **- Writing:** a dream job/company **-** Letter to the Editor **–** Biography & Autobiography **-** Checklist		
Unit – IV	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**	**9**
Grammar: Degrees of Comparison **-** Punctuations **–** Fragments & run**-**ons **- Vocabulary:** British & American **-** Spelling & words **- Listening:** Listening to global accents **-** listening to motivational speeches **-** S**peaking:** Narrating personal milestones **-** Sports commentaries **-** Movie Enactment **- Reading:** Narrative passages **- Writing:** E mail **-** Agenda & Minutes of Meeting **-** Special & Technical reports		
Unit – V	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**	**9**
Grammar: Purpose and Function **-** If clause **-** Error detection **- Vocabulary:** Coding & Decoding **-** Alphabet test **- Listening:** Listening to sample HR Interviews **- Speaking:** Introduction to phonetics - Stress, rhythm & Intonation **–** Guided & unguided speeches/conversations **-** Giving feedback **–** Debate **- Reading:** Key Note speeches **-** Newspaper reports **-** short technical texts from journals **Writing:** Circulars **-** Critical Appreciation of a non-detailed text **-** Technical proposals		
		Total:45

TEXT BOOK:

1.	Sanjay Kumar & Pushp Lata, “Communication Skills”, 2nd Edition, Oxford University Press, New Delhi, 2018.

REFERENCES:

1.	Meenakshi Raman and Sangeeta Sharma. “Technical Communication- Principles and Practice”. 4th Edition, Oxford University Press, New Delhi, 2022.
2.	Murphy Raymond, "English Grammar in Use", 5th Edition, Cambridge University Press, New York, 2019.
3.	Jack C. Richards and Chuck Sandy, “Passages” Student’s Book 2, 3rd Edition, Cambridge University Press, New York, 2014.

COURSE OUTCOMES: **On completion 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**	**PO7**	**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		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)

22MAC23 - PROBABILITY AND STATISTICS							
(Common to BE - Computer Science Engineering, Computer Science and Design & BTech – Information Technology branches)							
Programme & Branch	**BE - Computer Science Engineering, Computer Science and Design & BTech – Information Technology branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**2**	**BS**	**3**	**1***	**2***	**4**

Preamble	To provide an in-depth knowledge in random variables, correlation, sampling theory and promote the ability to use probability distributions and analysis of variance to experimental data.	
Unit – I	**Random Variables:**	**9**
Discrete and Continuous random variables – Probability Mass and Probability density functions – Mathematical expectation and Variance – Moments – Moment generating function.		
Unit – II	**Standard Probability Distributions:**	**9**
Discrete Distributions: Binomial distribution – Poisson distribution – Geometric distribution – Continuous Distributions: Uniform distribution – Exponential distribution – Normal distribution.		
Unit – III	**Two Dimensional Random Variables:**	**9**
Introduction – Joint probability distributions – Marginal and conditional distributions – Covariance – Correlation and regression.		
Unit – IV	**Testing of Hypothesis:**	**9**
Introduction – Critical region and level of significance – Types of Errors – Large sample tests: Z-test for single mean and difference of means – Small sample tests: Student's t-test for testing significance of single mean and difference of means – F-test for comparison of variances – Chi-square test: Test of goodness of fit – Test of independence of attributes.		
Unit – V	**Design of Experiments:**	**9**
Analysis of variance – One way classification: Completely Randomized Design – Two way classification: Randomized Block Design – Three way classification: Latin Square Design.		

LIST OF EXPERIMENTS / EXERCISES:

1.	Introduction to R studio.
2.	Identifying Mean and Variance for discrete and continuous random variables.
3.	Computation of probability using Binomial, Poisson and Normal distributions.
4.	Computation of correlation coefficient for the given data.
5.	Finding the Marginal and conditional distributions of two-dimensional random variable.
6.	Testing significance of means by student's t – test.
7.	Testing the independence of attributes by Chi-square test.
8.	Analyze whether the difference in means is statistically significant by completely randomized design.

Lecture:45, Tutorials and Practical:15, Total:60

TEXT BOOK:

1.	Veerarajan, T, "Probability and Statistics, Random Processes and Queuing Theory", 1st Edition, McGraw-Hill Education, Chennai, 2019.

REFERENCES/ MANUAL / SOFTWARE:

1.	William Mendenhall, Robert J. Beaver and Barbara M. Beaver, "Introduction to Probability and Statistics", 14th Edition, Cengage Learning, USA, 2013.
2.	Jay L. Devore., "Probability and Statistics for Engineering and the Sciences", 9th Edition, Cengage Learning, USA, 2016.
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.	Douglas C. Montgomery & George C. Runger, "Applied Statistics and Probability for Engineers ", 7th Edition, John Wiley and Sons, USA, 2018.
5.	Probability and Statistics Laboratory Manual.

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

CO1	interpret the concept of random variables.	Applying (K3), Manipulation (S2)
CO2	apply the standard probability distributions in engineering problems.	Applying (K3), Manipulation (S2)
CO3	understand the concepts of two dimensional random variables and regression.	Applying (K3), Manipulation (S2)
CO4	apply statistical tests for solving engineering problems involving small and large samples.	Applying (K3), Manipulation (S2)
CO5	apply the concepts of analysis of variance to experimental data.	Applying (K3), Manipulation (S2)

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

22PHT22 – PHYSICS FOR COMPUTER SYSTEMS							
(Common to CSE, CSD, AIML & AIDS branches)							
Programme & Branch	**BE/B.Tech - CSE, CSD, AIML and AIDS branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**2 / 1****	**BS**	**3**	**0**	**0**	**3**
Preamble	This course aims to impart the knowledge on oscillations & waves, acoustics, ultrasonics, laser, fiber optics, semiconductors and smart materials. It also describes the applications of aforementioned topics in computer sciences.						
Unit – I	**Oscillations and Waves:**						**9**
Periodic motion – Oscillations – Simple harmonic motion – Differential equation of simple harmonic motion – Forced oscillations – Damped oscillations – Application of simple harmonic motion in torsional pendulum, cantilever and LC circuit – Resonance – Waves – Equation of plane progressive wave – Types of progressive waves – Reflection and transmission of waves at a boundary (qualitative) – Energy transport of progressive waves.							
Unit – II	**Acoustics and Ultrasonics:**						**9**
Classification of sound – Characteristics of sound – Reverberation and reverberation time – Growth and decay of sound – Sabine's formula for reverberation time – Determination of sound absorption coefficient – Factors affecting acoustics of buildings and their remedies – Ultrasonics – Properties of ultrasonic waves – Generation of ultrasonic waves – Magnetostrictive generator and Piezoelectric generator – Non-destructive testing – Flaw detection.							
Unit – III	**Laser and Fiber Optics:**						**9**
Stimulated absorption – Spontaneous emission – Stimulated emission – Einstein's coefficients and their relations – Population inversion – Pumping – CO_2 laser – Holography – Fiber optics – Numerical aperture and acceptance angle – Classification of optical fibers based on refractive index, modes and materials – Fiber optics communication system (qualitative) –Temperature and displacement sensors.							
Unit – IV	**Semiconductors:**						**9**
Intrinsic semiconductor – Carrier concentration – Fermi level – Variation of conductivity with temperature – Determination of band gap – Extrinsic semiconductors – Carrier concentration in n-type and p-type semiconductors – Hall effect – Determination of Hall coefficient – Applications – Solar Cell: Principle, construction and working.							
Unit – V	**Smart Materials:**						**9**
Metallic glasses: Properties, preparation and applications – Shape memory alloys: Characteristics and applications – Nanostructure – Surface-to-volume ratio – Quantum confinement – Nanomaterials synthesis: Top-down and bottom-up approaches – Electron beam lithography – Physical vapour deposition – Carbon nanotubes: Structures, properties, synthesis by laser ablation method – Applications.							
							Total:45

TEXT BOOK:

1.	Avadhanulu M.N., Kshirsagar P.G. and Arun Murthy T.V.S., "A Textbook of Engineering Physics", 11th Edition, S. Chand & Company Pvt. Ltd., New Delhi, 2019.

REFERENCES:

1.	Hitendra K. Malik and A.K. Singh, "Engineering Physics", 2nd Edition McGraw-Hill Education , New Delhi, 2018
2.	Pandey B.K.and Chaturvedi S., "Engineering Physics" 2nd Edition, Cengage, New Delhi, 2022.
3.	Tamilarasan K. and Prabu K., "Materials Science", 1st Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 2019.

**** for 2022 batch 2nd sem for CSE, CSD, AIML & AIDS, for 2023 batch 1st sem for AIML & AIDS & 2nd sem for CSE & CSD**

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	make use of the concepts of oscillatory and wave motion to comprehend the phenomena related to the propagation of elastic waves.	Applying (K3)
CO2	apply the concepts of growth and decay of sound energy in a hall to compute Sabine's formula and to recognize the requirements of acoustically good buildings and also to describe the production of ultrasonic wave and the testing materials by non-destructive method.	Applying (K3)
CO3	apply the concepts of stimulated emission of radiation to explain the working and the applications of laser in engineering and technology. To apply the principle of propagation of light through optical fiber to compute acceptance angle and numerical aperture and to comprehend the loss in optical fiber and also to explain fiber optic communication system and the working of fiber optic sensors.	Applying (K3)
CO4	use the concept of density of states to compute the carrier concentration, electrical conductivity and band gap of intrinsic semiconductors and to compute the carrier concentration of extrinsic semiconductors, and also to explain the Hall Effect and the working of solar cell.	Applying (K3)
CO5	utilize appropriate methods to prepare metallic glasses, shape memory alloys, nanomaterials and carbon nano tubes and also to comprehend their properties and applications.	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	2		1	3	1
CO2	3	2	2						2	2		1	3	1
CO3	3	2	2						2	2		1	3	1
CO4	3	2	2						2	2		1	3	1
CO5	3	2	2						2	2		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	15	40	45				100
CAT2	15	40	45				100
CAT3	20	45	35				100
ESE	10	40	50				100

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

22CDC21 - PROGRAMMING AND LINEAR DATA STRUCTURES							
Programme& Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Programming in C**	**2**	**ES**	**3**	**0**	**2**	**4**

Preamble	This course helps the students to learn the advanced concepts of C language, and basic concepts and applications of Linear data structures such as linked list, stack and queue.	
Unit – I	**Pointers and Arrays, Pointers and Strings :**	**9**
Pointers :Introduction – Pointers and 1D array– passing an array to a function– returning an array from function – NULL pointers – Array of pointers – Pointer-to-pointer – Pointers and 2D array - Generic pointers –Dangling Pointer-Using Pointers for string manipulation – Two dimensional array of strings - array of pointers to strings.		
Unit – II	**Dynamic memory allocation, Pointers and Functions, Pointers and structures:**	**9**
Dynamic memory allocation - Function pointers :calling a function using a function pointer– Structures: Introduction – Structures in Functions –Pointers to structures-Accessing structure members - Using pointer as a function argument - Array of structures – self referential structures.		
Unit – III	**File Handling and Preprocessor Directives :**	**9**
File Handling Basics – opening and closing files – Detecting the end-of-file -File pointer and file buffer – File read/write functions – formatted functions fscanf() and fprintf() –Text and Binary files- Reading and writing binary files –Manipulating file position indicator - Renaming and Removing a file - Command line Arguments. Preprocessor - #define macros with and without arguments - #include directive-Conditional Compilation.		
Unit – IV	**Data structures and Linked List:**	**9**
Introduction to Data Structures – Classification – Introduction to linked lists - Linked lists vs Arrays – Singly linked list-Creating a list - Traversing a list-Adding a node-Deleting a node-Sorting a list-Destroying a list-printing linked list in reverse order- Reverse a singly list - copy a singly linked list.		
Unit – V	**Stack and Queue:**	**9**
Introduction – Stack – Implementation of stack using array and linked list – Applications of stack - Infix to Postfix expression conversion - Postfix expression evaluation – Queue – Implementation of Queue using array and linked list– Other variations of Queue – Applications of Queue.		

LIST OF EXPERIMENTS / EXERCISES:

1.	Program to access an array(1D and 2D) using pointers
2.	Program to manipulate strings using pointers
3.	Program to demonstrate dynamic memory allocation for 1D and 2D array
4.	Program to pass an array as an argument to function and access the array using pointers
5.	Program using pointers and structures
6.	Program to perform operations on files
7.	Program using conditional preprocessor directives
8.	Program to implement singly linked list
9.	Program to implement Stack and Queue using array and linked list
10.	Program to implement application of stack

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Sumitabha Das, “Computer Fundamentals &C Programming”, McGraw Hill Education(India) Private Limited, 1st Edition, 2018, for Unit I,II,III.
2.	Weiss M. A., “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, 2016 for Unit IV and V.

REFERENCES/ MANUAL / SOFTWARE:

1.	YashavantKanetkar, “Pointers in C”, BPP Publications, 4th Edition, 2017.
2.	PradipDey, Manas Ghosh, “Programming in C”, Oxford Higher education, 2nd Edition, 2016.
3.	Neo colab/ C compiler

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	implement programs to solve problems using pointers to arrays and strings	Applying (K3)
CO2	make use functions and structures with pointers to solve real world problems	Applying (K3)
CO3	demonstrate file operations and preprocessor directives	Applying (K3)
CO4	describe the different operations on singly linked list and make use of it for developing simple applications	Applying (K3)
CO5	manipulate the operations on stacks and queues	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								1	2	1
CO2	3	2	1	1								1	2	1
CO3	2	2	1	1								1	2	1
CO4	3	2	1									1	2	1
CO5	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	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)

22CDC22 – DIGITAL PRINCIPLES AND DESIGN							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**2**	**ES**	**3**	**0**	**2**	**4**

Preamble	This course enables the students to understand the basic principles of number system, Binary Codes, Boolean algebra, digital logic gates, combinational and sequential circuits. It also focuses on registers, counters and programmable logic devices.	
Unit – I	**Number Systems and Boolean Algebra:**	9
Number Systems and their conversions – Complements – Signed Binary Numbers – Binary Codes – Binary Logic – Boolean Algebra: Definitions – Basic and Axiomatic –Theorems of Boolean Algebra – Boolean functions: Realization of functions using Logic gates		
Unit – II	**Gate Level Minimization**:	9
Canonical and Standard Forms of Boolean functions – Minimization of functions using Karnaugh Map – Don't–Care Conditions – NAND and NOR Implementation– Exclusive-OR function – Minimization of functions using Quine-McCluskey method.		
Unit – III	**Combinational Logic**:	9
Analysis procedure – Design procedure – Half Adder – Full Adder – Half Subtractor – Full Subtractor – Binary Adder – Subtractor – Magnitude Comparator – Decoders – Encoders – Multiplexers – Demultiplexers – Boolean Functions implementation using Multiplexers and Decoders.		
Unit – IV	**Sequential Logic**:	9
Introduction – Latches and Flip-flops – Triggering – Analysis of clocked sequential circuits: State Equations – State Table – State Diagram – State Reduction and Assignment– Mealy and Moore machines and their circuit design procedure. Introduction to Asynchronous Sequential Circuits: Analysis Procedure – Race conditions.		
Unit – V	**Register, Counter and Programmable Logic:**	9
Register, Counter and Programmable Logic: Shift Registers: Serial Transfer – Serial Addition – Universal Shift register – Synchronous Counters: Binary Ripple Counter – BCD Ripple Counter – Ring Counter – Johnson Counter – Programmable Logic devices: ROM – PLA – PAL.		

LIST OF EXPERIMENTS / EXERCISES:	
1	Simulation of Boolean functions using Virtual lab
2	Implement the following combinational logic circuits using logic gates
3	i) Half Adder and Full Adder ii) Half Subtractor and Full Subtractor
4	Design and Implement 4- Bit Adder /Subtractor.
5	Design and Implement BCD Adder.
6	Design and implement a 4-bit binary to gray and gray to binary code converter.
7	Simulation of Multiplexer and Demultiplexer circuits using Virtual labs
8	Design and implement decoders and encoders.
9	Implement various Flip-flops using Logic gates.
10	Design and implement various Shift Registers.
	Lecture:45, Practical:30, Total:75

TEXT BOOK:	
1.	Morris Mano M., Micheal D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", 6th Edition, Pearson Education, 2018.

REFERENCES:	
1.	Salivahanan S. &Arivazhagan S., "Digital Circuits and Design", 5th Edition, Oxford University Press, New Delhi, 2018.
2.	Morris Mano M., Micheal D. Ciletti, "Digital Design (Uttaranchal Technical University)", 4th Edition, Pearson Education, 2012.
3.	Virtual Labs: http://vlabs.iitkgp.ac.in/dec

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

CO1	apply the different number systems and their conversion and oolean algebra	Applying (K3)
CO2	evaluate oolean expression using map and tabulation technique and implement using logic gates	Applying (K3)
CO3	make use of combinational logic circuits to evaluate the oolean expression	Applying (K3)
CO4	apply the concepts of sequential logic circuits to implement oolean functions	Applying (K3)
CO5	construct simple digital systems using registers, counters, and programmable logic devices	Applying (K3)
CO6	design the combinational logic circuits for the given application using logic gates	Applying (K3), Manipulation (S2)
CO7	build and execute sequential logic circuits for oolean expressions Applying	Applying (K3), Manipulation (S2)
CO8	design and implement converters, decoders and encoders	Applying (K3), Manipulation (S2)

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										3	1
CO2	3	2	1										3	1
CO3	3	2	1										3	1
CO4	3	2	1										3	1
CO5	3	2	1										3	1
CO6	3	2	2	2	1					1			3	1
CO7	3	2	2	2	1					1			3	1
CO8	3	2	2	2	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	10	45	45				100
CAT2	10	45	45				100
CAT3	10	45	45				100
ESE	10	45	45				100

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

22CDT21 - DESIGN THINKING							
(Common to Computer Science and Design & Computer Science and Engineering branches)							
Programme & Branch	**B.E. – Computer Science and Design & B.E. – Computer Science and Engineering**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**2**	**PC**	**3**	**0**	**0**	**3**
Preamble	Design Thinking is human-centered problem solving tool which emphasize on empathy, collaboration, co-creation and stakeholder feedback to unlock creativity and innovation, to devises feasible and viable idea/solutions.						
Unit – I	**Design Thinking and Explore:**						**9**
Design Thinking: Key Principles and Mindset – Five Phases, Methods and Tools of Design Thinking – User Guide – Foundation Building for Design Thinking – **Explore:** Methods & Tools – STEEP Analysis – Strategic Priorities – Activity System – Stakeholder Mapping – Opportunity Framing.							
Unit – II	**Empathize:**						**9**
Empathize: Methods & Tools – Field Observation – Deep User Interview – Empathy Map – User Journey Map - Need Finding – User Insights - User Persona Development.							
Unit – III	**Experiment:**						**9**
Experiment: Methods & Tools – Ideation – SCAMPER – Analogous Inspiration – Deconstruct & Reconstruct – User Experience Journey – Prototyping– Idea Refinement.							
Unit – IV	**Engage:**						**9**
Engage: Methods & Tools – Story Telling – Art of Story Telling – Storyboarding – Co-Creation with Users – Collect Feedback from Users.							
Unit – V	**Evolve:**						**9**
Evolve: Methods & Tools – Concept Synthesis – Strategic Requirements –Evolved Activity Systems – Activity System Integration – Viability Analysis – Innovation Tools using User Needs, CAP, 4S – Change Management - Quick Wins.							
							Total: 45

TEXT BOOK:

1. Lee Chong Hwa, "Design Thinking The Guidebook", Design Thinking Master Trainers of Bhutan, 2017. (E-Book)

REFERENCES:

1. Jeanne Liedtka and Tim Ogilvie, "Designing for Growth: A Design Thinking Tool Kit for Managers", Columbia University Press, 2011.
2. Jeanne Liedtka, Tim Ogilvie, and Rachel Brozenske, "The Designing for Growth FieldBook: A Step-by-Step Project Guide", Columbia University Press, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	construct design challenge and reframe the design challenge into design opportunity.	Applying (K3)
CO2	interview the user, and know the feelings of users to foster deep user understanding and be able to uncover the deep user insights and needs.	Applying (K3)
CO3	develop ideas and prototypes by brain storming using the ideation tools.	Applying (K3)
CO4	organize the user walkthrough experience using ideal user experience journey.	Applying (K3)
CO5	develop smart strategies & implementation plan that will deliver/achieve the idea/solution deduced from earlier phases.	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	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	3	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	10	20	70				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)

22MEL11 - ENGINEERING PRACTICES LABORATORY							
(Common to All Engineering and Technology Branches)							
Programme & Branch	**All BE/BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1/ 2**	**ES**	**0**	**0**	**2**	**1**

Preamble	This course is designed to provide a hands-on experience in basic of mechanical and electrical engineering practices.

LIST OF EXPERIMENTS / EXERCISES:

	PART A – MECHANICAL ENGINEERING
1.	Prepare a Square / Rectangular / V-Shape Projection with its Counterpart for Mating and Perform the Drilling, Tapping, and Assembling Tasks from the given Square / Rectangular MS Plates using Modern Power Tools.
2.	Prepare T / L / Lap Joint from given Wooden Work Piece and Make a Box / Tray out of Plywood using Modern Power Tools.
3.	Perform the Thread Formation on a GI/PVC Pipe and Prepare a Water Line from the Overhead Tank that is Leak-Proof.
4.	Make a Butt / Lap / Tee Joint of MS Plate using Arc Welding Process and Welding Simulator.
5.	**Activity:** Prepare an Innovative Model with the Knowledge from Fitting / Carpentry / Plumbing / Welding Involving Modern Power Tools.
	PART B – ELECTRICAL AND ELECTRONICS ENGINEERING
6.	Wiring circuit for fluorescent lamp and Stair case wiring
7.	Wiring Circuit of Incandescent lamp using Impulse Relay
8.	Measurement of Earth Resistance
9.	Soldering of Simple Circuits and trouble shooting
10.	Implementation of half wave and full wave Rectifier using diodes
	Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Engineering Practices Laboratory Manual.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	plan the sequence of operations for effective completion of the planned models / innovative articles	Creating (K6) Manipulation (S2)
CO2	identify and use appropriate modern power tools and complete the exercises/models accurately	Applying (K3) Manipulation (S2)
CO3	perform house wiring and realize the importance of earthing	Applying (K3), Manipulation (S2)
CO4	soldering with simple electronics circuits	Applying (K3), Manipulation (S2)
CO5	trouble shoot the electrical and electronic circuits	Applying (K3), Manipulation (S2)

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		3	1	3	1			3	3		3		
CO2	3		3	1	3				3	3		3		
CO3	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

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

22PHL22 - PHYSICS LABORATORY FOR COMPUTER SYSTEMS							
(Common to CSE, CSD, AIDS and AIML branches)							
Programme & Branch	**BE/B.Tech- CSE, CSD, AIDS and AIML branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**2**	**BS**	**0**	**0**	**2**	**1**

Preamble	This course aims to impart hands on training in the determination of parameters such as rigidity modulus, AC frequency, velocity of ultrasound, compressibility of a liquid, wavelength of laser, particle size, acceptance angle and numerical aperture of an optical fiber, band gap, Hall coefficient, thickness of a thin film and knowledge on the working of UJT, and also to impart skills on writing coding / developing project / product related to societal requirement.

LIST OF EXPERIMENTS / EXERCISES:

1.	Determination of the rigidity modulus of a metallic wire using torsional pendulum.
2.	Studying the variation of current and voltage in a series LCR circuit / Determination of the frequency of alternating current using electrically vibrating tuning fork (Melde's apparatus).
3.	Determination of the velocity of ultrasonic waves in a liquid and the compressibility of the liquid using ultrasonic interferometer.
4.	(i) Determination of the wavelength of a semiconductor laser. (ii) Determination of the particle size of the given powder using semiconductor laser.
5.	Determination of the acceptance angle and the numerical aperture of the given optical fiber.
6.	Determination of the band gap of a given semiconducting material using post-office box.
7.	Determination of the specific resistance of the material of a given coil of wire using Carey-Foster's bridge.
8.	Observation of the I-V characteristics of a uni junction transistor / Determination of the Hall coefficient of a material using Hall effect arrangement.
9.	Determination of the thickness of a thin film by air-wedge arrangement.
10.	Writing coding for any one of the above experiments / developing a project / a product.

Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Physics Laboratory Manual / Record, Department of Physics, 1st Edition, 2020.

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	determine the rigidity modulus of a wire using the concept of twisting couple. To study the variation of current in a series LCR circuit or to determine the velocity of ultrasound in a liquid and the frequency of AC using electrically vibrating rod by means of formation of standing waves.	Applying (K3), Precision (S3)
CO2	determine the wavelength of a laser and the particle size of a powder material using the concept of diffraction of light. To compute the acceptance angle and the numerical aperture of an optical fiber using the concepts of total internal reflection and to determine the band gap of semiconductor using the concept of variation of resistance with temperature.	Applying (K3), Precision (S3)
CO3	determine the specific resistivity of a given wire using the principle of Wheatstone bridge. To obtain the I-V characteristics of a UJT using the concept of region with negative resistance or to determine the Hall coefficient of a material by means of Hall effect. To determine the thickness of a thin film using the concept of interference and also to write coding / do project / develop product.	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	2	3					2	2		2	3	1
CO2	3	2	2	3					2	2		2	3	1
CO3	3	2	2	3					2	2		2	3	1

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

22VEC11 - YOGA AND VALUES FOR HOLISTIC DEVELOPMENT							
(Common to All Engineering and Technology Branches)							
Programme & Branch	**All B.E./B.Tech. Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1 / 2**	**HS**	**1**	**0**	**1**	**1**

Preamble	Yoga or yogasanas are considered as art and science of healthy living by our ancient gurus. It is method to bring harmony of body and mind for general wellbeing. Yoga is considered as one of the greatest gifts to the world by Indians for healthy living. Students in particular are benefitted by learning yoga.	
Unit – I	**Introduction:**	**2**
The Origins of Yoga – Definitions - Concepts - Aims and objectives of Yoga – Yoga is a Science and Art – Rules and Regulations of Asanas – Classifications of Yogasanas – Patanjali's Ashtanga Yoga – Pranayama – Mudras & Bandhas - Shatkarma (Cleansing Practice) - Streams of Yoga – Modern Trends in yoga.		
Unit – II	**Yoga and Mind:**	**2**
The Nature of Mind - Five Elements and the Mind - Meditation and the Mind - Functions of the Mind - Role of Yoga in Psychological problems: Mood Disorders, Major Depressive Disorder, Cyclothymic Disorder.		
Unit – III	**Yoga and Values, Diet:**	**2**
Human Values – Social Values – Role of Yoga in Personality Integration - Concepts of Natural Diet - Naturopathy Diet – Eliminative Diet – Soothing Diet – Constructive Diet.		
Unit – IV	**Asanas:**	**2**
Prayer - Starting & Closing - Preparatory practices – Loosening Practices – Meaning, Definitions and Objectives of Asanas - Principles of Practicing Asanas. Asanas: Standing – Sitting – Prone – Supine – Suryanamaskar.		
Unit – V	**Pranayama and Meditation:**	**2**
Breathing Practices for awareness - Definitions and Objectives of Pranayama - Principles of Practicing Pranayama. Pranayama: Nadi Shuddhi - Kapalabathi – Sitali – Sitkari – Bhranari – Ujjayi – Relaxation Techniques – Meditation.		

Lecture: 10, Practical: 10, Total:20

TEXT BOOK:

1.	Swami satyananda saraswathi, "Asana pranayama mudra bandha", Bihar school of yoga, 4th Edition, 1969.
2.	Swami mukthi Bodhanandha, "Hatha yoga pradipika", Bihar school of yoga, 4th Edition, 1985.

REFERENCES:

1.	B.K.S. Iyenkar, "Yoga the path of holistic health", DK Limited, 2nd Edition, 1969.
2.	Selvarasu, "Kriya cleansing in yoga", Aruvi yoga, 3rd Edition, 2002.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	realize the importance of yoga in physical health.	Applying (K3)
CO2	realize the importance of yoga in mental health.	Applying (K3)
CO3	realize the role of yoga in personality development and diet.	Applying (K3)
CO4	do the loosening practices, Asanas and realize its benefits.	Applying (K3)
CO5	do the practice of Pranayama, meditation and realize its benefits	Applying (K3)

Mapping of COs with POs and PSOs

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

ASSESSMENT PATTERN – THEORY

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 Technology Branches)							
Programme & Branch	**All BE / BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1 / 2**	**HS**	**1**	**0**	**0**	**1**

Preamble	தமிழர்களின் மொழி, இலக்கியம், ஓவியங்கள், சிற்பக்கலைகள், நாட்டுப்புறக் கலைகள், வீர விளையாட்டுக்கள், திணைக் கோட்பாடுகள், இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பைப் பற்றிய அறிவை வழங்குவதே இந்த பாடத்தின் நோக்கமாகும்.

அலகு – I	**மொழி மற்றும் இலக்கியம்**	**3**

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு – II	**மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை**	**3**

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு – III	**நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுக்கள்**	**3**

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு – IV	**தமிழர்களின் திணைக் கோட்பாடுகள்**	**3**

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு- சங்க காலத்தில் தமிழகத்தில் எழுத்தறிவும் கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு – V	**இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு**	**3**

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறபகுதிகளில் தமிழ் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

Total: 15

TEXT BOOK:

1.	ஆ. பூபாலன், தமிழர் மரபு, VRB Publishers Pvt Ltd, 2022.

REFERENCES:

1.	தமிழக வரலாறு- மக்களும் பண்பாடும்- கே கே பிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2.	கணினித்தமிழ் - முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)
3.	கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம்.(தொல்லியல் துறை வெளியீடு)
4.	பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)

COURSE OUTCOMES: படிப்பை முடித்தவுடன், மாணவர்கள்		**BT Mapped (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	தமிழர்களின் திணைக் கோட்பாடுகளைப் பற்றி விளக்க முடியும்.	Understanding (K2)
CO5	இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு பற்றி விளக்க முடியும்.	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						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 - HERITAGE OF TAMILS							
(Common to All Engineering and Technology Branches)							
Programme & Branch	**All BE / BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1 / 2**	**HS**	**1**	**0**	**0**	**1**

Preamble	The objective of this course is to impart knowledge about Tamil language, literature, paintings, sculptures, folk arts, heroic games, doctrines, contribution of Tamils to Indian culture.	
UNIT I	**Language and Literature**	**3**
Language families in india - dravidian languages – tamil as a classical language - classical literature in tamil – secular nature of sangam literature – distributive justice in sangam literature - management principles in thirukural - tamil epics and impact of buddhism & jainism in tamil land - bakthi literature azhwars and nayanmars - forms of minor poetry - development of modern literature in tamil - contribution of bharathiyar and bharathidhasan.		
UNIT II	**Heritage - Rock Art Paintings to Modern Art – Sculpture**	**3**
Hero stone to modern sculpture - bronze icons - tribes and their handicrafts - art of temple car making - - massive terracotta sculptures, village deities, thiruvalluvar statue at kanyakumari, making of musical instruments - mridhangam, parai, veenai, yazh and nadhaswaram - role of temples in social and economic life of tamils.		
UNIT III	**Folk and Martial Arts**	**3**
Therukoothu – karagattam - villu pattu - kaniyan koothu – oyillattam - leather puppetry – silambattam – valari - tiger dance - sports and games of tamils.		
UNIT IV	**Thinai Concept of Tamils**	**3**
Flora and fauna of tamils & aham and puram concept from tholkappiyam and sangam literature - aram concept of tamils - education and literacy during sangam age - ancient cities and ports of sangam age - export and import during sangam age - overseas conquest of cholas.		
UNIT V	**Contribution of Tamils to Indian National Movement and Indian Culture**	**3**
Contribution of tamils to indian freedom struggle - the cultural influence of tamils over the other parts of india – self-respect movement - role of siddha medicine in indigenous systems of medicine – inscriptions & manuscripts – print history of tamil books.		
		Total: 15

TEXT BOOK:

1.	S.Muthuramalingam, M.Saravanakumar, Heritage of Tamils, Yes Dee Publishing Pvt Ltd, 2023.

REFERENCES:

1.	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukarasu) (Published by : International Institute of Tamil Studies).
2.	The Contribution of Tamil of the Tamils to Indian Culture(Dr.M.Valarmathi)(Puplished by International Institute of Tamil Studies).
3.	Keeladi – 'Sangam City C ivilzation on the banks of river Vaigai; (Jointly Published by: Department of Archaeology & Tamilnadu Text Book and Educational Services Corporation, Tamilnadu).

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain valuable concepts in language and literature of tamils.	Understanding (K2)
CO2	illustrate about the tamils sculpture and their paintings.	Understanding (K2)
CO3	summarize about the tamils folk and martial arts.	Understanding (K2)
CO4	explain the thinai concept of tamils.	Understanding (K2)
CO5	explain the contribution of Tamils to the Indian National Movement and Indian culture.	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						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 – தமிழரும் தொழில்நுட்பமும்							
(Common to All Engineering and Technology Branches)							
Programme & Branch	**All BE/BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**2 / 3**	**HS**	**1**	**0**	**0**	**1**

முன்னுரை	தமிழ் கலாச்சாரத்தோடு ஒன்றிய தொழில் நுட்பங்களை பற்றிப் எடுத்துரைத்தல்	
அலகு – I	**நெசவு மற்றும் பானை தொழில்நுட்பம்**	**3**
சங்க காலத்தில் நெசவு தொழில் – பானைத் தொழில்நுட்பம் கருப்பு சிவப்பு பாண்டங்கள் – பாண்டகளில் கீறல் குறியீடுகள்		
அலகு – II	**வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்**	**3**
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு – சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச்சிற்பங்களும், கோவில்களும் – சோழர் காலத்து பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் – மாதிரிகட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னை இந்தோ-சாரோசெனிக் கட்டிடக் கலை.		
அலகு – III	**உற்பத்தித் தொழில்நுட்பம்**	**3**
கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.		
அலகு – IV	**வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம்**	**3**
அணை, ஏரி, குளங்கள், மதகு – சோழர்கால குமிழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.		
அலகு – V	**அறிவியல் தமிழ் மற்றும் கணினித்தமிழ்**	**3**
அறிவியல் தமிழின் வளர்ச்சி – கணினிதத்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் சொற்குவைத் திட்டம்.		
		Total:15

TEXT BOOK:

1.	தமிழக வரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியில் பணிகள் கழகம்), உலகத் தமிழாராய்ச்சி நிறுவனம், சென்னை, 2002
2.	கணினித்தமிழ் முனைவர் இல. சுந்தரம், விகடன் பிரசுரம், 2016

REFERENCES:

1.	கீழடி-வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம்.(தொல்லியல் துறை வெளியீடு)
2.	பொருநை-ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
3.	Social Life of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and RMRL – (in print)
4.	Social Life of the Tamils – The Classical Period (Dr.S.Sigaravelu) (Published by: International Institute of Tamil Studies).
5.	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukarasu) (Published by : International Institute of Tamil Studies)
6.	The Contribution of the Tamil to Indian Culture (Dr.M.Valarmathi) (Puplished by International Institute of Tamil Studies).

7.	Keeladi – 'Sangam City Civilzation on the banks of river Vaigai; (Jointly Published by: Department of Archaeology & Tamilnadu Text Book and Educational Services Corporation, Tamilnadu)
8.	Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author)
9.	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.

COURSE OUTCOMES: படிப்பை முடித்தவுடன், மாணவர்கள்		BT Mapped (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)

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		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 TECHNOLOGY							
(Common to All Engineering and Technology Branches)							
Programme & Branch	**All BE/BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**2 / 3**	**HS**	**1**	**0**	**0**	**1**

Preamble	This course aims to impart the essential knowledge on the tamil culture and related technology	
UNIT – I	**WEAVING AND CERAMIC TECHNOLOGY**	**3**
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.		
UNIT – II	**DESIGN AND CONSTRUCTION TECHNOLOGY**	**3**
Designing and Structural construction House & Designs in household materials during Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram – Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places – Temples of Nayaka Period – Type study (Madurai Meenakshi Temple) – Thirumalai Nayakar Mahal – Chetti Nadu Houses, Indo – Saracenic architecture at Madras during British Period.		
UNIT – III	**MANUFACTURING TECHNOLOGY**	**3**
Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel – Copper and gold – Coins as source of history – Minting of Coins – Beads making – industries Stone beads – Glass beads –Terracotta beads –Shell beads/ bone beats – Archeological evidences – Gem stone types described in Silappathikaram.		
UNIT – IV	**AGRICULTURE AND IRRIGATION TECHNOLOGY**	**3**
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry – Wells designed for cattle use – Agriculture and Agro Processing – Knowledge of Sea – Fisheries – Pearl – Conche diving – Ancient Knowledge of Ocean – Knowledge Specific Society.		
UNIT – V	**SCIENTIFIC TAMIL & TAMIL COMPUTING**	**3**
Development of Scientific Tamil – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.		
		Total:15

TEXT BOOK:

1.	Social Life of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and RMRL – (in print)
2.	Social Life of the Tamils – The Classical Period (Dr.S.Sigaravelu) (Published by: International Institute of Tamil Studies).

REFERENCES:

1.	தமிழக வரலாறு - மக்களும் பண்பாடும் - கே கே பிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியில் பணிகள் கழகம்), உலகத் தமிழாராய்ச்சி நிறுவனம், சென்னை, 2002
2.	கணினித்தமிழ் முனைவர் இல. சுந்தரம், விகடன் பிரசுரம், 2016
3.	கீழடி வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம்.(தொல்லியல் துறை வெளியீடு)
4.	பொருநை ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு
5.	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukarasu) (Published by : International Institute of Tamil Studies)
6.	The Contribution of the Tamils to Indian Culture (Dr.M.Valarmathi)(Puplished by International Institute of Tamil Studies).
7.	Keeladi – 'Sangam City Civilzation on the banks of river Vaigai; (Jointly Published by: Department of Archaeology & Tamilnadu Text Book and Educational Services Corporation, Tamilnadu)
8.	Studies in the History of India with Special Reference to Tamilnadu (dr.K.K.Pillay) (Published by : The Author)
9.	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.

COURSE OUTCOMES: On completion 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)

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		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)**

22GCL11 – FOUNDATION LABORATORY – MANUFACTURING, DESIGN AND ROBOTICS							
(Common to All BE/BTech branches)							
Programme& Branch	**All BE/BTech branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1 / 2**	**ES**	**0**	**0**	**6**	**3**

Preamble	This course is designed to provide foundational knowledge on engineering with hands-on experience on developing a prototype model with the basic knowledge of Computer-aided Design, Manufacturing Processes, 3D Printing Technology, Robotics and Embedded Control.

LIST OF EXPERIMENTS / EXERCISES:

	PART A – Manufacturing (30 Hours)
1.	Selection of product, free hand sketching and detailing
2.	Construction of model using Arc/TIG/MIG/Gas/Spot welding operations
3.	Enhancing the model with sheet metal
4.	Creating the parts of the model using lathe
5.	Creating the parts of the model using milling and drilling machines
	PART B – Product Design and Development (30 Hours)
1.	Free hand sketching and detailing of the component
2.	3D part modelling of the component using CAD software
3.	Engineering Analysis of the component model
4.	Generate the component using 3D printer
5.	Value addition to the produced component using CNC milling machine, CNC laser cutting machine and CNC router
	PART C – Robotics (30 Hours)
1.	Design of electronic circuit and its debugging
2.	Interfacing of sensors, actuators and wireless communion modules with microcontroller
3.	Assembly of Tracker Robot with accessories
4.	Development of control strategies for motion control, path planning and obstacle avoidance
5.	Demonstration and testing of Robot in static environment
	Total:90

REFERENCES/ MANUAL /SOFTWARE:

1.	Laboratory Manual
2.	AutoCAD 2020 and SOLID WORKS 2018 Software

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	develop the prototype model using mechanical operations like welding, forming and machining processes	Applying (K3), Precision (S3)
CO2	sketch 3D model and enhance the prototype using modern machines like 3D printer, CNC milling machine, CNC Laser cutter and CNC Router	Applying (K3), Precision (S3)
CO3	design and develop the autonomous robot for real-time applications	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	3	3		2				3	2		2		
CO2	3	3	3		3				3	2		2		
CO3	3	3	3		2				3	2		2		

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

22GCL12 – FOUNDATION LABORATORY – ELECTRICAL, WEB AND IOT							
(Common to all BE/BTech branches)							
Programme& Branch	**All BE/BTech branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1 /2**	**ES**	**0**	**0**	**6**	**3**

Preamble	This course is designed to provide a foundational knowledge on engineering with hands-on experience on the house wiring, Internet of Things and Web Technologies.

LIST OF EXPERIMENTS / EXERCISES:

	PART A – Electrical Installation (30 Hours)
1.	Develop wiring diagrams using software tools.
2.	Identify and select suitable components for Energy Measurement and Circuit Protection
3.	Design a wiring circuit integrating Energy Meter, MCB and RCCB
4.	Develop a wiring circuit for incandescent lamp and fluorescent lamp
5.	Develop and Investigate Simple and Staircase Wiring for Residential Applications
6.	Design the Wiring Circuits for Calling Bell System and Dimmable Light
7.	Create wiring circuits for power loads
8.	Measurement of Earth Resistance and its connections.
	PART B – Internet of Things (30 Hours)
1.	Design a Single layer PCB layout designing
2.	Fabricate Single layer PCB printing
3.	Assembling, soldering and desoldering practice on single layer PCB
4.	GPIO programming in ESP8266
5.	Sensor and actuator interfacing with internet enabled microcontroller device
6.	Sensor and actuator calibration
7.	Integration of microcontroller based system with Cloud platform
	PART C – Web Technologies (30 Hours)
1.	Design a website for an application using HTML and CSS.
2.	Convert the designed website into responsive website using Bootstrap.
3.	Add dynamism to the website by using JavaScript and embed the Social Media components to the website.
4.	Incorporate database interaction to the website.
5.	Deploy the developed website in the server.
	Total:90

REFERENCES/ MANUAL /SOFTWARE:

1.	Laboratory Manual
2.	Eric T.Freeman,Elisabeth Robson, ”Head First JavaScript Programming A Brain-Friendly Guide”, 1st Edition, O’Reilly , 2014.
3.	Eric T.Freeman,Elisabeth Robson, ”Head First HTML and CSS”,2nd Edition, O’Reilly , 2012
4.	Lynn Beighley,”Head First SQL”,1st Editin, O’Reilly,2007.

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

CO1	design electrical wiring circuits for buildings based on their requirement	Applying(K3), Precision (S3)
CO2	develop IoT based solutions and PCB for real world use cases.	Applying (K3), Precision (S3)
CO3	design and host an interactive dynamic website.	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	2	1					1					
CO2	3	2	2	1					1					
CO3	3	2	2	1					1					

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

22CDL21 - DESIGN THINKING LABORATORY							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**2**	**PC**	**0**	**0**	**2**	**1**

Preamble	It provides an exposure to develop a prototype models for design challenge.

List of Exercises / Experiments:

1. Develop SCOPES Template for your design challenge.
2. Perform User Research by using explore method and tools.
3. Conduct Field Observation for your design challenge
4. Conduct an interview with your customer by using empathy map and journey map.
5. Create user personas for your product or service.
6. Develop SCAMPER template for ideation.
7. Create user scenario/story telling for your product or service.
8. Create low-fidelity prototypes (paper prototypes) for your design challenge.
9. Create medium-fidelity prototypes (hardware/software prototypes) for your design challenge.
10. Collect feedback from users for your prototype model.

Total: 30

REFERENCES / MANUALS / SOFTWARES / TOOLS USED:

1.	Chart Papers, Stick Notes, IOT Components.
2.	Lee Chong Hwa, "Design Thinking the Guidebook", Design Thinking Master Trainers of Bhutan, 2017. (E-Book).
3.	Any Web Browser.

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	Construct design challenge and reframe the design challenge into design opportunity.	Applying (K3), Precision(S3)
CO2	Interview the user, and know the feelings of users to foster deep user understanding and be able to uncover the deep user insights and needs.	Applying (K3), Precision(S3)
CO3	Develop ideas and prototypes by brain storming using the ideation tools.	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	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

22MAT32 - DISCRETE MATHEMATICAL STRUCTURES							
(Common to Computer Science and Engineering & Computer Science and Design branches)							
Programme & Branch	**BE - Computer Science and Engineering & Computer Science and Design branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**3**	**BS**	**3**	**1**	**0**	**4**

Preamble	To impart knowledge in mathematical logic, partial ordering and lattices, investigate various category of functions and develop skills to apply group structures in coding theory.	
Unit – I	**Propositional Calculus:**	**9+3**
Propositions – Logical connectives – Compound propositions – Conditional and biconditional propositions – Truth tables – Tautologies and Contradictions – Inverse, Converse and Contrapositive – Logical equivalences and implications –Normal forms – Principal conjunctive normal form and Principal disjunctive normal form – Rules of inference – Arguments – Validity of arguments.		
Unit – II	**Predicate Calculus:**	**9+3**
Predicates – Statement function – Variables – Quantifiers – Universe of discourse – Theory of inference – Rules of universal specification and generalization – Rules of Existential specification and generalization - Validity of arguments.		
Unit – III	**Set Theory:**	**9+3**
Cartesian product of sets – Relations on sets – Types of relations and their properties – Matrix representation of a relation - Graph of a relation – Equivalence relations – Partial ordering – Poset – Hasse diagram – Lattices – Properties of lattices.		
Unit – IV	**Functions:**	**9+3**
Definition – Classification of functions – Composition of functions – Inverse functions – Characteristic function of a set – Recurrence relations – Solution of recurrence relations – Generating Functions – Solving recurrence relation by generating functions.		
Unit – V	**Group Theory:**	**9+3**
Groups and Subgroups (Definitions only) – Homomorphism – Cosets – Lagrange‘s theorem – Normal subgroups – Coding Theory : Group codes –Hamming distance – Basic notions of error correction – Error recovery in group codes (Excluding theorems in coding theory)		
Lecture:45, Tutorial:15, Total:60		

TEXT BOOK:

1.	Veerarajan T., “Discrete Mathematics with Graph Theory and Combinatorics”, Reprint Edition, Tata McGraw Hill Publishing Company, New Delhi, 2013.

REFERENCES:

1.	Tremblay J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw–Hill, New Delhi, Reprint 2010.
2.	Kenneth H. Rosen, “Discrete Mathematics and its Applications”, 8th Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2012.
3.	Susanna S. Epp, “Discrete Mathematics with Applications”, Metric Edition, Cengage Learning, USA, 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply propositional logic to validate the arguments.	Applying (K3)
CO2	apply the rules of inference and methods of proof in predicate calculus to verify the validity of arguments.	Applying (K3)
CO3	possess knowledge of various set theoretic concepts.	Applying (K3)
CO4	understand different types of functions and solve recurrence relations.	Understanding (K2)
CO5	apply the concepts of group structures in coding theory.	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										3	
CO2	3	2	1										1	
CO3	3	2	1											
CO4	3	3	3										1	
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	30	60				100
CAT2	10	30	60				100
CAT3	10	30	60				100
ESE	10	35	55				100

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

22CDC31 - DATA STRUCTURES

Programme & Branch	B.E. – Computer Science and Design	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	3	ES	3	0	2	4

Preamble	The course focuses on the basic concepts and applications of linear data structures and non-linear data structures.	
Unit – I	**Linear Data Structures and its Applications:**	**9**
Overview of Array, List, Stack and Queue – Linked List – Operations on List: Reversing a Linked List – Cloning a Linked List – Sorting a Linked List – Applications of List: Polynomial Addition – Representing Sparse Matrices – Applications of Stack: Infix to Postfix Expression Conversion – Postfix Expression Evaluation – Towers of Hanoi – Balancing Parenthesis – String Reversal – Applications of Queue: Reversing the Queue using Stack.		
Unit – II	**Trees:**	**9**
Preliminaries: Implementation of Trees – Tree Traversals with an Application – Binary Trees: Implementation – Expression Trees – The Search Tree ADT – Binary Search Trees: Construction – Insertion – Deletion – Searching – Find Min – Find Max – AVL Trees: Rotation – Insertion – Deletion.		
Unit – III	**Graphs:**	**9**
Definitions – Representation of Graphs – Types of Graph – Graph Traversal: Depth-First Search (DFS) – Breadth-First Search (BFS) – Topological Sort – Applications of DFS: Bi-connectivity – Euler Circuits – Finding Strongly Connected Components – Applications of BFS: Bipartite Graph – Graph Coloring.		
Unit – IV	**Advanced Trees:**	**9**
Splay Trees: Splaying – B Tree – B+ Tree – Red-Black Trees: Rotation – Insertion – Deletion – Priority Queues (Heaps) – Binary Heap – D-heaps – Leftist Heaps – Skew Heaps.		
Unit – V	**Searching, Sorting and Hashing:**	**9**
Searching: Linear search – Binary Search – Sorting: Internal Sorting: Bubble sort – Shell sort – Bucket sort – External Sorting: Multiway Merge – Polyphase Merge – Hashing: Hash Functions – Separate Chaining – Open Addressing: Linear Probing – Quadratic Probing – Double Hashing – Rehashing – Extendible Hashing – Applications of Hashing: Dictionary/Telephone Directory.		

LIST OF EXPERIMENTS / EXERCISES:

1.	Implementation of singly linked list and its operations
2.	Implementation of doubly linked list and its operations
3.	Implementation of circular linked list and its operations
4.	Implementation of polynomial addition using linked list
5.	Infix to postfix conversion using stack ADT
6.	Implement the application for evaluating postfix expressions using array of stack ADT
7.	Implementation of reversing a queue using stack
8.	Implementation of binary search tree traversals
9.	Implementation of graph traversal techniques
10.	Implement the operations of AVL Tree: i) Store a number on to the tree ii) Delete a number from the tree iii) Display all the numbers in the tree
11.	Implementation of sorting algorithms: Bubble sort and Shell sort
12.	Implement the following operations in hash table using array i) Store the element in hash table ii)Search an element from the table iii)Delete an element from the table

Lecture:45, Practical:30, Total:75

TEXT BOOK:	
1.	Weiss M. A., “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, 2016 for Units I,II,III,V.
2.	Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, “Introduction to Algorithms”, 3rd Edition, Mcgraw Hill, 2009 for Unit IV.
REFERENCES / SOFTWARE/ MANUAL:	
1.	Langsam Y.M., Augenstein J. and Tenenbaum A. M., “Data Structures using C and C++”, 2nd Edition, Pearson Education, 2015.
2.	Software : Dev C++
3.	Laboratory Manual

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	solve the computational problems using linear data structures.	Applying (K3), Precision(S3)
CO2	determine the tree structure and operations for solving problems.	Applying (K3), Precision(S3)
CO3	apply appropriate graph algorithms for solving computing problems.	Applying (K3), Precision(S3)
CO4	implement the operations of special trees.	Applying (K3), Precision(S3)
CO5	demonstrate the concept of sorting, searching and hashing techniques.	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	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

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)**

22CDC32 – USER EXPERIENCE DESIGN							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**3**	**PC**	**3**	**0**	**2**	**4**

Preamble	This course enables how to use user experiences to develop for products from scratch and user personas. Also emphasis the importance of a good UX design and the role of a UX designer.	
Unit – I	**UX Design Process**	**9**
Introduction to UX – UX Design Vs UI Design – Why is UX so Important – Full Stack Design – UX Design Process – Discovery and Planning – The UX Strategy – UX Research: Discover – Explore – Test – Listen – UX Analysis – Design – Production.		
Unit – II	**User Research and User Personas**	**9**
User Behavior Basics – The Gestalt Theory – Psychology in UX – User Research – Market Research Vs User Research – Benefits of User Research – Getting to Know Your Users – Grouping Customer Information – How to Conduct User Interviews? – User Personas: What are User Personas? – Creating a Persona – Four Different Perspectives on Personas – Benefits of Personas.		
Unit – III	**Affinity Diagram, Information Architecture and Visual Design Principles:**	**9**
Affinity Diagrams: Affinity Diagram – Work Activity Affinity Diagram – Capture, Grouping and Labeling. Information Architecture: Navigation – Task Flow – Content Strategy – Site Map – Gestures – Basics of Visual Design – Lines – Shapes – Colors – Font/Typography – Textures – Forms – Design Principles – Alignment – Hierarchy – Contrast – Repetition – Proximity – Balance – Space – Visual Design Tools.		
Unit – IV	**Wireframes and Prototyping:**	**9**
Introduction to Wireframe – How to Create Wireframes? – Types of Wireframes – Wireframing Tools: Sketch Wireframes – Stenciling and Paper cutouts – Wireframing Software – What is Prototyping – Prototyping Methods – Paper Prototypes – Digital Prototypes – Coding Prototypes – The process of Creating Prototypes – Prototyping Tools.		
Unit – V	**Post-launch UX Activities:**	**9**
Post-launch UX Activities – Collecting the Correct User Feedback: Customer Feedback Surveys – Emails and Contact Forms – Feedback through Social Media – User Accessibility Testing – A/B Testing – Tracking and Recording User UI Sessions – Creating and Analyzing Conversion Funnels.		

List of Exercises / Experiments:

1.	Perform user research to define the problem for your product or service.
2.	Group customer information data for your product or service.
3.	Conduct an interview with your customer.
4.	Create user personas for your product or service.
5.	Create user scenario/story telling for your product or service.
6.	Create affinity diagram for your product or service by using Sticky Notes, White Board and figma.
7.	Create low-fidelity wireframes for your product or service by using Pen and Paper/Stenciling or Paper cutouts.
8.	Create medium-fidelity wireframes for your product or service by using Figma.
9.	Create low-fidelity prototypes (paper prototypes) for your product or service by using pencil and paper.
10.	Create medium-fidelity prototypes (digital prototypes) for your product or service by using Figma.

Lecture: 45, Practical:30, Total:75

TEXT BOOK:	
1.	Elvis Canziba “Hands-On UX Design for Developers: Design, Prototype, and Implement Compelling User Experiences from Scratch”, First Edition, Packet Publishing, 2018.
REFERENCES/SOFTWARE/MANUAL:	
1.	Rex Hartson, Pardha S. Pyla, “The UX Book Process and Guidelines for Ensuring a Quality User Experience”, 1st Edition, Morgan Kaufmann Publisher, Elsevier, 2012
2.	https://www.netsolutions.com/insights/information-architecture/
3.	Figma / Figjam Tool.
4.	Laboratory manual.

COURSE OUTCOMES: **On completion 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), Precision(S3)
CO2	apply principles and procedures to conduct user research and create user personas.	Applying (K3), Precision(S3)
CO3	construct affinity diagram for the product or service and design information architecture based on various visual design principles.	Applying (K3), Precision(S3)
CO4	create wireframes and prototypes for the product or service by using various tools and software.	Applying (K3), Precision(S3)
CO5	make use of appropriate various post-launch UX activities to get feedback from the users.	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	3	3	2	1				3	2	1		3	2
CO2	3	3	3	2	1				3	2	1		3	2
CO3	3	3	3	2	1				3	2	1		3	2
CO4	3	3	3	2	1				3	2	1		3	2
CO5	3	3	3	2	1				3	2	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	15	35	50				100
CAT2	15	35	50				100
CAT3	15	35	50				100
ESE	15	35	50				100

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

22CDT31- OBJECT ORIENTED PROGRAMMING USING JAVA							
Programme & Branch	**B.E. - Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**3**	**PC**	**3**	**0**	**0**	**3**

Preamble	This course provides a concise introduction to the fundamental concepts of Java programming including inheritance, interfaces, exception handling and threads. Spring boot application building using Maven and Gradle are also focused.	
Unit – I	**Introduction to Java, Classes and Objects**	**9**
Evolution of Java – Overview of Java–Data Types, Variables and Arrays – Operators – Control Statements – Classes: Class Fundamentals-objects–Assigning Object Reference Variables –Methods – Constructors – this keyword – Garbage Collection - Overloading Methods – Objects as Parameters – Argument Passing – Returning Objects – Recursion – Access Control–Static – final - Nested and Inner Classes – Command–Line and Variable Length Arguments.		
Unit – II	**Inheritance, Packages and Interfaces**	**9**
Inheritance: Basics – Super keyword -Multilevel Hierarchy–Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces-Default, Static, Private interface methods		
Unit – III	**Exception Handling and Multithreading**	**9**
Exception Handling – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model–Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication- Suspending –Resuming, and Stopping Threads. Wrappers – Auto boxing.		
Unit – IV	**I/O, Generics, String Handling and Collections**	**9**
I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Introduction – Example –Parameters – General Form – Generic Methods, Constructors and Interfaces. Strings: Basic String class, methods and String Buffer Class. Collection frameworks: Overview– Collection Interfaces – Collection Classes.		
Unit – V	**Getting started with Spring Boot**	**9**
Introducing Spring Boot and essential features - Setting up the environment- Initializing a Spring Boot project with spring initializer - Bootstrapping a First Spring Boot Application – Build Tools – Maven and Gradle, pom.xml and build. gradle, building application using Maven and Gradle with Database Connectivity.		
		Total:45

TEXT BOOK:

1.	Herbert Schildt., "Java: The Complete Reference", 11th Edition, McGraw Hill Education, New Delhi, 2021 for Units I ,II,III & IV
2.	Shagun Bakliwal, "Hands-on Application Development using Spring Boot: Building Modern Cloud Native Applications by Learning RESTFul API, Microservices, CRUD Operations, Unit Testing, and Deployment", BPB Publications, 1st Edition, 2021 for Unit V

REFERENCES:

1.	Cay S.Horstmann., "Core Java Fundamentals", Volume 1, 11th Edition, Prentice Hall, 2018

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the concepts of classes and objects to solve simple problems	Applying (K3)
CO2	develop programs using inheritance, packages and interfaces	Applying (K3)
CO3	make use of exception handling mechanisms and multithreaded model to solve real world problems	Applying (K3)
CO4	build Java applications with I/O packages, string classes, Collections and generics concepts	Applying (K3)
CO5	develop simple Spring Boot Application using database connectivity	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	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

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	25	60				100
CAT2	15	20	65				100
CAT3	15	20	65				100
ESE	10	20	70				100

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

22CDT32 - COMPUTER ORGANIZATION							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**3**	**PC**	**3**	**1**	**0**	**4**

Preamble	This course explores on computer organization and its various arithmetic operations along with its performance.	
Unit – I	**Basic Structure of Computers and Machine Instructions**	**9+3**
Functional Units – Basic Operational Concepts – Number Representation and Arithmetic Operations – Performance – Memory Locations and Addresses – Memory Operations – Instruction and Instruction Sequencing – Addressing Modes – CISC Instruction Sets – RISC and CISC Styles.		
Unit - II	**Arithmetic Unit**	**9+3**
Addition and Subtraction of Signed Numbers – Design of Fast Adders – Multiplication of Unsigned Numbers – Multiplication of Signed Numbers – Fast Multiplication – Integer Division – Floating Point Numbers and Operations.		
Unit - III	**Processing Unit**	**9+3**
Fundamental Concepts – Instruction Execution – Hardware Components – Instruction Fetch and Execution Steps – Control Signals - Hardwired control – CISC Style Processors. Pipelining : Pipelining – Basic concepts – Pipeline Organization – Pipelining Issues - Data Dependencies – Memory Delay – Branch Delay – Performance Evaluation.		
Unit - IV	**Memory System**	**9+3**
Basic Concepts – Semiconductor RAM Memories – Read-Only Memories – Direct Memory Access – Memory Hierarchy - Cache Memories : Mapping Functions – Performance Consideration – Virtual Memory – Secondary Storage : Magnetic Hard Disks.		
Unit - V	**I/O Organization**	**9+3**
Accessing I/O Devices – Interrupts – Enabling and Disabling Interrupts – Handling Multiple Devices – Bus Structure – Bus Operation – Arbitration – Interface Circuits – Interconnection Standards		
		Lecture:45, Tutorial:15, Total: 60

TEXT BOOK:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, “Computer Organization and Embedded Systems”, 6th Edition, McGraw Hill International Edition, 2017.

REFERENCES:

1. Patterson David, A. and Hennessy John L., “Computer Organization and Design: The Hardware / Software Interface”, 5th Edition, Harcourt Asia, Morgan Kaufmann, Singapore, 2014.
2. Stallings William, “Computer Organization and Architecture: Designing for Performance”, 9th Edition, Pearson Education, New Delhi, 2012.
3. M. Morris Mano,” Computer System Architecture”, 3rd Edition, Pearson Education, New Delhi, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify the basic structure of computer and the operations that can be performed at machine instruction level.	Applying (K3)
CO2	solve various arithmetic operations on signed/unsigned integer and floating point numbers by using algorithms.	Applying (K3)
CO3	utilize the sequence of steps needed to fetch and execute the different types of machine instructions.	Applying (K3)
CO4	develop applications by using the various types of memory for efficient execution.	Applying (K3)
CO5	select the different input/output devices and interconnection standards to organize the computer system.	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	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

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

22GCT31- UNIVERSAL HUMAN VALUES							
(Common to All Engineering and Technology Branches)							
Programme & Branch	**All BE/BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**3/6**	**BS**	**2**	**0**	**0**	**2**

Preamble	To make the student to know what they 'really want to be' in their life and profession, understand the meaning of happiness and prosperity for a human being. Also to facilitate the students to understanding of harmony at all the levels of human living, and live accordingly	
Unit – I	**Introduction:**	**6**
Need and Basic Guidelines of Value Education – Content and Process of Value Education – Self Exploration – purpose of self-Exploration – Content and Process of Self exploration – Natural Acceptance – Realization and Understanding – Basic Human Aspirations – Continuous Happiness and Prosperity – Exploring Happiness and Prosperity – Basic Requirement for Fulfillment of Human Aspirations – Relationships – Physical Facilities – Right Understanding.		
Unit – II	**Harmony in the Self and Body:**	**6**
Human Being and Body – Understanding Myself as Co–existence of Self ('I') and Body, Needs of the Self and Body, Activities in the Self and Body, Self ('I') as the Conscious Entity, the Body as the Material Entity – Exercise – Body as an Instrument– Harmony in the Self ('I) – Understanding Myself – Harmony with Body.		
Unit – III	**Harmony in the Family and Society:**	**6**
Harmony in the Family – Justice – Feelings (Values) in Human Relationships – Relationship from Family to Society – Identification of Human Goal – Five dimensions of Human Endeavour.		
Unit – IV	**Harmony in Nature and Existence:**	**6**
Order of Nature – Interconnectedness – Understanding the Four order – Innateness – Natural Characteristic – Basic Activity – Conformance – Introduction to Space – Co–existence of units of Space – Limited and unlimited – Active and No–activity – Existence is Co–existence.		
Unit – V	**Implications of the above Holistic Understanding of Harmony on Professional Ethics:**	**6**
Values in different dimensions of Human Living – Definitiveness of Ethical Human Conduct –Implications of Value based Living – Identification of Comprehensive Human Goal – Humanistic Education – Universal Human Order – Competence and Issues in Professional Ethics.		
		Total:30

TEXT BOOK:

1.	Gaur R.R., Sangal R., Bagaria G.P., "A Foundation Course in Human Values and Professional Ethics", 1st edition, Excell Books Pvt. Ltd., New Delhi, 2016.

REFERENCES:

1.	Ivan Illich, "Energy & Equity", The Trinity Press, USA, 1974.
2.	Schumacher E.F., "Small is Beautiful: a study of economics as if people mattered", Britain, 1973.

COURSE OUTCOMES: **On completion 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)
CO3	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)

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	25	75					100
CAT2	25	75					100
ESE	NA						100

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

22CDL31 - OBJECT ORIENTED PROGRAMMING USING JAVA LABORATORY							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**3**	**PC**	**0**	**0**	**2**	**1**

Preamble	This course provides knowledge to develop applications using java programming language.

LIST OF EXPERIMENTS / EXERCISES:	
1.	Write simple Java programs using operators, arrays and control statements.
2.	Develop stack and queue data structures using classes and objects.
3.	Demonstrate the concepts of inheritance & polymorphism.
4.	Develop an application using interfaces by accessing super class constructors and methods.
5.	Develop an employee payroll application using packages.
6.	Implement exception handling and creation of user defined exception.
7.	Implement program to demonstrate multithreading and inter thread communication.
8.	Develop an application to perform file operations.
9.	Develop applications to demonstrate the features of generics classes and interfaces.
10.	Implement the concepts of collection frameworks.
11.	Developing First Spring Boot Application.
12.	Develop applications using Maven and Gradle
	Total:30

REFERENCES /SOFTWARE/ MANUAL:	
1.	Linux / Windows
2.	Eclipse IDE / Netbeans IDE
3.	Laboratory Manual

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	develop java programs using object oriented programming concepts	Applying (K3), Precision(S3)
CO2	identify simple applications using package, exception handling, multithreading, and generics concepts	Applying (K3), Precision(S3)
CO3	model a simple Spring Boot Application	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	2	1									3	2
CO2	3	2	2	1									3	2
CO3	3	2	2	1									3	2

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

22CDL32 - DESIGN TOOLS LABORATORY

Programme & Branch	B.E. – Computer Science and Design	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	3	PC	0	0	2	1
Preamble	This course provides knowledge to develop logos, icons, shapes, images for an application and micro interactions using design tools.						

LIST OF EXPERIMENTS / EXERCISES:

Implement the following experiments using Adobe Illustrator:

1. a.	Creating shapes with various tools like Pen tool, Curvature tool, Line tool, Shape tool, Shape builder tool, Brush tool, Pencil tool
1. b.	Draw different illustrations with various tools including Shape builder, Curvature Tool, Pencil tool.
2. a.	Demonstrate the Type tool using type on path, applying character and paragraph settings.
2. b.	Develop an outlined text of your name and apply a Neon effect.
3. a.	Demonstrate a color tool using fill tool, stroke tool, gradient tool
3. b.	Implement Steal a color using Adobe color tool from any image that you like and apply the same to your illustration.
4. a.	Implement Masking technique by masking an image inside any shape.
4. b.	Develop a logo for your brand using various illustrator tools
5.	Create a flower vector and export it as a vector image.

Implement the following experiments using Framer:

6.	Implement the following actions using action button in Framer tool a. Create three circle-shaped buttons b. Design two states for all layers c. Add an event d. Spring animation
7.	Create and implement interactive switches for various switch interactions
8.	Create and implement interaction for removing, archiving items from a list
9.	Create various animations as micro interaction for button loader
10.	Develop a prototype to implement micro interactions for pull to refresh and dragging interaction

Total:30

REFERENCES/ SOFTWARE/ MANUAL :

1.	Operating System: Windows
2.	Software: Adobe illustrator and Framer
3.	Laboratory manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	design and develop a concepts using various tools for image and shapes	Applying (K3), Precision(S3)
CO2	choose a appropriate color scheme using adobe color tool	Applying (K3), Precision(S3))
CO3	develop a unique shapes & icons and animate it.	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	2	1	2								3	2
CO2	3	2	2	1	2								3	2
CO3	3	2	2	1	2								3	2

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

22CDC41 - OPERATING SYSTEMS							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Computer Organization**	**4**	**PC**	**3**	**0**	**2**	**4**

Preamble	This course enables to explore operating system abstractions, system call interface, process, threads, and inter-process communication and various management functions of an operating system.	
Unit – I	**Operating Systems Overview:**	**9**
Introduction – Computer System Organization – Computer System Architecture – Operations – Resource Management – Security and Protection – Virtualization – Computing Environments. Operating Systems Structures: Services – User and OS Interface – System Calls – Linkers and Loaders – Operating system Structure – Building and Booting OS.		
Unit – II	**Process Management:**	**9**
Process Concept – Process Scheduling – Operations on Processes – Interprocess Communication – IPC in Shared Memory and Message Passing Systems. CPU Scheduling: Scheduling Criteria – Scheduling Algorithms. Multithreaded Programming: Threads Overview – Multicore Programming – Multithreading Models.		
Unit – III	**Process Synchronization:**	**9**
The Critical Section Problem - Peterson"s solution – Hardware support for Synchronization – Mutex Locks – Semaphores – Monitors. Deadlocks: Deadlock Characterization – Methods for handling deadlocks - Deadlock Prevention and Avoidance – Deadlock Detection – Recovery from Deadlock.		
Unit – IV	**Memory Management:**	**9**
Main Memory: Background – Contiguous Memory Allocation – Segmentation – Paging – Swapping. Virtual Memory: Background – Demand Paging – Page Replacement – Case study: Intel 32 Architecture.		
Unit – V	**Storage Management:**	**9**
Mass Storage Structure: Overview – HDD Scheduling. File System: File Concept – Access Methods – Directory Structure – Protection. File System Implementation: File System Structure – File System Operations – Directory Implementation – Allocation Methods - Free Space Management. – Security : The Security Problem – program Threats - Case study: Linux System.		

LIST OF EXPERIMENTS / EXERCISES:	
1.	Shell programming - command syntax - write simple functions - basic tests
2.	Shell programming - loops- patterns- expansions- substitutions.
3.	Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
4.	Write programs using the I/O system calls of UNIX operating system (open, read, write, close, etc)
5.	Developing application using inter process communication (using pipes or message queues)
6.	Implement the producer – consumer problem using semaphores (using UNIX system calls).
7.	Implement the following CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority
8.	Implement any two page replacement algorithms a) FIFO b) LRU c) LFU d) optimal
9.	Linux OS installation and installing software from source code as well as using binary package
10.	Installing and configuring printers and Samba configuration – file sharing

Lecture:45, Practical:30, Total:75

TEXT BOOK:	
1.	Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley & Sons Inc., 2018.

REFERENCES / SOFTWARE/ MANUAL:	
1.	William Stallings, "Operating Systems Internals and Design Principles", 9th Edition, Prentice Hall, 2018.
2.	Andrew S. Tanenbaum, "Modern Operating Systems", 4th Edition, Pearson Education, 2016.
3.	GCC Compiler/Linux
4.	Laboratory manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify an appropriate system calls for the operating system services	Applying (K3), Precision(S3)
CO2	make use of process management strategies for scheduling processes	Applying (K3), Precision(S3)
CO3	apply different methods for process synchronization and deadlock handling in multi-user environment	Applying (K3), Precision(S3)
CO4	make use of memory management strategies to address demand paging issues	Applying (K3), Precision(S3))
CO5	experiment various disk scheduling algorithms and file system operations	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	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

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

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

22CDC42 - PYTHON PROGRAMMING AND FRAMEWORKS							
Programme & Branch	**BE – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**4**	**ES**	**3**	**0**	**2**	**4**

Preamble	This course provides fundamental knowledge on Python programming and its frameworks. It also explores various packages for data manipulation and analysis.	
Unit – I	**Basic Concepts**	**9**
Introduction – Variables, Expressions and Statements – Functions – Conditionals and recursion – Fruitful Functions – return values, parameters, local and global scope, function composition, recursion – Iteration Statements – Mutable vs Immutable data types – Strings – String slices – Searching – Looping and Counting – String methods – String Comparison.		
Unit – II	**Data Structures**	**9**
Lists – List operations – slices and methods – Dictionaries – Dictionaries as set of Counters – Looping and Dictionaries – Dictionaries and Lists – Tuples – Tuples Basics – Lists and Tuples – Dictionaries and Tuples – Sequences of sequences – Sets – Sets Basics – Set Operations – Case Study – Data Structure Selection – Files – Basic File Operations – File names and paths – Exception Handling.		
Unit – III	**Object Oriented Programming & Python Database Integration**	**9**
Classes and Objects – Classes and Functions – Classes and methods – Object-oriented features – __init__() method – __str__() method – Operator Overloading – Type-based dispatch – Polymorphism – Inheritance – Aggregation and Association – Need for database programming – Connect Database – CRUD operations – Cursor Attributes.		
Unit – IV	**Data Manipulation with NumPy Arrays**	**9**
Python Environment & Frameworks: Anaconda – Jupyter notebook – NumPy: The Basics of NumPy Arrays – Computation on NumPy Arrays – Aggregations – Case Study Using Aggregation and Histogram – Computation on Arrays: Broadcasting – Comparisons, Masks and Boolean Logic – Sorting Arrays – Structured Arrays.		
Unit – V	**Data Manipulation with Pandas and Visualization**	**9**
Data Manipulation with Pandas: Pandas Objects – Data Indexing and Selection – Operating on data – Handling missing data – Hierarchical Indexing – Concat and Append – Merge and Join – Aggregation and Grouping - Data Visualization with Matplotlib: Line plots: Line Colors and Styles – Axes Limits – Labeling Plots.		

LIST OF EXPERIMENTS / EXERCISES:

1.	Implement user-defined functions with different types of argument passing methods
2.	Demonstrate the various string manipulation functions
3.	Demonstrate the various operations on List, Tuple, Dictionary, and Sets
4.	Implement the different file operations and exception handling
5.	Implement the concept of constructors and different types of inheritance
6.	Implement the concept of Aggregation, Association, and Polymorphism
7.	Develop an application to illustrate CRUD operations using Python and MySQL
8.	Develop an application to illustrate Array indexing, slicing, reshaping, and sorting using NumPy
9.	Demonstrate Data Manipulation with Pandas
10.	Demonstrate Data Visualization using line plots and histograms in Matplotlib

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, 2nd Edition, O’Reilly Publishers, 2016 for Units I, II & III.
2.	Jake Vander Plas, “Python Data Science Handbook Essential Tools for Working with Data”, 1st Edition, O’Reilly Publishers, 2016 for units IV & V.

REFERENCES / SOFTWARE/ MANUAL:

1.	Martin C Brown, “Python: The Complete Reference”, Fourth Edition, McGraw Hill Education, 2018
2.	https://www.i2tutorials.com/crud-operations-with-mysql-database-using-python/
3.	Software: Jupyter Notebook (Anoconda).
4.	Laboratory manual.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	demonstrate the use of functions and string in Python	Applying (K3), Precision(S3)
CO2	make use of list, dictionaries, tuples, and sets data structures for developing applications	Applying (K3), Precision(S3)
CO3	implement object oriented programming concepts and CRUD operations using MySQL	Applying (K3), Precision(S3)
CO4	perform data manipulation with NumPy arrays	Applying (K3), Precision(S3)
CO5	perform data manipulation with Pandas and data visualization using Matplotlib	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	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

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)**

22CDT41 - DATABASE MANAGEMENT SYSTEMS							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**4**	**PC**	**3**	**0**	**0**	**3**

Preamble	This course focuses on the fundamentals of data models and database system design along with file organization and query processing.

Unit – I	**Data Models and Relational Model:**	**9**

Introduction – Database System Applications – Purpose of database systems – View of data – Database Languages – Relational Databases – Database Architecture – Database Users and administrators – Relational Model – Structure of Relational Databases – Database Schema – Keys – Schema Diagrams – Relational Query Languages – Relational Algebra – Fundamental Relational Operations – Additional relational operations.

Unit – II	**SQL and Database Design:**	**9**

Database Design – E-R model – Constraints – ER diagrams – Reduction to Relational Schema – ER design issues. SQL: Basic structure – Operations – Aggregate Functions – Sub queries – Nested Sub queries – modification of the database – Intermediate SQL: Joins – views – Index – Integrity Constraints – SQL data types and schemas – Authorization.

Unit – III	**Relational Database Design:**	**9**

Relational Database Design: Features of good relational designs – Functional dependency – Decomposition using functional dependencies – Normal Forms: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF – Data Storage: RAID – Tertiary storage – Overview of query processing and query optimization - File Organization – Organization of Records in Files – Data dictionary storage.

Unit – IV	**Indexing, Hashing and Transactions:**	**9**

Indexing, Hashing and Transactions: Ordered indices – B tree index files – B+ Tree index files – Multiple key access – Static and Dynamic Hashing – Bitmap indices – Transaction concept – Transaction model – Storage structure – Transaction atomicity and durability – Isolation – Serializability.

Unit – V	**Concurrency Control and Recovery System:**	**9**

Concurrency Control and Recovery System: Lock-based Protocols – Deadlock Handling – Multiple Granularity – Timestamp and Validation Based Protocols – Failure classification – Storage – Recovery and atomicity – Algorithm – Buffer management – Failure with loss of nonvolatile storage – early lock release and logical undo operations.

Total:45

TEXT BOOK:

1. Silberschatz Abraham, Korth Henry F. and Sudarshan S., “Database System Concepts”, 7th Edition, McGraw Hill, New York, 2019.

REFERENCES:

1. ElmasriRamez and Navathe Shamkant B., “Fundamental Database Systems”, 6th Edition, Pearson Education, New Delhi, 2010.
2. Date C.J., Kannan A. and Swamynathan S., “An Introduction to Database Systems”, 8th Edition, Pearson Education, New Delhi, 2006.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	model the features, architecture, applications of database system and relational algebra operations.	Applying (K3)
CO2	experiment an ER model to retrieve an information	Applying (K3)
CO3	choose the appropriate normal form for the given relational database	Applying (K3)
CO4	apply indexing and hashing techniques for effective transaction processing	Applying (K3)
CO5	analyze concurrency control and recovery in a relational database	Analyzing (K4)

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	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

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	20	30	50				100
CAT3	20	30	50				100
ESE	25	35	30	10			100

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

22CDT42 - USER INTERFACE DESIGN							
Programme & Branch	**BE - Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**User Experience Design**	**4**	**PC**	**3**	**0**	**0**	**3**

Preamble	This course provides knowledge to design and prototype the user interfaces for the identified problem statement.	
Unit - I	**Basic Design Components**	**9**
Material Design: Introduction, Principles. Material Environment: Surfaces. Elevation. Light and Shadows. Basic Components: App bars Bottom and Top, Bottom Navigation, Buttons, Cards, Text Fields, Navigation Drawer, Human Interface Guidelines.		
Unit - II	**Advanced Design Components**	**9**
Advanced Components: Backdrop, Checkboxes, Chips, Date Pickers, Dialogs, Dividers, Image List, Lists, Menus, Progress Indicators, Radio Buttons, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Tabs, Tool Tips, Time Pickers, Fluent Design System.		
Unit - III	**Navigation and Layout**	**9**
Getting Around: Navigation, Signposts, and Wayfinding: Signposts- Wayfinding- Navigation Types – Design Considerations – Navigational Models – Patterns. Layout of Screen Elements: Basics of Layout – Patterns.		
Unit - IV	**Visual Style and Mobile Interfaces**	**9**
Visual Style and Aesthetics: Basics of Visual Design – Visual Design for Enterprise Applications – Range of Visual Styles. Mobile Interfaces: Challenges and Opportunities of Mobile Design – Approach to Mobile Design – Patterns		
Unit - V	**Actions and Commands - Forms and Controls**	**9**
Actions and Commands: Tap, Swipe, and Pinch -Rotate and Shake -Buttons -Menu Bars - Menus – Toolbars - Links- Action Panels - Hover Tools - Keyboard Actions- Drag-and-Drop -Typed Commands-Affordance-Direct Manipulation. Forms and Controls: Basics of Form Design – Patterns.		
		Total:45

TEXT BOOK:

1.	Fabio Staiano, “Designing and Prototyping Interfaces with Figma Learn Essential UX/UI Design Principles by Creating Interactive Prototypes for Mobile, Tablet, and Desktop”, Packt Publishing, 2022 for units I & II.
2.	Tidwell, J., Valencia, A., Brewer, C. (2019). Designing Interfaces: Patterns for Effective Interaction Design. Germany: O'Reilly Media for units III,IV and V.

REFERENCES:

1.	Material Design, https://material.io/components
2.	Human Interface Guidelines, https://developer.apple.com/design/human-interface-guidelines/
3.	Fluent Design System, https://www.microsoft.com/design/fluent/#/

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the material design principles to create user interface	Applying (K3)
CO2	make use of the advanced material components for creating user interface	Applying (K3)
CO3	utilize the basic principles to design navigation and elements of layout	Applying (K3)
CO4	demonstrate the concept of visual design and mobile design in user interface	Applying (K3)
CO5	apply the guidelines for designing effective and usable forms using controls	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	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

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

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

22CDT43 - DESIGN AND ANALYSIS OF ALGORITHMS							
Programme& Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Data Structures**	**4**	**PC**	**3**	**1**	**0**	**4**
Preamble	This course offers formal introduction to common algorithm design techniques and methods for analyzing the performance of algorithms.						
Unit – I	**Introduction:**						**9+3**
Algorithm - Fundamentals of Algorithmic Problem Solving - Important Problem Types. Fundamentals of the Analysis of Algorithm Efficiency: Analysis Framework - Asymptotic Notations and its properties - Mathematical analysis for Recursive and Non-recursive algorithms - Empirical analysis of algorithm - Algorithm visualization.							
Unit – II	**Brute Force and Divide & Conquer**						**9+3**
Brute Force:Selection and Bubble Sort, Sequential search and String Matching - closest pair and convex hull problem. Divide and Conquer: Merge sort - Quick sort - Binary tree traversals and related properties - Multiplication of large integers and Strassen's Matrix Multiplication - closest pair and convex hull problem.							
Unit – III	**Decrease &Conquer and Transform & Conquer**						**9+3**
Decrease & Conquer: Insertion sort -Topological Sorting - Fake coin problem - Computing a Median and the Selection Problem. Transform and Conquer: Presorting - Balanced search trees - AVL trees -2-3Trees- Heaps and Heap sort.							
Unit – IV	**Dynamic Programming and Greedy Technique**						**9+3**
Dynamic Programming: Warshall's and Floyd's algorithm - Optimal Binary Search Trees - Knapsack Problem and Memory functions. Greedy Technique: Prim's algorithm - Kruskal's Algorithm - Dijkstra's Algorithm - Huffman Trees and codes.							
Unit – V	**Backtracking and Branch & Bound**						**9+3**
Backtracking: n-Queens problem - Hamiltonian Circuit Problem - Subset Sum Problem. Branch and Bound: Assignment problem - Knapsack Problem - Traveling Salesman Problem - Overview of P, NP and NP-Complete Problems							
Lecture:45, Tutorial:15, Total:60							
TEXT BOOK:							
1.	Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, 2012.						
REFERENCES:							
1.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, Prentice Hall of India, 2009.						
2.	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Reprint Edition, Pearson Education, 2006.						

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	analyse the efficiency of algorithms using various frameworks	Analyzing (K4)
CO2	apply brute force and divide-and-conquer techniques to solve various problems and analyze their efficiency.	Analyzing (K4)
CO3	utilize decrease-and-conquer and transform-and-conquer strategies for solving problems	Applying (K3)
CO4	make use of dynamic programming and greedy techniques to solve problems	Applying (K3)
CO5	solve difficult combinatorial problems with backtracking and branch & bound techniques	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	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

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	30	40	20			100
CAT2	10	30	60				100
CAT3	10	30	60				100
ESE	10	10	60	20			100

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

22CDL41 - DATABASE MANAGEMENT SYSTEMS LABORATORY

Programme & Branch	B.E. – Computer Science and Design	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	4	PC	0	0	2	1

Preamble	This course enables to develop database applications for real world problems

LIST OF EXPERIMENTS / EXERCISES:

1.	Demonstrate Data definition language and integrity constraints.
2.	Demonstrate Data manipulation language, Data control language commands and TCL commands.
3.	Execute nested and sub queries in SQL.
4.	Demonstrate Join operations in SQL.
5.	Create Views and index and perform SQL operations in it.
6.	Demonstrate the concepts of looping using PL/SQL statements.
7.	Implement Cursors and its operations.
8.	Implement Triggers and its operations.
9.	Develop Procedures and Functions to perform operations in SQL.
10.	Mini project: (Application Development using Oracle/ SQL SERVER / MYSQL) Sample Applications: Inventory Control System Hospital Management System Railway Reservation System Web Based User Identification System Hotel Management System Student Information System Library Information System and etc.,

Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Front End: Microsoft Visual Studio 6.0, Microsoft .NET Framework SDK v2.0, Java etc.,
2.	Back End : ORACLE / SQL SERVER / MYSQL
3.	Manuals: https://docs.oracle.com/cd/E11882_01/server.112/e41085.pdf
4.	Laboratory manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	construct databases using SQL and PL/SQL	Applying (K3), Precision (S3)
CO2	execute queries using the concepts of embedded query languages	Applying (K3), Precision (S3)
CO3	develop database applications for the real world problems	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	2	1									3	2
CO2	3	2	2	1									3	2
CO3	3	2	2	1									3	2

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

22CDL42 - USER INTERFACE DESIGN LABORATORY								
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**4**	**PC**	**0**	**0**	**2**	**1**

Preamble	This course enables the students to design modern mobile apps using fundamental design principles, process, and workflow

LIST OF EXPERIMENTS / EXERCISES:	
1.	Explore Figma Interface in • Various tools in toolbar • Layers, Assets, Pages • Design Panel
2.	Apply design constraints to objects in your workflow
3.	Create Frames and grids and add it in Figma
4.	Apply Auto Layout to either frames or components in Figma
5.	Create and use Figma components in Your Design
6.	Create a style guide for your mobile and web application.
7.	Create a mockup mobile UI screens for any mobile app.
8.	Create a mockup web UI screens for any web application.
9.	Create Prototyping in Figma • Prototype Panel • Inspect Panel
10.	Create a Prototype for your mockup mobile and web application.
11.	Create a micro interaction in Figma
12.	Create a portfolio for your mockup mobile and web project.
	Total:30

REFERENCES /SOFTWARE/ MANUAL:	
1.	Figma
2.	Laboratory Manual

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	explore the basics of user interface design tools and its interfaces.	Applying (K3), Precision(S3)
CO2	design and use reusable components.	Applying (K3), Precision(S3)
CO3	create prototypes and portfolio for mobile and web applications.	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	2	1									3	2
CO2	3	2	2	1									3	2
CO3	3	2	2	1									3	2

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

22GEL41 - PROFESSIONAL SKILLS TRAINING - I							
(Common to All BE/ BTech Engineering and Technology branches)							
Programme & Branch	**All BE/ BTech Engineering and Technology branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**4**	**EC**	**0**	**0**	**80**	**2**

Preamble	This subject is to enhance the employability skills and to develop career competency	
Unit – I	**Soft Skills – I :**	**20**
Soft skills and its importance: Pleasure and pains of transition from an academic environment to work environment-Need for change- Fear, stress and competition in the professional world-Importance of positive attitude- Self motivation and continuous knowledge up gradation-Self-confidence. Professional grooming and practices: Basics of corporate culture-Key pillars of business Etiquette- Basics of etiquette-Introductions and greetings-Rules of the handshake, earning respect, business manners-Telephone etiquette- Body Language.		
Unit – II	**Quantitative Aptitude and Logical Reasoning – I:**	**30**
Problem solving level I: Number System-LCM &HCF-Divisibility test-Surds and indices-Logarithms- Ratio-proportions and Variation-Partnership-Time speed and distance-Data interpretation-data representation. Logical reasoning: Family tree-Deductions-Logical connectives-Binary logic Linear arrangements- Circular and complex arrangement		
Unit – III	**Grammar, Vocabulary, Listening, Speaking, Reading and Writing:**	**30**
Grammar: Parts of speech - Tenses - Articles and Prepositions - Vocabulary: Synonyms & Antonyms - Analogies - Syllogism - Spelling test - Cloze test - Concord - Spotting Errors - Listening: Listening to TED talks, ESL & ESOL Videos - Podcasts - Speaking : Mock Interviews - Personality traits - Better pronunciation - Extempore talk - Reading: Reading with stress, pauses, slurs and fillers - Soft skills - Writing: Job application letter & resume - Video resume – Different types of writing - Jumbled sentences - Professional e-mail writing - Business letters - One page essay - Report writing - Editing & proofreading – Writing skills for IELTS		
		Total:45

TEXT BOOK:

1.	R.S. Aggarwal, “Quantitative Aptitude”, 7th Edition, S. Chand Publication, 2022.
2.	R.S. Aggarwal, “A Modern Approach to Logical Reasoning”, S. Chand Publication, 2022 edition.
3.	Edgar Thorpe and Showick Thorpe, “Objective English for Competitive Examination”, 6th Edition, Pearson India Education Services Pvt Ltd, 2017.

REFERENCES:

1.	Stephen Bailey, “Academic Writing: A practical guide for students”, Routledge, New York, 2011.
2.	Meenakshi Raman and Sangeeta Sharma. “Technical Communication- Principles and Practice”. 4th Edition, Oxford University Press, New Delhi, 2022.

COURSE OUTCOMES: On completion 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 English language skills for various academic and professional purposes	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				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
Assessment Test		50	50				100

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

22EGL31 - COMMUNICATION SKILLS DEVELOPMENT LABORATORY							
(Common to All Engineering and Technology Branches)							
Programme & Branch	**All B.E./B.Tech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**4**	**HS**	**0**	**0**	**2**	**1**

Preamble	This course is designed to impart necessary skills to listen, speak, read and write in order to obtain better professional communication skills.

LIST OF EXPERIMENTS / EXERCISES:

1.	Self-Introduction & Mock Interview
2.	Job Application letter with Resume
3.	Presentation: A Technical topic / Project report & a Case study
4.	Situational Dialogues / Telephonic Conversations
5.	Group Discussion
6.	Reading Aloud
7.	Listening Comprehension
8.	Writing Company Profiles
9.	Preparing reviews of a book/product/movie
10.	Pronunciation Test

Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Lab Manual
2.	Orell Digital Language Lab Software

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	enhance effective listening and reading skills	Understanding (K2), Imitation (S1)
CO2	acquire professional skills required for workplace/higher education	Applying (K3), Naturalization (S5)
CO3	use English language skills effectively in various situations	Applying (K3), Articulation (S4)

Mapping of Cos with POs and PSOs

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

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

22CDT51 – IOT and Cloud Computing							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**5**	**PC**	**3**	**0**	**0**	**3**
Preamble	The course describes various communication protocols for IoT, IoT levels and design methodologies and illustrates the development of simple real time IoT applications. This course also demonstrates developing real-time IoT applications using AWS cloud services.						
Unit - I	**Introduction to Internet of Things:**						**9**
Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT Communication Models - IoT Communication APIs – IoT enabling Technologies- IoT Levels and Templates – Domain Specific IoT- IoT and M2M - IoT Platform Design methodologies.							
Unit - II	**Infrastructure and Service Discovery Protocols for the IoT System**						**9**
Low Power Wide Area Networking Technologies - Layered Architecture of IoT-Protocol architecture of IoT-Infrastructure Protocols – Device or Service Discovery for IoT – Protocols for IoT Service Discovery.							
Unit - III	**Python for IoT and Introduction to Raspberry Pi:**						**9**
Python packages for IoT-Introduction to Raspberry Pi – Interfaces (serial, SPI, 12C) Programming – Python program with Raspberry Pi (interfacing external devices) – controlling output – reading input from pins – connecting IoT to Cloud (ThingSpeak).							
Unit - IV	**Cloud for IoT Applications:**						**9**
Cloud computing Service models-Types of Cloud- Cloud Technology-Cloud Service Ecosystem-Cloud Enabled Environment-Cloud Inspired Enterprise Transformations- IoT and Cloud Inspired Smarter Environments- Hybrid Clouds- Federated Clouds-Special Purpose Clouds-The Emergence of Edge/Fog clouds-The Architectural Components of the Smarter Traffic System							
Unit - V	**AWS IoT: Developing and Deploying in Internet of Things:**						**9**
AWS IoT Core services – Creation of IoT resources –Rules Engine for building IoT applications-Benefits of Device Shadows - Protocols for communication with and between devices- Creation of web based application for device Communication- Benefits of AWS IoT analytics							
							Total:45

TEXT BOOK:

1.	Arshdeep Bahga and Vijay Madisetti, “Internet of Things - A Hands-on Approach”, Universities Press, 2015 for Units I,II,II
2.	Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”, CRC Press, 2017, for Units IV & V

REFERENCES:

1.	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things”, Cisco Press, 1st Edition, 2017.
2.	Rajkumar Buyya, James Broberg & Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", NA Edition, Wiley, NA, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	analyze the suitability of various IoT System levels in providing an IoT-based solution for a given problem	Analyzing (K4)
CO2	identify the role of IoT protocols in building IoT applications	Applying (K3)
CO3	make use of Raspberry Pi and the supporting Python packages to develop real-time IoT applications	Applying (K3)
CO4	inference smart applications using IoT with cloud computing services and deployment model	Analyzing (K4)
CO5	develop Real-time IoT applications using AWS cloud services	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	3	2	1									3	2
CO2	3	3	2	1									3	2
CO3	3	3	2	1									3	2
CO4	3	3	2	1									3	2
CO5	3	3	2	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	30	30	20			100
CAT2	20	40	40				100
CAT3	30	50	20				100
ESE	15	54	34				100

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

22CDT52-VIRTUAL REALITY AND AUGMENTED REALITY							
Programme & Branch	**BE - Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**5**	**PC**	**3**	**0**	**0**	**3**
Preamble	This course introduces the fundamentals of the Virtual Reality and Augmented Reality to efficiently incorporate user experience, identifying and resolving conflicts in real life. It aims to analyze the application of AR and VR in architecture, gaming, entertainment etc.						
Unit - I	**Design ,Art Across Digital Realities and eXtended Reality**						**9**
How Humans Interact with Computers-Modalities Through the Ages-Types of Common HCI Modalities -The Current State of Modalities for Spatial Computing Devices - Current Controllers for Immersive Computing Systems-A Note on Hand Tracking and Hand Pose Recognition-Designing for Our Senses, Not Our Devices-Sensory Design-Five Sensory Principles.Virtual Reality for Art-3D Art Optimization-Introduction-Draw Calls- Using VR Tools for Creating 3D Art -Acquiring 3D Models Versus Making Them from Scratch.							
Unit - II	**Hardware, SLAM, Tracking**						**9**
How the Computer Vision That Makes Augmented Reality Possible Works-A Brief History of AR- Select an AR Platform-Mapping-Platforms- Apple's ARKit- Other Development Considerations –Lighting-The AR Cloud- The Dawn of the AR Cloud-The Bigger Picture—Privacy and AR Cloud Data.							
Unit - III	**Creating Cross-Platform Augmented Reality and Virtual Reality**						**9**
Virtual Reality and Augmented Reality: Cross-Platform Theory-The Role of Game Engines-Understanding 3D Graphics-Portability Lessons from Video Game Design-Simplifying the Controller Input-Virtual Reality Toolkit: Open Source Framework for the Community-Three Virtual Reality and Augmented Reality Development Best Practices.							
Unit - IV	**Enhancing Data Representation:Data Visualization and Artificial Intelligence in Spatial Computing**						**9**
Data and Machine Learning Visualization Design and Development in Spatial Computing-Introduction-Understanding Data Visualization-Principles for Data and Machine Learning Visualization-2D Data Visualizations versus 3D Data Visualization-Animation-Data Representations, Infographics, and Interactions-3D Reconstruction and Direct Manipulation of Real-World Data.							
Unit - V	**Character AI ,Behaviors and Use Cases in Embodied Reality**						**9**
Introduction - Behaviors -Current Practice: Reactive AI-More Intelligence in the System: Deliberative AI-The Virtual and Augmented Reality Health Technology Ecosystem-VR/AR Health Technology Application Design - Standard UX Isn't Intuitive-The Fan Experience: SportsXR.							
							Total: 45
TEXT BOOK:							
1.	Creating Augmented and Virtual Realities by Erin Pangilinan, Steve Lukas, Vasanth Mohan Released March 2019,Publisher(s): O'Reilly Media, Inc.,ISBN: 9781492044147						
REFERENCES:							
1.	Paul Mealy,Virtual & Augmented Reality For Dummies,ISBN: 978-1-119-48134-8 July 2018						

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the fundamentals of Design ,Art Across Digital Realities and extended Reality	Applying(K3)
CO2	make use of components of Hardware, SLAM, and Tracking	Applying(K3)
CO3	apply the concept by creating Cross-Platform Augmented Reality and Virtual Reality	Applying(K3)
CO4	apply the techniques for enhancing Data Representation for Data Visualization and Artificial Intelligence in Spatial Computing	Applying(K3)
CO5	utilize the character of AI ,behaviors and use cases in embodied reality	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	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

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

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

22CDT53-AGILE METHODOLOGIES							
Programme & Branch	**BE - Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5**	**PC**	**3**	**0**	**0**	**3**

Preamble	This course introduces software engineering concepts and agile principles at a higher level of abstraction which is to be acquired by software engineers and developers.

Unit – I	**Process Models, Analysis and Design**	**9**

Software process structure – Process models: Waterfall model – Incremental process models – Evolutionary process models - Requirements engineering - Requirements analysis - Scenario Based Modeling – Class-Based Modeling – Flow Oriented Models – Behavioral Models- Design Concepts

Unit – II	**Agile Principles and Scrum**	**9**

Understanding the Agile Values – Agile Principles – Agile Project - Scrum and Self-Organizing Teams - Basic pattern for a Scrum Project – Rules of Scrum – Self-Organizing Teams - Scrum Values – Daily Scrum – Sprints, Planning and Retrospectives - Scrum Planning and Collective Commitment - User stories – Conditions of Satisfaction – Story Points and Velocity – Burn down Charts – Planning and Running a Sprint – Generally Accepted Scrum Practices – JIRA Tool.

Unit – III	**XP and Incremental Design, Lean, and Kanban**	**9**

Primary Practices of XP – The XP values help the team change their mindset – An effective mindset starts with the XP values – Understanding the XP principles – Feedback Loops- Lean Thinking – Commitment, Options Thinking and Set Based Development – Create Heroes and Magical Thinking – Eliminate Waste – Value Stream Map – Deliver As Fast As Possible – WIP Area Chart – Pull Systems – The Principles of Kanban – Improving Your Process with Kanban – Measure and Manage Flow – Little's Law – Emergent Behavior with Kanban

Unit – IV	**Software Testing Fundamentals**	**9**

Software testing strategies: Strategic approach – Issues – Test strategies for conventional and Object Oriented software – Validation and System testing – Debugging – Testing conventional applications: White box testing – Basis path testing – Control structure testing – Black box testing – Software configuration management – SCM repository – SCM process.

Unit – V	**Software Project Management**	**9**

Software Project Management Concepts – Process and Project Metrics – Estimation for Software Projects – Project Scheduling – Risk Management – Software Configuration Management – Software Process Improvements (SPI) – The SPI Process – Capability Maturity Model Integration (CMMI) – Other SPI Frameworks.

Total:45

TEXT BOOK:

1.	Roger S. Pressman & Bruce R. Maxim, "Software Engineering: A Practitioner's Approach", 7th Edition, McGraw-Hill Education , 2019 for Units I,IV &V
2.	Andrew Stellman and Jennifer Greene, "Learning Agile: Understanding Scrum, XP, Lean and Kanban", First Edition, O'Reilly Media Inc, 2015. for units III, IV

REFERENCES:

1.	Ian Sommerville, "Software Engineering", 10th Edition, Pearson Education, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the requirement engineering tasks , design concepts and analyze the various software development models for a given scenario	Analyzing (K4)
CO2	outline agile principles and apply Scrum for project development.	Applying (K3)
CO3	model applications using XP, Lean and Kanban practices.	Applying (K3)
CO4	make use of various software testing techniques to test the software systems.	Applying (K3)
CO5	estimate the cost of software, risks of handling, do software planning and configuration management.	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	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

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	35	30	20			100
CAT2	15	35	50				100
CAT3	15	35	50				100
ESE	10	40	40	10			100

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

22CDT54-COMPUTER NETWORKS							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**5**	**PC**	**3**	**0**	**0**	**3**
Preamble	This course provides an overview of the basics of data communications and networking. The course presents the top-down approach of layers and also the functionalities and protocols of different layers						
Unit – I	**Introduction to the Internet:**						**9**
Internet – Network edge: Access networks – Physical media – Network core: Packet switching – Circuit switching – Network of networks - Delay, loss and throughput in packet-switched networks – Protocol layers and their service models.							
Unit – II	**Application Layer:**						**9**
Principles of Network applications – The web and HTTP – Electronic mail in the internet – DNS-Internet's directory service – Peer-to-Peer File Distribution – Video Streaming and Content Distribution Networks – Socket programming: Creating Network applications							
Unit – III	**Transport Layer:**						**9**
Introduction and transport layer services – Multiplexing and Demultiplexing – Connectionless transport: UDP – Principles of reliable data transfer: Reliable Data Transfer over a Lossy Channel with Bit Errors: rdt3.0 - Go-Back-N – Selective Repeat – Connection-oriented transport: TCP – TCP congestion control							
Unit – IV	**Network Layer:**						**9**
Overview – Inside a router – Internet Protocol (IP): IPv4, Addressing, IPv6 – Generalized forwarding and SDN –Routing algorithms: Link-State and Distance-Vector – Intra-AS routing in the Internet: OSPF – ICMP							
Unit – V	**Link Layer and LAN:**						**9**
Introduction to Link layer – Error detection and correction techniques – Multiple access links and protocols – Switched LAN - Security in Computer Networks: Introduction to Network Security – Principles of Cryptography: Symmetric Key Cryptography, Public Key Encryption							
							Total:45

TEXT BOOK:

1. Kurose James F. and Ross Keith W., "Computer Networking: A Top-Down Approach", 8th Edition, Pearson Education, New Delhi, 2022.

REFERENCES:

1. Behrouz A. Forouzan, "Data Communications and Networking", 6th Edition, McGraw Hill Education, 2022.
2. Andrew S. Tanenbaum, Nick Feamster, David J. Wetherall, "Computer Networks", 6th Edition, Pearson Education, 2022.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	evaluate the performance of a network in terms of different QoS parameters	Applying (K3)
CO2	develop client-server applications using application layer protocols	Applying (K3)
CO3	identify a suitable transport layer protocol for a given application	Applying (K3)
CO4	apply various routing protocols for a given network scenario	Applying (K3)
CO5	demonstrate the need for link layer protocols in providing error free transmission	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	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

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	40	50				100
CAT2	10	45	45				100
CAT3	10	40	50				100
ESE	5	40	55				100

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

22CDL51 – IOT AND CLOUD COMPUTING LABORATORY

Programme & Branch	B.E. – Computer Science and Design	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	PC	0	0	2	1

Preamble	This course demonstrates the working of various communication technologies like GSM, ZigBee, Wifi and BLE. This course also explores the development of simple real-time IoT applications using Raspberry Pi, sending the sensed values using SMS and mail and uploading the values onto the cloud. Furthermore, it allows the simulation of IoT scenarios.

LIST OF EXPERIMENTS / EXERCISES:

Mobile Communication Experiments:	
1.	Experiments on GSM / GPRS Basic AT Commands, Voice calls / Voice communication, Phone Book, SMS
2.	Experiments on interfacing BLE mote
Internet of Things Experiments:	
3.	Simulating traffic light controller
4.	Web page integration with Raspberry Pi
5.	Sensing and Sending the sensor value via SMS
6.	Sending images and video via Gmail
7.	Measuring sensor value and uploading the content onto cloud for analysis
8.	Working with Cooja Simulator • Creating an IoT scenario • Sending data between an IoT client and server
Cloud Experiments using Cloud Service Providers (AWS, Google Cloud Platform, Azure, etc.):	
9.	Develop applications using Platform as a Service (like AWS greengrass/ AWS Elastic Bean Stack)
10.	Develop applications implementing Infrastructure as a Service (like AWS s3)
11.	Develop applications using Software as a Service (like AWS Lambda)
12.	Mini Project

Total:30

REFERENCES /SOFTWARE/ MANUAL:

1.	Operating System : Windows/Linux/Contiki
2.	Software : Win X Talk, Python IDE, Thingspeak, Cooja Simulator
3.	Laboratory Manual

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	demonstrate the basic working principles of different communication systems like GSM, and Bluetooth	Applying (K3), Precision (S3)
CO2	develop simple real-time IoT applications using sensors to send SMS and images/video via Mail and upload onto the cloud	Applying (K3), Precision (S3)
CO3	design simple IoT scenarios for sending data between an IoT client and server using Cooja Simulator	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	1	2	2								3	2
CO2	3	2	1	2	2								3	2
CO3	3	2	1	2	2								2	2

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

22CDL52-VIRTUAL REALITY AND AUGMENTED REALITY LABORATORY							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5**	**PC**	**0**	**0**	**2**	**1**

Preamble	This course enables the students to design modern apps using fundamental design principles, process, and workflow of UI design using browser-based UI design tool, Figma within the application.

LIST OF EXPERIMENTS / EXERCISES:	
1.	Setup an Input system for marker-less AR system.
2.	Setup an Interaction for marker-less AR system.
3.	Optimize, debug and build marker-less AR application
4.	Setup an Input system for marker AR system.
5.	Setup an Interaction for marker AR system.
6.	Optimize, debug and build marker AR application
7.	Setup 3D model for VR Environment
8.	Setup VR Input System
9.	Setup VR interaction system
10.	optimize, debug and built VR education application

Total:30

REFERENCES/ MANUAL /SOFTWARE:	
1.	Visual Studio/ Unity/UnReal/ Vuforia Engine
2.	Laboratory Manual

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	understand how to use Input system and Interaction for AR and VR marker and marker-less components	Applying (K3), Precision(S3)
CO2	design an 3D model for VR Environment	Applying (K3), Precision(S3)
CO3	optimize, debug and built marker and marker-less AR and VR education application	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	2	1	1								3	2
CO2	3	2	2	1	1								3	2
CO3	3	2	2	1	1								3	2

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

22GEL51 - PROFESSIONAL SKILLS TRAINING - II							
(Common to All BE/ BTech Engineering and Technology branches)							
Programme & Branch	**All BE/ BTech Engineering and Technology branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5**	**EC**	**0**	**0**	**80**	**2**

Preamble	This subject is to enhance the employability skills and to develop career competency	
Unit – I	**Soft Skills – II :**	**20**
Group discussions: Advantages of group discussions-Structured GD- Team work: Value of team work in organizations- Definition of a team, why team-Elements of leadership, disadvantages of a team, stages of team formation- Group development activities. Facing an interview: Foundation in core subject- industry orientation / knowledge about the company- professional personality- Communication skills-Activities before Interview, upon entering interview room, during the interview and at the end Mock interviews.		
Unit – II	**Quantitative Aptitude and Logical Reasoning – II:**	**30**
Problem solving level II: Money related problems-Mixtures-Symbol base problem-Clocks and calendars-Simple-linear-quadratic and polynomial equations-Special, equations-Inequalities-Sequence and series-Set theory-Permutations and combinations-Probability-Statistics-Data sufficiency- Geometry-Trigonometry-Heights and distances-Co-ordinate geometry-Mensuration. Logical reasoning: Conditionality and grouping-Sequencing and scheduling- Selections-Networks:-Codes; Cubes-Venn diagram in logical reasoning- Quant based reasoning-Flaw detection- Puzzles-Cryptarithms.		
Unit – III	**Reading & Speaking Skills**	**30**
Reading: Reading comprehension– Effective Reading strategies – Descriptive, Inferential, & Argumentative reading passages – Identifying and locating factual information within a text – global reading/skimming for general understanding – selective comprehension / scanning for specific information – detailed comprehension / intensive reading – understanding the development of an argument – identifying the writer's attitude and opinions – Reading news articles in business magazines, newspapers – Reading notices and book reviews –Interpreting graphic data & Advertisements. Speaking: Mock Interviews –Self-Introduction – Sharing of Real Time Experience; Conversational Practices –Role Play – Short Talks / TED Talks –Extempore; Giving a Presentation on Various Topics – Technical / Non-Technical Topics – Project Review Presentation – Oratory and Effective Public Speaking; Pair Discussion – Group Discussion – The process of Group Discussion – Strategies to be adopted – Skills Assessed – Telephonic Conversations & Skills – Negotiating Skills.		
		Total:45

TEXT BOOK:

1.	Edgar Thorpe and Showick Thorpe, "Objective English for Competitive Examination", 6th Edition, Pearson India Education Services Pvt Ltd, 2017.

REFERENCES:

1.	Aruna Koneru, "Professional Speaking Skills," Oxford University Press India, New Delhi, 2015.
2.	Thorpe, Showick and Edgar Thorpe, "Winning at Interviews," 5th edition, Pearson Education, India, 2013.
3.	Rizvi, Ashraf M, "Effective Technical Communication," 2nd Edition, McGraw Hill Education India, 2017.

COURSE OUTCOMES: On completion 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)

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	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						

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

22CDT61-MACHINE LEARNING							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Python Programming and Frameworks**	**6**	**PC**	**3**	**0**	**0**	**3**

Preamble	This course focuses on finding patterns or making predictions from empirical data. This course also explores the techniques such as supervised, unsupervised learning algorithms and reinforcement learning.	
Unit – I	**Introduction**	**9**
Learning-Types of Machine Learning-Supervised Learning: Regression - Classification. The machine learning process-Some Terminology-Testing machine learning algorithms - Turning data into probabilities- The Naive Bayes classifier-The brain and the neuron - Hebb's rule-McCulloch and Pitts Neurons-Limitations of McCulloch and Pitts Neuron model - Neural networks-The perceptron.		
Unit – II	**Linear Discriminants, Multi-layer Perceptron and Dimensionality Reduction**	**9**
Linear separability-Linear regression. The Multi-layer Perceptron: Going Forwards-Going backwards- The multi-layer perceptron in practice. Dimensionality reduction-Linear Discriminant Analysis (LDA)-Principal Components Analysis (PCA).		
Unit – III	**Supervised Learning**	**9**
Gaussian mixture models: The Expectation Maximization (EM) Algorithm- Information Criteria-Nearest neighbour methods: Nearest Neighbour Smoothing-Distance measures-Support Vector Machines: Optimal separation-Kernels-Support Vector Machine Algorithm-Multi-class classification-SVM Regression Learning with Trees: Using decision trees-Constructing decision trees-Classification and Regression Trees (CART).		
Unit – IV	**Ensemble Learning and Unsupervised Learning**	**9**
Boosting: AdaBoost-Stumping. Bagging-Random Forests-Comparison with Boosting -Different ways to combine classifiers-Unsupervised Learning: K-means - K Medoids - Bayesian Networks.		
Unit – V	**Evolutionary Learning and Reinforcement Learning**	**9**
Evolutionary Learning: Genetic algorithm-Generating offspring-Using genetic algorithms-Genetic programming-Reinforcement Learning: Overview- Example: getting lost-Markov decision processes – Values-The difference between SARSA and Q-learning-Uses of reinforcement learning.		
		Total:45

TEXT BOOK:

1. Stephen Marsland, “Machine Learning – An Algorithmic Perspective”, 2nd Edition, Chapman and Hall / CRC Machine Learning and pattern Recognition Series, 2014.

REFERENCES:

1. Tom M. Mitchell, “Machine Learning”, 1st Edition, McGraw-Hill Education, India, 2013.
2. ShaiShalev-Shwartz and Shai Ben-David, “Understanding Machine Learning: From Theory to Algorithms”, 1st Edition, Cambridge University Press, USA, 2014.
3. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das , “Machine Learning”,1st edition, Pearson Education, 2019

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Identify the perspectives of machine learning and neural networks	Applying (K3)
CO2	apply regression, multi-layer perceptron and dimensionality reduction for real world problems	Applying (K3)
CO3	utilize Gaussian mixture models and tree based learning for solving a given problem	Applying (K3)
CO4	model the principles of ensemble learning and unsupervised learning for optimization	Applying (K3)
CO5	make use of genetic algorithm and reinforcement learning for solving a given problem	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	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

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

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

22CDT62-GAME DESIGN							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**6**	**PC**	**3**	**0**	**0**	**3**
Preamble	This course helps the students to provide the basic knowledge and practical guide to develop mobile games without priorknowledge or skills that are required to understand its contents.						
Unit - I	**Games Design Basics**						**9**
The role of the game designer, Passions and skills, A play centric design process. Structure of games-go fish versus quake, puzzles, puzzles vs games, players, roles of players, Player interaction patterns, rules, resources.							
Unit - II	**Designing and editing games**						**9**
Working with dramatic elements challenge, play, working with system dynamics-games as systems, system dynamics, interacting with systems, designing a game-conceptualization –brainstorming, Alternative methods, editing and refining, Turning ideas into game, Ideas vs Designs.							
Unit - III	**Game prototyping**						**9**
Methods of prototyping, prototyping your original idea, Digital Prototyping-types of digital prototypes, selecting viewpoints, effective interface Design, playtesting-recruiting Playtesters, Basic usability techniques, data gathering, functionality, completeness and balance-what you are testing for –game internal solutions.							
Unit - IV	**Accessibility of Gaming**						**9**
Improving player choices, Fun killers, working as a game designer, developers Team, publisher's team, stages and methods of development-stages confined, using agile development, agile project planning and communicating designs.							
Unit - V	**Understanding Game Industry**						**9**
Understanding the new game Industry-Platforms for distribution, Genres of gameplay, Publishers, Business game publishing, Selling yourself and your ideas to the game industry-Getting a job at a publisher or Developer pitching your original ideas.							
							Total:45
TEXT BOOK:							
1.	Taylor & Francis," Game Design Workshop A Playcentric Approach to creating Innovative Game", Fourth edition, CRC press, london, newyork ,2014.						
REFERENCES:							
1.	Manning, J., & Buttfield-Addison, P.Mobile Game Development with Unity: Build Once, Deploy Anywhere. "O'Reilly Media, Inc.&quot,2017.						
2.	Ultimate Game design; Prototyping & Publishing.						

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	describe the most important platforms, structure and roles for develop game	Applying (K3)
CO2	build the design process of games and editing of games.	Applying (K3)
CO3	focus on the basic prototype of game and its controls along with the UI creation	Applying (K3)
CO4	learn Techniques used to prototype and achieve to develop a balanced game	Applying (K3)
CO5	discuss about the new game industry and selling your ideas into game industry.	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	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

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	10	50	40				100
CAT 3	15	45	40				100
ESE	10	50	40				100

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

22CDL61- MACHINE LEARNING LABORATORY							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Python Programming and frameworks**	**6**	**PC**	**0**	**0**	**2**	**1**

Preamble	This course focuses on providing hands on experience in designing and implementing machine learning algorithms for providing solutions to the real world problems.

LIST OF EXPERIMENTS / EXERCISES:

1.	Exploration of UCI, Kaggle repository datasets and tools like WEKA, Rapid Miner, Python scikit-learn, etc.,
2.	Perform data manipulation using NumPy and Pandas and, data visualization using matplotlib.
3.	Implement Naïve Bayes classification and predict the class label for a given data.
4.	Implement linear models to approximate the given data.
5.	Implement multi-layer perceptron algorithm for the specified data.
6.	Implement K-NN algorithm for the specified data.
7.	Implement SVM algorithm for the given data.
8.	Implement the concept of decision tree with suitable dataset.
9.	Implement K-means clustering algorithm for the given data and visualize and interpret the result.
10.	Implement genetic operators and Q-learning for the given data.
11.	Build a supervised model / unsupervised model using appropriate dataset in cloud framework.
12.	Mini-project: students work in team on any socially relevant problem that needs a machine learning based solution, and evaluate the model performance.

Total:30

REFERENCES/ SOFTWARE/ MANUAL:

1.	Operating System : Windows/Linux
2.	Software : Weka / Rapid Miner / Python / Cloud framework
3.	Laboratory Manual

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	apply probabilistic based learning and supervised learning algorithms for the given data.	Applying (K3), Precision (S3)
CO2	develop the concepts of information theoretic approach and unsupervised learning algorithms for the specified data.	Applying (K3), Precision (S3)
CO3	model the solutions for the given problem using genetic algorithm and reinforcement learning.	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	2	1									3	2
CO2	3	2	2	1									3	2
CO3	3	2	2	1									3	2

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

22CDL62- GAME DESIGN LABORATORY							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**6**	**PC**	**0**	**0**	**2**	**1**

Preamble	This course enables the students to create games and experiences in both 2D and 3D

LIST OF EXPERIMENTS / EXERCISES:

1.	Plan development based on GDD written using Mind Mapping Tools (Mind Manager)
2.	Basics of Unity Game Engine (Set up 3D Scene)
3.	Creating Game Objects and Components
4.	C# Code to Move, Scale and Rotate 3D object
5.	Learning to get Input from Canvas
6.	Learning to use Raycast
7.	Code Core Loop based on Game Design Document
8.	Create HUD and Scoring
9.	Setup and Manage Scenes & Analytics Scene
10.	Run Profiler and list the Top 4 Computation Hungry Scripts

Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Unity Software
2.	Adobe Illustrator
3.	Adobe After Effects
4.	Laboratory Manual

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	learn about the Unity 3D Game Engine and basic elements of Unity 3D	Applying (K3), Precision(S3)
CO2	develop the C# program and how to use that C# knowledge to program Unity games	Applying (K3), Precision(S3)
CO3	model a complete game from start-to-finish	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	2	1									3	2
CO2	3	2	2	1									3	2
CO3	3	2	2	1									3	2

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

22GEP61 - COMPREHENSIVE TEST AND VIVA							
(Common to All Engineering and Technology Branches)							
Programme & Branch	**B.E & Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**All core Subjects of CSD**	**6**	**EC**	**0**	**0**	**0**	**2**
							Total:60

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	Identify the foundation courses in the field of computer science and design	Applying(K3)
CO2	Examine each foundation course and relate it to other courses	Applying(K3)
CO3	Summarize the concepts, methods and tools in the field of computer science and design to excel in placements and competitive examinations	Applying(K3)
CO4	Organize the contents of the courses and discover a holistic approach to problem solving	Applying(K3)
CO5	Make use of all the core courses to qualify as a fully competent graduate in computer science and design field.	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									3	2
CO2	3	2	1	1									3	2
CO3	3	2	1	1									3	2
CO4	3	2	1	1									3	2
CO5	3	2	1	1									3	2

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

22MNT31 - ENVIRONMENTAL SCIENCE							
(Common to All BE/BTech branches)							
Programme & Branch	**All B.E/B.Tech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**3 / 6**	**MC**	**2**	**0**	**0**	**0**

Preamble	This course provides an approach to understand the various natural resources, ecosystem, bio-diversity, pollution control & monitoring methods for sustainable life and also to provide knowledge and to create awareness for engineering students on biological sciences.	
Unit – I	**Environmental Studies and Natural Resources**	**5**
Introduction to Environmental Science – uses, over-exploitation and conservation of forest, water, mineral, food, energy and land resources–case studies		
Unit – II	**Ecosystem and Biodiversity**	**5**
Ecosystems: concept and components of an ecosystem -structural and functional features – Functional attributes (Food chain and Food web only). Biodiversity: Introduction – Classification – Bio geographical classification of India- Values of biodiversity – Threats and Conservation of biodiversity - case studies.		
Unit – III	**Environmental Pollution**	**5**
Environmental Pollution: Definition – causes, effects and control measures of: (a) Air pollution - Climate change, global warming, acid rain, ozone layer depletion (b)Water pollution (c) Soil pollution - Role of an individual in prevention of pollution - case studies.		
Unit – IV	**Environmental Monitoring**	**5**
Sustainability -three pillars of sustainability- factors affecting environmental sustainability-approaches for sustainable development - Introduction to EIA - objectives of EIA - environment protection act – air (prevention and control of pollution) act – water (prevention and control of pollution) act.		
Unit – V	**Introduction to Biological Science**	**5**
Functions of Carbohydrates, lipids, proteins and nucleic acids - Cells and its organelles - plasma membrane, mitochondria and nucleus- Heredity and DNA - organization of DNA in cells - Genes and chromosomes- Cell division -Types of cell division- mitosis & meiosis - Cell cycle and molecules that control cell cycle.		
		Total:25

TEXT BOOK:

1. Anubha Kaushik, and Kaushik C.P., “Environmental Science and Engineering”, 6th Multicolour Edition, New Age International Pvt. Ltd., New Delhi, 2018, for Unit-I, II, III, IV.
2. Rastogi.SC, “Cells and Molecular Biology”, 2nd Edition, reprint, New Age International (P) Limited Publishers, New Delhi, 2008, for Unit-V.

REFERENCES:

1. Palanisamy P.N., Manikandan P., Geetha A., Manjula Rani K., Kowshalya V.N., “Environmental Science”, Pearson Education, New Delhi, Revised Edition 2019.
2. Mukhtar Ahmad, “Text book of modern biochemistry", Volume I & II, Oxford & IBH Publishing Co. Pvt. LTD, Delhi, 1995.

COURSE OUTCOMES: On completion 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)

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	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						

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

22CDP61 - PROJECT WORK I							
Programme & Branch	**BE - Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Programming Languages**	**6**	**EC**	**0**	**0**	**8**	**4**

Preamble	It provides practical exposure to the students and an opportunity to apply the computational mathematics concepts to solve the real world problems. It also gives opportunity to the students to work in a team.

Total:120

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	identify and formulate an computer science and design related solutions for an engineering problem	Applying (K3) Precision (S3)
CO2	analyze and review research literature related to the problem	Applying (K3) Precision (S3)
CO3	apply mathematical knowledge for design a solution for the problem	Applying (K3) Precision (S3)
CO4	implement computer science and design enabled solutions	Applying (K3) Precision (S3)
CO5	communicate, demonstrate and document the work as a member and leader in a team	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	1	1	1	2	2	3	3	3	3	3	3	2
CO2	3	2	1	1	1	2	2	3	3	3	3	3	3	2
CO3	3	2	1	1	1	2	2	3	3	3	3	3	3	2
CO4	3	2	1	1	1	2	2	3	3	3	3	3	3	2
CO5	3	2	1	1	1	2	2	3	3	3	3	3	3	2

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

22CDP62 - PROJECT WORK I							
Programme & Branch	**BE - Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Programming Languages**	**6**	**EC**	**0**	**0**	**8**	**4**

Preamble	It provides practical exposure to the students and an opportunity to apply the computational mathematics concepts to solve the real world problems. It also gives opportunity to the students to work in a team.
	Total:120

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	identify and formulate an computer science and design related solutions for an engineering problem	Applying (K3) Precision (S3)
CO2	analyze and review research literature related to the problem	Applying (K3) Precision (S3)
CO3	apply mathematical knowledge for design a solution for the problem	Applying (K3) Precision (S3)
CO4	implement computer science and design enabled solutions	Applying (K3) Precision (S3)
CO5	communicate, demonstrate and document the work as a member and leader in a team	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	1	1	1	2	2	3	3	3	3	3	3	2
CO2	3	2	1	1	1	2	2	3	3	3	3	3	3	2
CO3	3	2	1	1	1	2	2	3	3	3	3	3	3	2
CO4	3	2	1	1	1	2	2	3	3	3	3	3	3	2
CO5	3	2	1	1	1	2	2	3	3	3	3	3	3	2

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

22GCT71 - ENGINEERING ECONOMICS AND MANAGEMENT							
(Common to All BE/BTech branches)							
Programme & Branch	**All BE/BTech branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**HS**	**3**	**0**	**0**	**3**

Preamble	The aim of the course is to create fundamental knowledge on management by introducing concepts like economics, national income, marketing, operations management, accounting principles etc.	
Unit – I	**Micro Economics**	**9**
Economics – Basics Concepts and Principles – Demand and Supply – Law of demand and Supply – Determinants – Market Equilibrium – Circular Flow of Economic Activities and Income.		
Unit – II	**Macro Economics, Business Ownership and Management concepts**	**9**
National Income and its Measurement Techniques. Inflation - Causes of Inflation – Controlling Inflation – Business Cycle - Forms of Business – Ownership Types. Management concepts: Taylor and Fayol's Principles – Functions of Management - Managerial Skills - Levels of Management - Roles of Manager.		
Unit – III	**Marketing Management**	**9**
Marketing - Core Concepts of Marketing - Four P's of Marketing - New Product Development – Intellectual Property Rights (IPR), Product Life Cycle - Pricing Strategies and Decisions.		
Unit – IV	**Operations Management**	**9**
Operations Management - Resources - Types of Production System - Site Selection, Plant Layout, Steps in Production Planning and Control - Inventory - EOQ Determination.		
Unit – V	**Financial Management**	**9**
Accounting Principles – Financial Statements and its Uses – Depreciation - Straight Line and Diminishing Balance Method – Break Even Analysis – Capital Budgeting - Significance –Traditional and Discounted Cash Flow Methods.		
		Total:45

TEXT BOOK:

1. Compiled by Department of Management Studies, Kongu Engineering College, "Economics and Management for Engineers", 1st Edition, McGraw Hill Education, Noida, 2013.

REFERENCES:

1. Geetika, Piyali Ghosh and Purba Roy Choudhury, "Managerial Economics", 3rd Edition, McGraw-Hill, New Delhi, 2018.
2. William J. Stevenson, "Operations Management", 14th Edition, McGraw-Hill Education, 2021.
3. William G. Nickels, James M. McHugh, Susan M. McHugh, "Understanding Business", 12th Edition, McGraw-Hill Education, New York, 2019.

COURSE OUTCOMES: On completion 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)

Mapping of COs with POs and PSOs

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**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)

22CDP71 - PROJECT WORK II PHASE I							
Programme & Branch	**BE - Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**EC**	**0**	**0**	**10**	**5**

Preamble	It provides practical exposure to the students and an opportunity to apply the computational mathematics concepts to solve the real world problems. It also gives opportunity to the students to work in a team.

Total:150

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	identify and formulate an computer science and design related solutions for an engineering problem	Applying (K3) Precision (S3)
CO2	analyze and review research literature related to the problem	Applying (K3) Precision (S3)
CO3	apply mathematical knowledge for design a solution for the problem	Applying (K3) Precision (S3)
CO4	implement computer science and design enabled solutions	Applying (K3) Precision (S3)
CO5	communicate, demonstrate and document the work as a member and leader in a team	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	1	1	1	2	2	3	3	3	3	3	3	2
CO2	3	2	1	1	1	2	2	3	3	3	3	3	3	2
CO3	3	2	1	1	1	2	2	3	3	3	3	3	3	2
CO4	3	2	1	1	1	2	2	3	3	3	3	3	3	2
CO5	3	2	1	1	1	2	2	3	3	3	3	3	3	2

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

22CDP72 - PROJECT WORK II PHASE I							
Programme & Branch	**BE - Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**EC**	**0**	**0**	**12**	**6**

Preamble	It provides practical exposure to the students and an opportunity to apply the computational mathematics concepts to solve the real world problems. It also gives opportunity to the students to work in a team.

Total:180

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	identify and formulate an computer science and design related solutions for an engineering problem	Applying (K3) Precision (S3)
CO2	analyze and review research literature related to the problem	Applying (K3) Precision (S3)
CO3	apply mathematical knowledge for design a solution for the problem	Applying (K3) Precision (S3)
CO4	implement computer science and design enabled solutions	Applying (K3) Precision (S3)
CO5	communicate, demonstrate and document the work as a member and leader in a team	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	1	1	1	2	2	3	3	3	3	3	3	2
CO2	3	2	1	1	1	2	2	3	3	3	3	3	3	2
CO3	3	2	1	1	1	2	2	3	3	3	3	3	3	2
CO4	3	2	1	1	1	2	2	3	3	3	3	3	3	2
CO5	3	2	1	1	1	2	2	3	3	3	3	3	3	2

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

22CDT71- CYBERNETICS							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	Nil	**7**	**PC**	**3**	**0**	**0**	**3**
Preamble	This subject will provide the essential understanding of security and its needs, the skills and tools that everyone who wants to work as security personal, and explore advanced security methodologies.						
Unit – I	**Introduction to Cyber Security:**						**9**
Importance of Cyber Security: Scenarios for Security – Understanding the attack surface – Security Evaluation: Legacy Cybersecurity Systems – Transformations in Cybersecurity – Advancements in Security Technology to Security 2.0 – How ML and AI will play a larger role in Cybersecurity.							
Unit – II	**Cybersecurity Technologies:**						**9**
Learning Cybersecurity Technologies: Mobile Security – Advanced Data Security – Cloud Security – Modern Day Regulations – Incidence Response and Forensics – Enterprise Security at Scale – Penetration Testing – DevSecOps – IoT Security – UBA – EDR.							
Unit – III	**Cybersecurity Skills:**						**9**
Cybersecurity Skills: General Cybersecurity Roles – Skills to Acquire in Cybersecurity – Other Skills: Ethical Hacking – Application Security – Cloud Security – DevSecOps – Threat and Vulnerability assessment – Information security and Management – Cyber Security Litigation Support – Regulatory Compliance and Auditing.							
Unit – IV	**Attacker Mindset and Cyber Defense:**						**9**
Attackers: Categories of Hackers – Traits of Hackers – Social Characteristics of Hackers – How Hackers Think – Psychology of Hackers – **Cyber Defense**: Proactive Cyber Defense – Reactive Cyber Defense – Overview of Operational Security – The Significance of Three Security Pillars – Security Operations and Continuous Monitoring – Digital Forensics and Real-time Incident Response with SIEM.							
Unit – V	**Networking, Mentoring and Shadowing:**						**9**
Mentoring – Networking – Shadowing – Cybersecurity Labs: ILT – VILT – Self-study cybersecurity labs – Security Intelligence Resources: Checklist Resources – Cybersecurity Advice and Reliable Information Sources – Cybersecurity Courses – Cybersecurity Threat-intelligence Resources.							
							Total: 45
TEXT BOOK:							
1.	Erdal Ozkaya, " Cybersecurity: The Beginner's Guide A Comprehensive Guide to Getting Started in Cybersecurity", Packt Publishing, 1st Edition, 2019.						
REFERENCES:							
1.	Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publishers, 2011.						
2.	William Stallings, Lawrie Brown, "Computer Security Principles and Practice", Third Edition, Pearson Education, 2015.						

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the cyber security fundamentals to secure systems.	Applying (K3)
CO2	make use of the various cybersecurity technologies	Applying (K3)
CO3	explain the various skills and tools required to work as security personal.	Applying (K3)
CO4	construct a cyber-defense system using the mindset, psychology and characteristics of hacker.	Applying (K3)
CO5	utilize the security intelligence resources to secure the information.	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	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

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

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

22CDP81 - PROJECT WORK II PHASE II							
Programme & Branch	**BE - Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**8**	**EC**	**0**	**0**	**8**	**4**

Preamble	It provides practical exposure to the students and an opportunity to apply the computational mathematics concepts to solve the real world problems. It also gives opportunity to the students to work in a team.

Total:120

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	identify and formulate an computer science and design related solutions for an engineering problem	Applying (K3) Precision (S3)
CO2	analyze and review research literature related to the problem	Applying (K3) Precision (S3)
CO3	apply mathematical knowledge for design a solution for the problem	Applying (K3) Precision (S3)
CO4	implement computer science and design enabled solutions	Applying (K3) Precision (S3)
CO5	communicate, demonstrate and document the work as a member and leader in a team	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	1	1	1	2	2	3	3	3	3	3	3	2
CO2	3	2	1	1	1	2	2	3	3	3	3	3	3	2
CO3	3	2	1	1	1	2	2	3	3	3	3	3	3	2
CO4	3	2	1	1	1	2	2	3	3	3	3	3	3	2
CO5	3	2	1	1	1	2	2	3	3	3	3	3	3	2

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

22CDE01-DATA SCIENCE							
Programme & Branch	**BE - Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5**	**PE**	**3**	**0**	**0**	**3**
Preamble	This course introduces data science and essentials of applied statistics, applied probability and computer science required in the context of data science and its applications.						
Unit – I	**Introduction**						**9**
Introduction – Data Science – Data Science Relate to Other Fields - The Relationship between Data Science and Information Science – Computational Thinking – Issues of Ethics, Bias, and Privacy in Data Science – Data Types – Data Collections – Data Pre-processing. Techniques: Data Analysis and Data Analytics – Descriptive Analysis – Diagnostic Analytics – Predictive Analytics Prescriptive Analytics – Exploratory Analysis – Mechanistic Analysis.							
Unit – II	**Applications, Evaluations, and Methods**						**9**
Solving Data Problems: Collecting and Analyzing social media data. Data Collection Methods – Picking Data Collection and Analysis Method: Quantitative Methods – Qualitative Methods – Evaluation: Comparing Models – Cross-Validation.							
Unit – III	**Probability**						**9**
Probability Concepts – Axioms of Probability – Conditional Probability and Independence – Bayes Theorem –Random Variables – Mean and Variance of a Discrete and Continuous Random Variable – Common Distributions: Binomial - Poisson – Uniform – Normal - Exponential - Gamma -Chi-Square - Weibull – Beta.							
Unit – IV	**Statistics**						**9**
Role to Statistics - Estimation of Parameter and Sampling Distribution: Point Estimation – Sampling Distributions and the Central Limit Theorem. Statistical Intervals for a Single Sample: Confidence Interval on Mean – variance and Standard Deviation – Population Proportion – Guidelines – Bootstrap – Tolerance and Prediction Intervals.							
Unit – V	**Evaluation**						**9**
Hypothesis Testing –Tests on the Mean, Variance and Standard – Tests on a Population Proportion – Summary –Testing for Goodness of Fit – Contingency Table Tests – Nonparametric Procedures – Equivalence Testing – Combining P -Values. A/B testing concepts – T-test and p-value – Measuring t-statistics and p-values.							
							Total:45

TEXT BOOK:

1. Chirag Shah, “A Hands-On Introduction to Data Science”, 1st Edition, Kindle Edition, 2020 for Units I & II.
2. Douglas C. Montgomery, George C. Ranger, Applied Statistics and Probability for Engineers, Sixth Edition, Wiley, 2013. for units III, IV,&V.

REFERENCES:

1. Joel Grus, "Data Science from the Scratch", NA Edition, O’Reilly, NA, 2015.
2. Frank Kane, “Hands-On Data Science and Python Machine Learning”, First edition, Packt Publication, 2017

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply pre-processing techniques to clean, and prepare data and visualize	Applying (K3)
CO2	utilize the data analysis techniques for applications handling large data	Applying (K3)
CO3	determine the probability density function of random variables	Applying (K3)
CO4	make use of the statistical foundations and analyze the degree of certainty of predictions using statistical test and models	Applying (K3)
CO5	apply the concept of testing of hypothesis of various parameters, goodness of fit tests and nonparametric tests to 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	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

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	15	45	40				100
ESE	10	40	50				100

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

22CDE02-ARTIFICIAL INTELLIGENCE							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**5**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course focuses on search methods, game playing, planning, constraint satisfaction and knowledge representation in artificial intelligence.	
Unit- I	**Intelligent Agents and Blind search**	**9**
Definition – History – Agents and Environments – Good behavior and the concepts of rationality – Nature of environments – Structure of intelligent agents. State space search: Generate and Test – Simple search – Depth First Search (DFS) – Breadth First Search (BFS) - Comparison of DFS and BFS – Depth Bounded DFS.		
Unit- II	**Informed Search Methods**	**9**
Informed Search Methods: Heuristic Search: Heuristic functions – Best First Search – Hill Climbing – Local maxima –Solution state space – Variable neighbor-hood descent – Beam search – Taboo search. Peak to Peak Methods. Brute force – Branch and Bound –Refinement search		
Unit- III	**A* and Randomized Search Methods**	**9**
Algorithm A* - Admissibility of A *– Recursive Best First Search. Escaping local maxima: Iterated hill climbing – Simulated annealing – Genetic algorithms (GA) – Travelling Salesman Problem (TSP) – GA based methods for TSP		
Unit- IV	**Game playing, Planning and Constraint Satisfaction**	**9**
Board games – Game playing algorithms: Algorithm Minimax – Algorithm Alpha Beta – B* Search –Limitations of search. The STRIPS domain – Forward state space planning – Backward state space planning – Goal stack planning – Plan space planning – Introduction to Constraint satisfaction Problem - N-Queens		
Unit- V	**Prepositional Logic, First Order Logic and Inferencing**	**9**
Formal logic **–** Propositional logic **–** Resolution in propositional logic – First Order Logic (FOL) – Incompleteness of forward chaining – Resolution refutation in FOL – Horn clauses and SLD resolution – Backward chaining.		
		Total:45

TEXT BOOK:

1.	KhemaniD.,"A First Coursein ArtificialIntelligence",1st Edition,9th reprint, McGraw Hill Education(India) Private Limited, 2019. Units for 2nd half of 1st Unit, II,III,IV &V
2.	Stuart Russell and Peter Norvig,"Artificial Intelligence: A Modern Approach", 3rd Edition, Pearson Education, 2013 for first half of 1st Unit.

REFERENCES:

1.	Wolfgang Ertel, "Introduction to Artificial Intelligence", 2nd Edition, Springer, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	paraphrase Artificial Intelligence, intelligent agents, and apply blind search to solve problems.	Applying(K3)
CO2	make use of the effectiveness of heuristics in informed search methods.	Applying(K3)
CO3	choose optimal solutions using A* and randomized search methods.	Applying(K3)
CO4	apply game playing and planning in problem solving.	Applying(K3)
CO5	make use of propositional logic and first order logic in knowledge-based reasoning.	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	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

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	20	30	50				100

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

22CDE03 - INTRODUCTION TO 3D DESIGN							
Programme & Branch	**BE - Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course provides an introduction to designing for students working in 3D across related disciplines such as graphic objects and fundamentals of 3D object representations, transformations and viewing. This course will benefit the students to apply these algorithms and techniques in upcoming real world scenarios.

Unit – I	**Introduction to 3D Design**	**9**
Introduction – Form Organization – Design definition – Looking: Attentive observation, comparison, connections – Touch: Tactile sensation – Context: Shaping force, site specific – Learning – Ideas and Approaches: Process – Tools – Transformation – variation and deformation – Conceptual strategies – Problem solving – Sketching, Model making and prototyping.		
Unit – II	**Elements of 3D Design & Principles**	**9**
Form – Cube – Mass and Space – Line – Plane: 2D Element – Convention of 2D to 3D – Surface Qualities: Texture, Color – Chromatic Luminosity – Time and Motion. 3D Design Principles: Unity and Variety – Repetition: Visual and structural, Modularity – Pattern - Rhythm – Illusion of Motion – Balance - Symmetry and Asymmetry – Harmony – Proximity – Emphasis – Proportion – Scale.		
Unit – III	**Structure, Functions, Forming and Fabrication of 3D Design**	**9**
Structure: Structural Principles – Structural Economy – Tension and Compression – Joinery – Transformers- Functions: Utility – Design and compared art – Form and Functions – Style: Signature and Typology. Basic forming: Additive, Subtractive, constructive – The Found Object: Readymade – Bridging Art and Life – Hybrid Form – Industrial Methods: The Machine Aesthetic – Replication Technologies.		
Unit – IV	**Three Dimensional Concepts and Object Representations**	**9**
Three Dimensional Concepts - Three Dimensional Object Representations – Polygon Surfaces - Curved lines and surfaces, Quadric surfaces, Blobby objects, Spline Representations and Interpolation methods, Bezier and B-Spline curves and surfaces, Beta and Rational Splines, Conversion and Display. Sweep Representations - Constructive solid Geometry methods - Fractal Geometry methods.		
Unit – V	**Three Dimensional Transformations and Viewing**	**9**
Three Dimensional Geometric Transformations – Translation, Rotation, Scaling, Reflection, Shear, Composite Transformations, Transformation functions, Coordinate Transformations. Three Dimensional Viewing – pipeline, coordinates, projections, volumes and projection transformations, Clipping, Viewing Functions.		
		Total:45

TEXT BOOK:

1.	Stephen Pentak, Richard Roth, “Design Basics 3D”, Cengage Learning, 8th Edition, 2013 for Unit I,II &III
2.	Hearn Donald and Baker M. Pauline, —Computer Graphics C Versionǁ, 2nd Edition,Pearson Education,2010 for Unit IV & V.

REFERENCES:

1.	Samit Bhattacharya, "Computer Graphics”, Oxford University Press, ISBN13:978-0-19-809619-1, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	describe the fundamentals of 3D design.	Applying (K3)
CO2	utilize the elements and principles of 3D design	Applying (K3)
CO3	make use of the structures, functions, forming and fabrications of 3D design	Applying (K3)
CO4	apply various 3D object representations and methods	Applying (K3)
CO5	manipulate 3D objects by applying transformation, clipping, and viewing operations.	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	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

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

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

22CDE04-ANIMATION BASICS							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**5**	**PE**	**3**	**0**	**0**	**3**
Preamble	This course helps the students to learn the basics of computer animation programming and computer animators who want to better understand the underlying computational issues of animation software. It also surveys algorithms and programming techniques for specifying and generating motion for graphical objects.						
Unit - I	**Introduction and Background**						**9**
Introduction: Perception - Heritage of Animation - Animation Production - History of Computer Animation. Background: Spaces and Transformations - Orientation Representation - Fixed Angle Representation, Euler Angle Representation, Angle and Axis, Quaternions, Exponential Map.							
Unit – II	**Interpolation-Based Animation**						**9**
Interpolation: Appropriate Function - Controlling the Motion Along a Curve- Interpolation of orientations- Working with paths- Interpolation-Based Animation: Key-frame systems - Animation languages - Deforming objects - Three-dimensional shape interpolation -Morphing							
Unit - III	**Motion Capture Techniques**						**9**
Kinematic Linkages: Hierarchical modeling-Forward kinematics-Inverse kinematics. Motion Capture: Motion capture technologies - Processing the images - Camera calibration - Three-dimensional position reconstruction -Fitting to the skeleton - Output from motion capture systems - Manipulating motion capture data.							
Unit - IV	**Physically Based Animation**						**9**
Physically Based Animation: Basic physics -Spring animation examples - Particle systems -Rigid body –simulation – Cloth - Enforcing soft and hard constraints - Fluids: Liquids and Gases - Specific fluid models - Computational fluid dynamics.							
Unit - V	**Modeling and Animating Human Figures**						**9**
Modeling and Animating Human Figures: Overview of virtual human representation - Reaching and grasping – Walking-Coverings. Facial Animation: The human face - Facial models - Animating the face - Lip-sync animation. Behavioral Animation: Primitive and Modeling intelligent behaviors - Knowledge of the environment - Crowds.							
							Total:45
TEXT BOOK:							
1.	Rick Parent., “Computer Animation Algorithms and Techniques”, 3rd edition, Morgan Kaufmann, 2012.						
REFERENCES:							
1.	Theoharis, T., Papaioannou, G., Platis, N., & Patrikalakis, N. M., “Graphics and visualization: principles & algorithms”. CRC Press, 2008						
2.	Parent, R., Ebert, D. S., Gould, D., Gross, M., Kazmier, C., Lumsden, C. J. & Worley S, “Computer animation complete: all-in-one: learn motion capture, characteristic, point-based, and Maya winning techniques”. Morgan Kaufmann Publishers,2009.						

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	select the technical background of computer graphics relevant to computer animation	Applying (K3)
CO2	develop various computer animation algorithms and techniques	Applying (K3)
CO3	apply how the images are processed to reconstruct articulated figure kinematics	Applying (K3)
CO4	plan physics-based animation and modeling of fluids	Applying (K3)
CO5	model Human figure animation, facial animation and behavioral animation	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	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

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	10	45	45				100
CAT3	15	40	45				100
ESE	10	40	50				100

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

22CDE05-DATA VISUALIZATION TECHNIQUES							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5**	**PE**	**3**	**0**	**0**	**3**
Preamble	This course provides complex information in a way that is easier to interpret by turning information into visually engaging images and stories.						
Unit - I	**Introduction**						**9**
Visualization – visualization process – role of cognition – Pseudocode conventions – Scatter plot - Data foundation: Types of data - Structure within and between records - Data preprocessing – Human perceptions and information processing – Visualization foundations.							
Unit - II	**Spatial and Geospatial, Time oriented data and Multivariate data**						**9**
One, two, three dimensional data – Dynamic data – Combining techniques - Visualization of spatial data - Visualization of point data - Visualization of line data - Visualization of area data - Issues in Geospatial data Visualization –Characterizing and visualizing Time oriented data- Point, Line ad region based techniques for multivariate data							
Unit - III	**Tree, Graph, Networks, Text and Document**						**9**
Displaying hierarchical structure – Displaying Arbitrary Graphs/Networks – Other issues. Visualization techniques for Tree- Graph and Networks - Levels of text representation – Vector space model – Single Document Visualization – Document collection visualization Extended text visualization.							
Unit - IV	**Designing Effective Visualization**						**9**
Steps in Designing Visualization – problems in Designing Effective Visualization – Comparing and evaluating visualization techniques – Visualization Systems.							
Unit - V	**Information Dashboard Design**						**9**
Characteristics of dashboards – Key goals in visual design process – Dashboard display media – Designing dashboards for usability – Strategies for designing dashboards- Meaningful organization – Maintaining consistency – Aesthetics of dashboards – Testing for usability – Case Studies: Sales dashboard, Marketing analysis dashboard.							
							Total: 45

TEXT BOOK:

1.	Matthew O. Ward. , Georges Grinstein and Daniel Keim., “Interactive Data Visualization: Foundations, Techniques, and Applications”, 2nd Edition, CRC Press, 2015 for units I ,II,III & IV
2	Stephen Few, "Information Dashboard Design: The Effective Visual Communication of Data", O'Reilly, 2nd Edition, 2013 for unit V.

REFERENCES:

1.	Catherine Marsh, Jane Elliott, Exploring Data: An Introduction to Data Analysis for Social Scientists, Wiley Publications, 2nd Edition, 2008.
2.	Ben Fry, “Visualizing Data: Exploring and Explaining Data with the processing Environment”, O Reily Publications, First Edition, 2007

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify principles of visual perception and carryout preprocessing in real time data	Applying (K3)
CO2	choose visualization techniques for various data analysis tasks	Applying (K3)
CO3	apply visualization techniques for the applications using unstructured data	Applying (K3)
CO4	make use of different visualization techniques for the given problems	Applying (K3)
CO5	develop information dashboard for Sales and marketing analysis	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	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

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

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

22CDE06-DESIGNING HUMAN CENTERED SYSTEMS							
Programme & Branch	**BE - Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5**	**PE**	**3**	**0**	**0**	**3**

Preamble	The objective of this course is to understand the principles of effective design and the Human Centered Design (HCD) process for product development. this course will focus on is: how can we design human-centered systems that people find useful and usable? This course is an introduction to designing, prototyping, and evaluating user interfaces.

Unit – I	**Psychopathology and Psychology of Everyday Things and Actions**	**9**

The Complexity of Modern Devices - Human-Centered Design - Fundamental Principles of Interaction - The System Image – The Paradox of Technology – The Design Challenge – How People Do Things: The Gulfs of Execution and Evaluation - The Seven Stages of Action - Human Thought: Mostly Subconscious - Human Cognition and Emotion - The Seven Stages of Action and the Three Levels of Processing - People as Storytellers - Blaming the Wrong Things - Falsely Blaming Yourself - The Seven Stages of Action: Seven Fundamental Design Principles.

Unit – II	**Knowledge in the Head and in the World**	**9**

Precise Behavior from Imprecise Knowledge - Memory Is Knowledge in the Head - The Structure of Memory - Approximate Models: Memory in the Real World - Knowledge in the Head - The Tradeoff Between Knowledge in the World and in the Head - Memory in Multiple Heads, Multiple Devices - Natural Mapping - Culture and Design: Natural Mappings Can Vary with Culture.

Unit – III	**Constraints, Discoverability, and Feedback**	**9**

Four Kinds of Constraints: Physical, Cultural, Semantic, and Logical – Applying Affordances, Signifiers, and Constraints to Everyday Objects - Constraints That Force the Desired Behavior - Conventions, Constraints, and Affordances - The Faucet: A Case History of Design – Using Sound as Signifiers.

Unit – IV	**Classification of Errors, Slips and Mistakes**	**9**

Understanding Why There Is Error – Deliberate Violations - Two Types of Errors: Slips and Mistakes – The Classification of Slips – The Classification of Mistakes – Social and Institutional Pressures - Reporting Error – Detecting Error – Designing for Error – When Good Design Isn't Enough - Resilience Engineering – The Paradox of Automation – Design Principles for Dealing with Error.

Unit – V	**Views of Human Centered Design**	**9**

Solving the Correct Problem - The Double-Diamond Model of Design - The Human-Centered Design Process – What I Just Told You? It Doesn't Really Work That Way – The Design Challenge - Complexity Is Good; It Is Confusion That Is Bad – Standardization and Technology - Deliberately Making Things Difficult - Design: Developing Technology for People - Competitive Forces – New Technologies Force Change - How Long Does It Take to Introduce a New Product? - Two Forms of Innovation: Incremental and Radical - The Design of Everyday Things - The Future of Books - The Moral Obligations of Design.

Total:45

TEXT BOOK:

1.	Don Norman, "The Design of Everyday Things: Revised and Expanded Edition", 2nd Edition, Basic Books Publication, ISBN: 978- 0465050659, 2013.

REFERENCES:

1.	Bill Buxton, "Sketching User Experiences: Getting the Design Right and the Right Design", Illustrated Edition, Morgan Kaufmann Publication, ISBN: 978-0123740373, 2007.
2.	Jon Yablonski, "Laws of UX: Using Psychology to Design Better Products & Services", 1st Edition, Shroff/O'Reilly Publication, ISBN: 978-9352139989, 2020.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify the psychological matters of everyday things and actions in addition to that emotional design.	Applying (K3)
CO2	build the design knowledge in developing products and also understand the natural mappings and culture views.	Applying (K3)
CO3	identify how change can be extremely disconcerting, even to professionals, even if the change is for the better.	Applying (K3)
CO4	make use of the approaches deal with design to eliminate or minimize the human errors.	Applying (K3)
CO5	Plan the general design guidelines based on the views on human centered design.	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	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

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	25	55				100
CAT2	20	30	50				100
CAT3	20	30	50				100
ESE	20	30	50				100

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

22CDF01-DEEP LEARNING							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**6**	**PE**	**2**	**0**	**2**	**3**

Preamble	This course provides an overview of machine learning, neural networks, and Deep learning techniques for solving real world problems.

Unit- I	**Introduction**	**6**

Learning Algorithms – Capacity, Over fitting and Under fitting – Hyper parameters and Validation Sets – Estimators, Bias and Variance – Maximum Likelihood Estimation – Bayesian Statistics – Linear Regression – Supervised Learning Algorithms – Unsupervised Learning Algorithms – Building a Machine Learning Algorithm – Challenges Motivating Deep Learning

Unit- II	**Deep Feed forward Networks**	**6**

Example: Learning XOR – Gradient–Based Learning – Stochastic Gradient Descent – Hidden Units – Architecture Design – Back-Propagation and Other Differentiation Algorithms

Unit- III	**Regularization for Deep Learning**	**6**

Parameter Norm Penalties – Dataset Augmentation – Noise Robustness – Semi-Supervised Learning – Multi-Task Learning – Early Stopping – Parameter Tying and Parameter Sharing – Bagging and Other Ensemble Methods – Drop out – Adversarial Training.

Unit- IV	**Convolutional Networks**	**6**

Convolution Operation – Motivation – Pooling – Variants of the Basic Convolution Function – Structured Outputs Efficient Convolution Algorithms —Transfer Learning - Applications: Computer Vision.

Unit- V	**Sequence Modeling: Recurrent and Recursive Nets**	**6**

Recurrent Neural Networks – Bidirectional RNNs – Encoder – Decoder Sequence-to-Sequence Architectures – Deep Recurrent Networks – Recursive Neural Networks – The Long Short-Term Memory and other Gated RNN – Transformers. Applications: Natural Language Processing.

List of Exercises/Experiments:

1.	Program to test the performance of multi-layer neural network with various activation and loss functions
2.	Tuning the neural network performance with hyper parameters
3.	Train a Deep learning model to classify a given image using pre trained model
4.	Implement Object detection using Convolution Neural Network
5.	Implement binary image classification using CNN.
6.	Develop Recommendation system from sales data using Deep Learning
7.	Develop Deep learning model by tuning hyper parameters
8.	Implement multi class classification problem using RNN.
9.	Perform Sentiment Analysis in network graph using RNN
10.	Implement Image generation using GAN

Lecture:30, Practical: 30, Total: 60

TEXT BOOK:

1.	Ian Good fellow, Yoshua Bengio, and Aaron Courvill, “Deep Learning”, 1stEdition, MIT Press, 2016.

REFERENCES/SOFTWARE/MANUAL:

1.	Josh Patterson and Adam Gibson, “Deep Learning–APractitioner’sApproach”,1stEdition,O’Reilly Series,2017
2.	Basant Agarwal, Namita Mittal, Richi Nayak, Srikanta Patnaik, "Deep Learning-Based Approaches for Sentiment Analysis", Springer Nature Singapore, 2020.
3.	Jupiter Notebook,Tensor flow,Keras,Pytorch
4.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the concepts of machine learning algorithms to solve simple problems	Applying(K3) Precision (S3)
CO2	solve simple problems using the concepts of deep neural networks	Applying(K3) Precision (S3)
CO3	make use of different regularization methods for Deep learning	Applying(K3) Precision (S3)
CO4	exemplify the concepts of CNN models and apply it for solving computer vision related problems	Applying(K3) Precision (S3)
CO5	develop the concepts of RNN models and apply it for solving Natural Language problems	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	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

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	15	50	35				100
ESE	20	40	40				100

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

22CDF02 - BIG DATA ANALYTICS							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**6**	**PE**	**2**	**0**	**2**	**3**

Preamble	This course provides knowledge about Big data and its framework, storage and stream processing with SPARK and KAFKA.

Unit - I	**Big data**	**6**

Introduction – Types of Digital Data – characteristics – evolution – definition – challenges – Big Data – Big Data Analytics – importance – data science – terminologies used in Big Data environments – Analytics Tools.

Unit - II	**Hadoop**	**6**

Hadoop Introduction – RDBMS VsHadoop – Distributed computing challenges – Hadoop Overview – HDFS – Processing data with Hadoop – Interacting with Hadoop Ecosystem. Introduction to MapReduce Programming- Mapper– Reducer– Combiner – Partitioner–Searching - Sorting – Compression – Hadoop File System.

Unit - III	**MongoDB and Cassandra**	**6**

Introduction to MongoDB – Terms used in MongoDB– Data types in MongoDB – MongoDB Query Language. Introduction to Cassandra — Features of Cassandra — CQL Data types — CQLSH– CRUD operations — Collections — Alter commands — Import and Export —Querying System tables.

Unit - IV	**HIVE and PIG**	**6**

Introduction to Hive – Architecture – Data types – File format – Hive Query Language – RCFile implementation. Introduction to Pig – Pig on Hadoop – Data types – Running Pig – Execution modes of Pig – HDFS commands – Relational Operators – Eval function –Complex Data types.

Unit - V	**Apache SPARK and KAFKA**	**6**

Introduction – SPARK architecture – SPARK SQL – SPARK Streaming – SPARK Eco system – SPARK for Big Data Processing –SPARK applications — Apache KAFKA — KAFKA Architecture — Use cases.

List of Exercises / Experiments :

1.	Install, configure and run Hadoop and HDFS.
2.	Demonstrate File Management tasks in Hadoop.
3.	Implement word count programs using MapReduce.
4.	DevelopMapReduce code to find the maximum temperature of a city.
5.	Implement Matrix Multiplication using MapReduce.
6.	Develop a code that stores big data in MongoDB.
7.	Develop a code that stores big data in Cassandra.

Lecture:30, Practical:30, Total:60

TEXT BOOK:

1.	SeemaAcharya and SubhashiniChellappan, “Big Data and Analytics”, 2nd Edition, Wiley, 2019.

REFERENCES/SOFTWARE/MANUAL:

1.	Dr.AnilMaheshwari, “Big Data”, 2nd Edition, McGraw Hill Education, 2019
2.	EMC Education Services,”Data science and Big data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, JohnWiley and Sons, 2015.
3.	https://spark.apache.org/docs/latest/
4.	Mongo DB, Apache Hadoop,Spark,KAFKA
5.	Laboratory manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	choose the characteristics of big data and use it for identifying the types of digital data	Applying (K3) Precision (S3)
CO2	build MapReduce programs in Hadoop framework	Applying (K3) Precision (S3)
CO3	utilize MongoDB and Cassandra to develop database applications	Applying (K3) Precision (S3)
CO4	develop solutions for big data problems using Hive and Pig	Applying (K3) Precision (S3)
CO5	organize the need for stream processing and use of Spark and Kafka	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	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

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

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

22CDE07-INFORMATION DESIGN							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**6**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course provides an insights about information design and how to organize an information, about colour coding.	
Unit - I	**Inception of Information Design**	9
Introduction – Definition – History of Information Design – Need of Information Design – Types – Identifying audience – Defining the audience and their needs – Inclusivity – Visual impairment – Case study.		
Unit - II	**Organizing Information**	9
Hierarchy of information – Dynamic composition and gesture – Sequence of information – Organizing information – Using a grid – Setting up the grid – Structure of grid – Hierarchy of grid.		
Unit - III	**Legibility and Readability**	9
Readability: Colour – Tint and Tone – Legibility, readability and contrast – Weight, Size and Scale – Typographic elements – Graphic elements – Imagery – Visibility and contrast – Colour-coding – Choice of typeface, weight and scale – Case study : Illustration and Graphics in information design.		
Unit - IV	**Experimentation and Inspiration for the design process**	9
Importance of experimentation and inspiration – Lateral thinking – Inspiration for design – Editing data for inspiration – Inspiration from world – Visual mapping – case study.		
Unit - V	**Design through media**	9
Choosing appropriate media – compare print and digital – Designing digital platforms – computer data visualization – Inspiration design in practice: Design outcomes – Routes for print-based, interactive and environmental information design – case study.		
		Total:45

TEXT BOOK:

1. Andy Ellison, Kathryn Coates, "An Introduction to Information Design", 1st Edition, Orion Publishing Co, 2014

REFERENCES:

1. Rune Pettersson, “Information Design An Introduction”, John Benjamins Publishing Company, 2002
2. Courtney Marchese, “Information Design for the Common Good Human-centric Approaches to Contemporary Design Challenges”, Bloomsbury Publishing, 2021

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify the audience and their requirements about information design	Applying (K3)
CO2	organize an information in sequence using grid	Applying (K3)
CO3	make use of color and graphic elements in design	Applying (K3)
CO4	experiment with lateral thinking and inspiration of design	Applying (K3)
CO5	construct the concepts of digital design through media	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	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

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	25	60				100
CAT2	15	20	65				100
CAT3	15	20	65				100
ESE	10	20	70				100

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

22CDE08- MOBILE APPLICATION DESIGN SYSTEM							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**6**	**PE**	**3**	**0**	**0**	**3**
Preamble	This course helps the students to provide the basic knowledge and practical guide to design better mobile application with the help of elements of design system.						
Unit - I	**Mobile App**						**9**
Introduction – App vs Mobile Website – App Design and Development process – Types of Application – App categories– Resources– Design Constraints – user research							
Unit - II	**Interaction and Patterns**						**9**
Principles of User Experience – Interaction and ways of handling mobile device – Incidence in device orientation- Patterns of interaction: Navigation – Tabs- Lists-Image Gallery- Drawer Menu.							
Unit - III	**Actions and Gestures**						**9**
Actions: Action bar – Action overflow – Shortcuts – Sharing – Search – List editing – Dialogue box – In-App notifications – Data Input – Gestures: Tap – Drag – Slide – Long press – Double tap – Pinch and Spread – Rotate.							
Unit - IV	**Visual Design**						**9**
Interface styles – Native and Custom interfaces – Visual identity – icons – Grid – Typography – Color – Text – Interactive elementsLanguage – Visual details – Animating the App							
Unit - V	**Testing and Launching the App**						**9**
Testing: Usability test – Mobile Testing – Technology differences – Preparing design files – Image Slicing – Communication – Launching the App: Publishing the App – Promotional image and elements – After Launch: User comments – User Analytics – Promotion.							
							Total:45
TEXT BOOK:							
1.	Javier Cuello & Jose Vittone, “Designing Mobile Apps”, 1st Edition, CreateSpace Independent Publishing Platform, 2013.						
REFERENCES:							
1.	Cameron Banga and Josh Weinhold,”Essential Mobile Interaction Design”,1st Edition,Addison-Wesley,2014.						

COURSE OUTCOMES: On completion of the course, the students will be able to		BTMapped (Highest Level)
CO1	describe the most important mobile applications	Applying (K3)
CO2	built user interface design for mobile apps	Applying (K3)
CO3	identify on the basic elements to handle actions and gestures	Applying (K3)
CO4	Develop and design interactive elements for better visual design	Applying (K3)
CO5	build on testing the applications and to launch.	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	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

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	25	60				100
CAT2	10	35	55				100
CAT3	15	25	60				100
ESE	20	25	55				100

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

22CDE09-INTERACTIVE VISUAL DATA ANALYSIS FOR DESIGNER							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**6**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course enables the students to apply essential strategies to create more effective data visualizations for nonprogrammers.	
Unit - I	**Principles Of Data Visualization**	**9**
Visual Processing and Perceptual Rankings: Anscombe's Quartet - Gestalt Principles Of Visual Perception - Preattentive Processing. Five Guidelines for Better Data Visualizations- Show the Data - Reduce the Clutter - Integrate the Graphics and Text - Avoid the Spaghetti Chart - Start with Gray - Form And Function.		
Unit - II	**Basic Chart Types**	**9**
Comparing Categories: Charts: Bar, Marimekko and Mosaic, Unit, Isotype, and Waffle, Gauge and Bullet, Waterfall - Paired Bar - Stacked Bar- Diverging Bar - Sankey Diagram -Time: Chart - Line ,Circular Line ,Slope, Bump, Cycle, Area,Stacked Area, Horizon, Gantt – Sparklines -Streamgraph - Flow Charts and Timelines - Connected Scatterplot. Distribution: Histogram - Chart: Pyramid, Candlestick, Violin - Plot: Box-and-Whisker, Ridgeline, Stem-and-Leaf		
Unit - III	**Advanced Chart Types**	**9**
Geospatial: Choropleth Map – Cartogram - Proportional Symbol and Dot Density Maps - Flow Map – Relationship: Scatterplot- Parallel Coordinates Plot - Radar Charts - Chord Diagram - Arc Chart -Correlation Matrix-Network Diagrams -Tree Diagrams - Part-To-Whole: Pie Charts – Treemap -Sunburst Diagram - Nightingale Chart -Voronoi Diagram – Qualitative: Icons - Word - Quotes - Phrases - Matrices and Lists - Tables: Guidelines – Demonstration.		
Unit - IV	**Designing and Redesigning Your Visual**	**9**
Developing: Anatomy - Color Palettes - Defining Fonts - Guidance - Exporting Images - Accessibility, Diversity, and Inclusion. Redesigns: Paired Bar Chart, Stacked Bar Chart, Line Chart, Choropleth Map, Dot Plot, Line Chart, Table- Data Visualization Tools.		
Unit - V	**D3 Basics**	**9**
Introduction: Origins and Context – Alternatives – Setup – Data: Generating Page Elements - Binding Data - Drawing with Data: Drawing divs and SVGs - Making a Bar Chart and Scatterplot - Scales – Axes- Updates, Transitions, and Motion – Interactivity – Paths : Line and Area Charts– Selections – Layouts: Pie, Stack and Force Layout		
		Total: 45

TEXT BOOK:

1.	Schwabish, Jonathan. Better data visualizations: A guide for scholars, researchers, and Wonks,1st Edition, Columbia University Press, 2021. for Units I,II,III & IV
2	Murray, Scott. Interactive data visualization for the web: an introduction to designing with D3, 2nd Edition, O'Reilly Media, Inc.", 2017, for Unit V

REFERENCES:

1.	Christian Tominski, Heidrun Schumann, Interactive Visual Data Analysis, A K Peters/CRC Press; 1st edition, 2020
2.	Tamara Munzner, Visualization Analysis and Design, A K Peters/CRC Press; 1st edition, 2014

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	experiment with the principles of visual perception and data visualization best practices	Applying (K3)
CO2	model the basic chart types used for Comparing Categories, Time and Distribution.	Applying (K3)
CO3	identify the chart types for Geospatial, Relationship, Part-To-Whole, Qualitative and Tables.	Applying (K3)
CO4	apply the steps involved in designing and redesigning of Data Visualization	Applying (K3)
CO5	utilize how to perform data Visualization using D3 tool	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	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

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)**

22CDE10-DIGITAL MARKETING							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**6**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course is designed to provide college students with a comprehensive understanding of digital marketing strategies and techniques used by businesses to achieve their marketing objectives. Through a combination of lectures, case studies, and hands-on projects, students will learn about various digital marketing channels, tools, and best practices to create effective marketing campaigns.

Unit- I	**Basics of Digital Marketing**	**9**
Evolution of Digital Marketing - Introduction to Digital Marketing - How Website works - Website ingredients - Digital Marketing vs Traditional Marketing - The role of digital marketing in business - Digital Marketing channels - Customer journey (stages of Digital Marketing) - Digital Marketing Metrics - Tools used in Digital Marketing (Free as well as third party tools) - Demand generation - Demand fulfilment, Digital Marketing trends .		
Unit- II	**Search Engine Optimization (SEO)**	**9**
How Search Engine works - SERP layout - Role of search algorithms - Ranking Factors - SEO Components (Technical SEO - On-page SEO - Off-page SEO) Keyword Research - On-Page SEO Techniques -Off-Page SEO Techniques - Technical SEO (Introduction to technical SEO, website indexing, crawl ability, XML sitemaps, robots.txt, broken links, redirect issues and other technical issues) - Local SEO (Google My Business, How Local SEO works)		
Unit- III	**Search Engine Marketing (SEM) and Social Media Marketing (SMM)**	
Introduction to Search Engine Marketing (SEM) - PPC model - Key SEM platforms (Google Ads, Microsoft Advertising, etc.) - SEM Campaign Creation and Management - Bidding formula - Native advertising.Introduction to Social Media Marketing (SMM) - Major social media platforms and their marketing potential (Facebook, Instagram, Twitter, LinkedIn, etc.) - Organic vs. paid social media marketing - SMM Campaign Creation and Management - Social media marketing strategy - Integrating SEM and SMM in Digital Marketing Strategy .		
Unit- IV	**Content Marketing and Email Marketing**	
Introduction to Content Marketing and its importance - Content marketing funnel - Types of content - Content Creation and Optimization - Content Distribution and Promotion - Measuring content marketing performance.Introduction to Email Marketing - Types of email marketing - Benefits of email marketing - Email marketing regulations and best practices - Email Campaign Creation and Management - Email marketing metrics - Email marketing technical setup .		
Unit - V	**Digital Business Present and Future**	**9**
Digital Marketing – Landscape and Emerging Areas: Digital Marketing – Global Landscape – Digital Marketing – The Indian View – Digital Marketing – Emerging Trends and Concepts. A Career in Digital Marketing: Emerging Opportunities for Digital Marketing Professionals – Building a Career in Digital Marketing– Top Digital Marketing Areas as Career Tracks –Approaching a Career in Digital Marketing.		
		Total:45

TEXT BOOK:

1.	Puneet Bhatia, “Fundamentals of Digital Marketing”, 2nd Edition, Pearson Education, 2019.

REFERENCES:

1.	Ian Dodson, ”The art of Digital Marketing the definitive guide to creating strategic, targeted and measurable online campaigns”,1st Edition,Wiley,2016.
2.	Simon Kingsnorth, ”Digital Marketing Strategy an integrated approach to online marketing”, 1st Edition, Kogan Pages, 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the concept of digital marketing landscape and its importance in modern business	Applying (K3)
CO2	able to apply website performance, conduct keyword research, implement on-page and off-page optimization strategies, and perform technical SEO audits to improve search engine rankings and drive organic traffic.	Applying (K3)
CO3	explore, create, manage, and optimize paid search and social media campaigns, as well as integrate SEM and SMM into a cohesive digital marketing strategy to achieve marketing objectives.	Applying (K3)
CO4	make use of the content marketing and email marketing principles and techniques.	Applying (K3)
CO5	develop the emerging areas of digital marketing	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	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

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

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

22CDE11-DESIGN OF INTERACTIVE SYSTEMS							
Programme & Branch	**BE - Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	The objective of this course is to learn all the aspects of design and development of interactive systems, which are now an important part of our lives. The design and usability of these systems leave an effect on the quality of people's relationship to technology. Web applications, social media applications, multimedia applications, embedded devices, etc., are all a part of this system, which has become an integral part of our lives. By the end of the course, the students will be familiar with the goals, problems and structure of interactive system design process. Moreover, the students will be exposed to the core techniques for task analysis and user analysis. Furthermore, students will be able to understand the innovative features of interactive system and be able to improve existing interfaces by considering these features..
Unit - I	**Essentials of Designing Interactive Systems** **9**
Designing Interactive Systems: A Fusion of Skills – PACT: A Framework for Designing Interactive Systems – The Process of Human-Centred Interactive Systems Design – Usability – Experience Design – The Home Information Centre (HIC): A Case Study in Designing Interactive Systems.	
Unit – II	**Techniques for Designing Interactive Systems** **9**
Techniques: Understanding – Environment – Design – Evaluation – Task Analysis – Visual Interface Design: GUI – Interface Design Guidelines – Psychological Principles and Interface Design Information Design – Visualization – Multimodal Interface Design: Interacting in Mixed Reality – Using Sound at the Interface – Tangible Interaction – Gestural Interaction and Surface Computing.	
Unit – III	**Contexts for Designing Interactive Systems – I** **9**
Designing Websites: Website Development – The Information Architecture of Websites – Navigation Design for Websites - Social Media: Background ideas – Social Networking – Sharing with Others – The Developing Web – Collaborative Environments: Issues for Cooperative Working – Technologies to Support Cooperative Working – Collaborative Virtual Environments – Agents and Avatars: Agents – Adaptive Systems – An Architecture for Agents – Applications of Agent-Based Interaction – Avatars and Conversational Agents.	
Unit - IV	**Contexts for Designing Interactive Systems – II** **9**
Ubiquitous Computing - Information Spaces – Blended Spaces - Home Environments - Navigating in Wireless Sensor Networks – Mobile Computing: Context Awareness – Understanding in Mobile Computing – Designing for Mobiles - Evaluation for Mobile Computing – Wearable Computing: Smart Materials – Material Design - From Materials to Implants.	
Unit – V	**Foundations of Designing Interactive Systems** **9**
Memory and Attention: Memory – Attention – Human Error – Affect – Cognition and Action – Social Interaction: Human Communication – People in Groups – Presence – Culture and Identity – Visual Perception – Non-visual Perception - Navigation.	
	Total:45

TEXT BOOK:

1. David Benyon, "Designing Interactive Systems: A comprehensive guide to HCI, UX and interaction design", 3rd Edition, Pearson Publication, ISBN: 978-1447920113, 2013.

REFERENCES:

1. Brenn Hill, Samanyu Chopra, Paul Valencourt, "Blockchain Quick Reference: A guide to exploring decentralized blockchain application development", Packt publishing, 1st Edition 2018.
2. Michael G. Lamming, William M. Newman, "Interactive System Design", 1st Edition, Addison Wesley Publication, ISBN: 978-0201631623, 1995.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify the issues of designing interactive systems and apply the guidelines on different systems.	Applying (K3)
CO2	understand the requirements of interactive systems, probing people for ideas, getting people to participate in the design process, card sorting to develop information architectures and investigating similar systems for ideas.	Applying (K3)
CO3	build interaction and experience design in the different contexts like website design, social media, agents and avatars.	Applying (K3)
CO4	experiment with the interaction and experience design on mobile, ubiquitous and wearable computing.	Applying (K3)
CO5	develop the psychological foundations of HCI, ID and UX.	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	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

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	20	55				100
CAT2	20	30	50				100
CAT3	20	25	55				100
ESE	20	25	55				100

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

22CDE12 - MOTION GRAPHICS							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**PE**	**3**	**0**	**0**	**3**
Preamble	This course enables the students to provide a wide understanding of the key concepts and techniques for thorough analysis of motion graphics designed for websites, desktop and mobile touchscreen applications and games.						
Unit - I	**Introduction to Tools, Image, Space and Time Concepts**						**9**
Introduction: Motion Graphics – Difference between Motion Graphics with Animation and Visual Effects . Tools: Camera – Video andstill Image Formats – Video Compression- Image Creation and Manipulation. Image: Pixel – Design Elements – Tone – Color – Rasters and Vectors – Text – Design Principles.Space: Aspect Ratio – 2D Motion – 2.5 Dimensions – 3D CGI – Stereoscopic 3D. Time: Frame-Frame-rate — Animation — Tweening — Time Slice — Motion.Case Study.							
Unit – II	**Recording, Recreating, Planning and Production**						**9**
Compositing – Transparency-Mattes – Keying – Blending Modes – Color Adjustments – Sound. Recording and Recreating Motion: Rotoscoping – Motion Tracking – Match Moving – Motion or Performance Capture. Process – Planning: Message and Audience – Sketchbooks – Collecting Inspiration – Design Process – Production Pipeline. Process – Production-Shooting Video – Media Management — Prototyping. Case Study							
Unit - III	**History and Application of Motion Graphics**						**9**
History Motion Graphics. Application - Motion Graphics in Film, Motion Graphics in Television, Motion Graphics in Interactive Media:Game Design, Informational Kiosks, Mobile Touchscreens, Desktop Applications, DVD-Video Menus- Motion Graphics in PublicSpaces: Interior Spaces — Exhibit Design — Performance — Exterior Spaces.							
Unit - IV	**Typography and Conceptualization**						**9**
Motion Literacy: Language of Motion – Primary and Secondary Motion. Kinetic Images and Typography – Properties and Style. Pictorial Composition: Principles – Grid Systems – Breaking Spatial Conventions. Sequential Composition: Forms of Continuity and Discontinuity- Montage. Conceptualization: Assessment – Formulation – Cultivation – Storyboards – Animatics. Animation Processes.							
Unit - V	**Compositing and Sequencing**						**9**
Motion Graphics Compositing: Blend Operations – Keying – Alpha Channels – Mattes – Spline Mask – Nesting – Color Correction. Motion Graphics Sequencing: Cut and Transition – Mobile Framing – Establishing Pace and Rhythm –Birth , Life and Death.							
							Total:45
TEXT BOOK:							
1.	Crook, Ian, and Peter Beare. Motion graphics: Principles and practices from the ground up. Bloomsbury Publishing, 2017 for units I &II.						
2.	Krasner, Jon. Motion graphic design: applied history and aesthetics. Routledge, 2013 for units III,IV &V.						
REFERENCES:							
1.	Austin Shaw, “Design for Motion”, 2nd edition,Taylor & Francis,2015.						

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the core principles, concepts and terminology of motion graphics.	Applying (K3)
CO2	develop creative motion graphics through interactive exercises.	Applying (K3)
CO3	construct the application of motion graphics in Film Television, Interactive Media and public spaces	Applying (K3)
CO4	use the concept of Typography and conceptualization in Motion Graphics	Applying (K3)
CO5	make use of various compositing and sequencing techniques to create animated visual effects in motion graphics	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	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

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

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

22CDE13 - MULTIMEDIA TOOLS AND APPLICATIONS							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course provides the fundamentals of multimedia and the stages of multimedia projects and their applications. This course will benefit the students to apply these multimedia techniques in upcoming real world scenarios.

Unit - I	**Introduction to Multimedia**	**9**

Introduction - Multimedia - Definitions - Where to Use Multimedia - Multimedia in Business, Schools, Home, Public Places – Virtual Reality - Delivering Multimedia - CD-ROM, DVD, Flash Drives - The Broadband Internet. Cover Text - The Power of Meaning - Fonts and Faces - Using Text in Multimedia - Computers and Text - Font Editing and Design Tools - Hypermedia and Hypertext. Images.

Unit - II	**Sound, Animation and Video**	**9**

Sound - The Power of Sound - Digital Audio - MIDI Audio - MIDI vs. Digital Audio - Multimedia System Sounds - Audio File Formats - Vaughan's Law of Multimedia Minimums - Adding Sound to Your Multimedia Project. Animation - The Power of Motion - Principles of Animation -Animation by Computer - Making Animations That Work. Video - Using Video - How Video Works and Is Displayed – Digital Video Containers - Obtaining Video Clips - Shooting and Editing Video.

Unit - III	**Making Multimedia**	**9**

The Stages of a Multimedia Project - The Intangibles - Multimedia Skills – Hardware – Software – Authoring Systems - The Process ofMaking Multimedia – Scheduling – Estimating - RFPs and Bid Proposals - Designing – Producing.

Unit - IV	**Internet and Multimedia**	**9**

Internet History – internetworking - Multimedia on the Web - Developing for the Web - Text for the Web - Images for the Web - Sound for the Web - Animation for the Web - Video for the Web. Mobile Multimedia - Digital Revolution Worldwide - Mobile Hardware – Connections - Mobile Operating Systems - Case Study: A Simple Stock Control Application.

Unit - V	**Applications**	**9**

Multimedia in the real world - Multimedia and the Single user - Multimedia on networks - Training and education - Multimedia forInformation and sales - Point-of-information Systems - Point-of-sale Systems - Image processing — Project Management.

Total:45

TEXT BOOK:

1.	Tay Vaughan, Multimedia: Making It Work, 9th Edition, McGraw-Hill Publications,2014 for units I,II &III.
2.	Judith Jeffcoate, Multimedia In Practice: Technology And Applications, 1st Edition, CRC Press, 2019 for units V
3.	Ashok Banerji and Ananda Mohan Ghosh, Multimedia Technologies, 1st Edition, Tata McGraw Hill, 2010 for units IV

REFERENCES:

1.	Savage Savage, Vogel Vogel, An Introduction to Digital Multimedia,3rd edition,Jones & Bartlett Learning, 2009

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the concepts of multimedia.	Applying (K3)
CO2	make use of the concept of sound, animation and videos in real time applications	Applying (K3)
CO3	utilise the stages and needs of multimedia project and apply for real time projects	Applying (K3)
CO4	experiment with use of how to use multimedia with internet	Applying (K3)
CO5	identify the areas to use multimedia applications.	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO 9	PO10	PO1 1	PO12	PSO 1	PS O2
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

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT-1	15	40	45				100
CAT-2	15	40	45				100
CAT-3	15	40	45				100
ESE	15	40	45				100

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

22CDE14-WEB MINING							
Programme & Branch	**BE - Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course provides knowledge about web searching, indexing, query processing and web content mining.	
Unit – I	**Information Retrieval and Web Search**	**9**
Basic Concepts – Information Retrieval Models – Relevance Feedback – Evaluation Measures – Text and Web Page Pre-processing – Inverted Index and its compression – Latent Sematic Indexing – Web Search – Meta-Searching and Combining Multiple Rankings – Web Spamming.		
Unit – II	**Web Crawling**	**9**
Basic Crawler Algorithm – Implementation Issues – Universal Crawlers – Focused Crawlers – Topical Crawlers – Evaluation – Crawler Ethics and Conflicts.		
Unit – III	**Wrapper Generation**	**9**
Preliminaries –Wrapper Induction-Instance-Based Wrapper Learning –Automatic Wrapper Generation: Problems –String Matching and Tree Matching – Multiple Alignment – Building DOM Trees –Extraction Based on a Single List Page and Multiple pages – Introduction to Schema Matching –Pre-Processing for Schema Matching-Schema – Level Match –Domain and Instance-Level Matching –Combining similarities.		
Unit – IV	**Web Usage Mining**	**9**
Web Usage Mining – Clickstream Analysis – Log Files – Data Collection and Pre-Processing – Data Modeling for Web Usage Mining – The BIRCH Clustering Algorithm –Affinity Analysis and the A Priori Algorithm – Discretizing the Numerical Variable: Binning – Applying the A Priori Algorithm to CCSU Web Log Data– Discovery and Analysis of Web Usage Patterns – Recommender Systems and Collaborative Filtering		
Unit – V	**Opinion Mining**	**9**
The Problem of Opinion Mining – Document Sentiment Classification – Sentence Subjectivity and Sentiment Classification – Opinion Lexicon Expansion – Aspect-Based Opinion Mining – Mining Comparative Opinions Search and Retrieval – Opinion Spam Detection.		
		Total:45

TEXT BOOK:

1.	Bing Liu, " Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data (Data Centric Systems and Applications)", Springer; 2nd Edition 2011 for units I,II,III&V
2.	Zdravko Markov, Daniel T. Larose, "Data Mining the Web: Uncovering Patterns in Web Content, Structure, and Usage", John Wiley & Sons, Inc., 2010 for unit IV.

REFERENCES:

1.	Anthony Scime, "Web Mining Applications and Techniques", Idea Group Pub., 2005

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify information retrieval models and methods related to Web search	Applying (K3)
CO2	apply algorithms for Web crawling applications	Applying (K3)
CO3	make use of wrapper to extract structured data	Applying (K3)
CO4	model the behavioural patterns and profiles of users interacting with a Web site	Applying (K3)
CO5	apply opinion mining techniques to classify opinions	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	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

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

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

22CDE15 - BUSINESS INTELLIGENCE AND ITS APPLICATIONS							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**PE**	3	0	0	3

Preamble	This course focuses on learners to apply the business intelligence concepts and techniques to various applications for making better decisions	
Unit – I	**Business View of Information Technology Applications**	**9**
Core Business Processes – Baldrige Business Excellence Framework – Purpose of using IT in Business – Characteristics of Internet-ready IT Applications – Enterprise Applications – Information users and their requirements. Case Study: GoodLife HealthCare Group, Good Food Restaurants Inc, Ten To Ten Retail Stores. Types of Digital Data: Introduction – Structured Data –Unstructured Data – Semi-Structured Data – Difference between semi-structured and structured data.		
Unit – II	**Business Intelligence and Data Integration**	**9**
Business Intelligence: Definition – Evolution – Need for BI – BI Value Chain – Business Analytics –BI Framework – BI Users – BI Applications – BI Roles and Responsibilities – Data Integration : Need for Data Warehouse – Definition of Data Warehouse – Data mart – Ralph Kimbal's Approach vs. W.H.Inmon's Approach – Goals of Data Warehouse –ETL Process – Data Integration Technologies – Data Quality – Data Profiling.		
Unit – III	**OLTP, OLAP and Multidimensional Data Modeling**	**9**
OLTP – OLAP – OLAP Architectures – Data Models – Role of OLAP Tools in BI –OLAP Operations –Basics of Data Modeling – Types of Data Model – Data Modeling Techniques –Fact Table –Dimension Table –Dimensional Models –Dimensional Modeling Life Cycle –Designing the Dimensional Model.		
Unit – IV	**Performance Management and Enterprise Reporting**	**9**
Understanding Measures and Performance – Measurement System – Role of metrics –KPIs – Enterprise Reporting: Reporting Perspectives – Report Standardization and Presentation Practices – Enterprise Reporting Characteristics – Balanced Scorecard – Dashboards –Creating Dashboards – Scorecards vs. Dashboards – Analysis.		
Unit – V	**Role of Statistics in Analytics and BI Applications**	**9**
Role of Statistics in Analytics –Data Description and Summarization – Statistical Test – Application of Analysis in Industries. BI Applications: Understanding Business Intelligence and Mobility – Business Intelligence and Cloud Computing –Business Intelligence for ERP systems – Social CRM and Business Intelligence.		
		Total:45

TEXT BOOK:

1.	Prasad R.N. and SeemaAcharya, "Fundamentals of Business Analytics", 2nd Edition, Wiley-India Publication,2016.

REFERENCES:

1.	Ramesh Sharda, DursunDelen and Efraim Turban, "Business Intelligence, Analytics, and Data Science:A Managerial Perspective", 4th Edition, Pearson Education, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify the enterprise view of IT applications and identify the different types of digital data	Applying (K3)
CO2	make use of Business Intelligence concepts and techniques to experiment ETL process	Applying (K3)
CO3	compare OLTP with OLAP systems and design dimensional model	Applying (K3)
CO4	apply different software design techniques for a given problem	Applying (K3)
CO5	model 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	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- 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	45	40				100
CAT2	15	40	45				100
CAT3	15	40	45				100
ESE	15	40	45				100

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

22GEE02-TOTAL QUALITY MANAGEMENT							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course deals with Quality concepts and TQM principles focusing on process quality to assure product quality to the customers. It also deals with the Basic and modern Quality management tools including ISO standards.	
Unit - I	**Quality Concepts and Principles:**	**9**
Quality Concepts and Principles: Definition of Quality - Dimensions of Quality - Quality Planning - Quality costs - Basic concepts of Total Quality Management - Historical Review. Principles of TQM - Leadership –Concepts - Quality Council - Quality Statements - Strategic Planning - Deming Philosophy - Barriers to TQM Implementation		
Unit - II	**Total Quality Management-Principles and Strategies:**	**9**
Total Quality Management-Principles and Strategies: Customer satisfaction –Customer Perception of Quality - Customer Complaints - Customer Retention - Employee Involvement –Motivation - Empowerment - Teams - Recognition and Reward - Performance Appraisal - Benefits. Continuous Process Improvement –Juran Trilogy - PDSA Cycle - 5S - Kaizen - Supplier Partnership –Partnering - sourcing - Supplier Selection - Supplier Rating - Relationship Development - Performance Measures		
Unit - III	**Control Charts for Process Control:**	**9**
Control Charts for Process Control: The seven tools of quality - Statistical Fundamentals –Measures of central Tendency and Dispersion - Population and Sample - Normal Curve - Control Charts for variables and attributes - Process capability - Concept of six sigma.		
Unit - IV	**TQM-Modern Tools:**	**9**
TQM-Modern Tools: The new seven tools of quality - Benchmarking-Need - Types and process; Quality Function Deployment-HOQ construction - case studies; Taguchi"s Robust design-Quality loss function - DOE; Total Productive Maintenance-uptime enhancement; Failure Mode and Effect Analysis-Risk Priority Number - Process - case studies.		
Unit - V	**Quality Systems:**	**9**
Quality Systems: Need for ISO 9000 and Other Quality Systems - ISO 9000 : 2015 Quality System –Elements - Implementation of Quality System - Documentation - Quality Auditing - Introduction to TS 16949 - QS 9000 - ISO 14000 - ISO 18000 - ISO 20000 - ISO 22000. Process of implementing ISO - Barriers in TQM implementation.		
		Total:45

TEXT BOOK:

1. Dale H. Besterfield, "Total Quality Management", 3rd Edition, Pearson Education, New Delhi, 2011.

REFERENCES:

1. Subburaj Ramasamy, "Total Quality Management", Tata McGraw Hill, New Delhi, 2008.
2. Feigenbaum A.V., "Total Quality Management", 4th Edition, Tata McGraw Hill , New Delhi, 2004.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify the need, history and principles of quality and TQM	Applying (K3)
CO2	illustrate the principles and strategies of TQM	Applying (K3)
CO3	make use of various tools and techniques of quality management	Applying (K3)
CO4	utilise various quality tools and techniques in both manufacturing and service industry	Applying (K3)
CO5	apply the concepts of quality management system and ISO.	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	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

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

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

22CDF03-ADVANCED JAVA PROGRAMMING							
Programme & Branch	**B.E- Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**PE**	**2**	**0**	**2**	**3**

Preamble	This course enables the students to develop, test, and deploy applications ready for production and how to establish them as cloud-based applications using Spring Boot.	
Unit - I	**Spring Boot**	**9**
Introduction – MVC Pattern - Features - Advantages, Microservices, System Requirements, Setting up the environment, 12-factor app, Spring Initializer, Build Tools – Maven and Gradle, pom.xml and build.gradle, Building application using Maven and Gradle, entry point class, Bootstrap Application Context , Spring Boot Starter Dependencies - Auto-Configuration		
Unit - II	**Spring Annotations and Data**	**9**
Spring Boot Annotations: Java annotations – Existence of Spring Annotations - Spring and Spring Boot Annotations. Working with Spring Data JPA and Caching: Accessing relational data using JdbcTemplate and Spring Data JPA with the in-memory database and MySQL - Query methods in Spring Data JPA - Caching.		
Unit - III	**Learning RESTFul API**	**9**
Building RESTFul Microservices: Creating and Consuming RESTFul APIs- Spring Boot Actuators – Custom health check indicators – Exception handling -Service discovery – RestTemplate - Routing a request – Spring Cloud Gateway. Securing a Web Application: Authentication and Authorization concepts – Spring security filters – Enabling and Disabling security – Oauth security – Accessing REST secured APIs –REST services		
Unit - IV	**Implementing Resilience4J and Swagger**	**9**
Building Resilient System: Client-side load balancing – Circuit breaker – Implementing Resilience4J. Logging: Logging Data – Logback – Spring Cloud Sleuth and Zipkin – ELK. Working with the Swagger API Management Tool: API documentation – Implementing Swagger - Swagger UI – Swagger documentation – Swagger Codegen.		
Unit - V	**Testing and Deploying**	**9**
Testing a Spring Boot Application: Unit Testing and Integration Testing – JUnit and Mockito framework – Checking code coverage – Testing RESTFul web services – Cucumber automation testing. Deploying a Spring Boot Application – Docker and containerization - Setting up Docker- Heroku CLI and deployment. Case Study.		

LIST OF EXPERIMENTS / EXERCISES:

1.	Build a simple web application with Spring Boot and add some services to it.
2.	Create your own Custom Starter with Spring Boot
3.	Demonstration of starter and libraries for connecting an application with JDBC.
4.	Create REST Service with Spring Boot
5.	Implementation of Form Data Binding and Validation with Spring Boot.
6.	Demonstration of REST API Validation and Globally Error Handling with Spring Boot.
7.	Implementing Reactive Circuit Breaker Using Resilience4j
8.	Build out your API documentation by integrating an OpenAPI specification document into Swagger UI.
9.	Implementation of Unit Testing Rest Services with Spring Boot and JUnit.
10.	Write an Integration Tests for Rest Services with Spring Boot.

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Shagun Bakliwal, “Hands-on Application Development using Spring Boot: Building Modern Cloud Native Applications by Learning RESTFul API, Microservices, CRUD Operations, Unit Testing, and Deployment”, BPB Publications, 1st Edition, 2021.

REFERENCES/ SOFTWARE/ MANUAL:

1.	Rajput, D. “Mastering Spring Boot 2.0: Build modern, cloud-native, and distributed systems using Spring Boot”, Packt Publishing Ltd, 2018.
2.	Claudio and Greg, “Developing Java Applications with Spring and Spring Boot”, Packt Publishing Ltd, 2018.
3.	Software: Eclipse IDE/ Netbeans IDE/ Spring tool 4.19.1
4.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the Spring Boot and all its capabilities.	Applying (K3) Precision (S3)
CO2	construct the common annotations of the Spring Data and Spring Data JPA	Applying (K3) Precision (S3)
CO3	build RESTFul Microservices and Secured Web Application	Applying (K3) Precision (S3)
CO4	experiment with Resilience4J and Swagger API and host the apps on Cloud.	Applying (K3) Precision (S3)
CO5	learn to apply Testing and Deploying a Spring Boot Application	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	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

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

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

22CDE16-SOFTWARE QUALITY AND TESTING							
Programme & Branch	**B.E. & Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Agile Methodology**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course focuses on the implementation of appropriate functionality that satisfies the requirements/needs of its targeted client/users for the intended software system, product, or service correctly and efficiently.	
Unit - I	**Software Quality Assurance and Review Techniques**	**9**
Defining Quality – Importance of Quality –Quality Control Vs Quality assurance –Quality assurance at each phase of SDLC - Need for SQA group in an Organization. Structured walkthroughs –Inspections –Various roles and responsibilities involved in Inspections –Making review successful.		
Unit - II	**Software Measurement and Metrics**	**9**
Product quality – Models for software product Quality – Process Quality Aspects. Measurement and Metrics: Introduction – Measurement during software life cycle context –Defect metrics – Metrics for software maintenance– Requirements related metrics – Measurements and process improvement – Measurement principles.		
Unit - III	**Basics of Testing**	**9**
Introduction – Definition– Testing Approaches – Essentials – features and principles of software Testing. Testing Environment: Assessing Capabilities – Staff Competency and User Satisfaction – Creating an environment supportive of software testing – Building the software testing process: Testing Guidelines.		
Unit - IV	**Software Testing process**	**9**
Overview of Software Testing Process – Organizing for testing: Workbench – Input – Procedure. Developing the test plan: Workbench – Input – Procedure. Verification testing: Workbench – Input – Procedure. Validation testing :Workbench – Input – Procedure – Introduction to test case		
Unit - V	**Analyzing and reporting**	**9**
Analyzing and reporting test results: Workbench – Input – Procedure. Testing software system security – Testing client/server systems – Testing web-based systems – Using Agile Methods to Improve Software Testing.		
		Total:45

TEXT BOOK:

1.	Nina S. Godbole, "Software Quality Assurance Principles and Practice", 2nd Edition, Narosa Publishing House, 2017 for units I,II
2.	Perry William, "Effective Methods for Software Testing", 3rd Edition, Wiley, India, 2013 for units III, IV, V

REFERENCES:

1.	S.A Kelkar, “Software Quality and Testing”, PHI Learning Pvt. Ltd Eastern Economy Edition, 2012.
2.	Sondra Ashmore, Kristin Runya, “Introduction to Agile Methods”, Pearson Education, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply quality assurance steps at each phase of SDLC and conduct reviews and inspections	Applying (K3)
CO2	identify the concepts, metrics, and models in software quality assurance	Applying (K3)
CO3	apply the step by step activities and set up environment for software testing	Applying (K3)
CO4	develop procedures and workbenches for various testing process	Applying (K3)
CO5	build testing for client server, web based and software security systems and identify the agile methods for improving the testing process	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	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

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

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

22CDE17- MANAGING DESIGN PROCESS							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**PE**	**3**	**0**	**0**	**3**
Preamble	This course provides knowledge of the how to manage the design process, concept development and implementing the design. This course will benefit the students to apply these design concepts and techniques in upcoming real world scenarios.						
Unit – I	**Concept Development – Applied Creativity and Design Centric Research**						**9**
Introduction - Managing the design process - Applied Creativity - Big Goals - Design Centric Research – importance of research for design – Research aligns and focuses design – Design Research is about better design thinking –Research tactics – Defining the audience– Defining the medium.							
Unit – II	**Concept Development – Strategic Thinking and Informed Risk Taking**						**9**
Strategic Thinking – Design and Strategy – Design strategy – Design as a business tool – Developing a Design Strategy – Managing Aesthetic Strategy – Evaluating design strategy – Articulating Design Strategy – Common mistakes in Design Strategy - Informed Risk Taking – Creative Briefs.							
Unit – III	**Concept Development – Aesthetic Considerations and Managing Expectations**						**9**
Aesthetic in Design – Components – Mapping Aesthetics – Aesthetic Dynamics in Design – Evaluating Aesthetic Choices – Design Critique – Approving Aesthetic Ideas. Managing Expectations - Managing Client Expectations – Best Practices – Communication and Design Management.							
Unit – IV	**Implementing Design – Project Management and Setup, Planning , Budgeting**						**9**
Introduction – Designer – Client Collaborative process. Project Management – Overview – Design Project Management Cycle – Project management enhances creativity – Traits for success in Project Management. Project Setup – Planning – Budgeting.							
Unit – V	**Implementing Design – Assembling the team, Managing Creatives and clients, Profitability**						**9**
Assembling the team – Teamwork basics – Creative mix – teamwork responsibilities – Characteristics of successful design teams –Virtual Teamwork – Screening creatives. Managing Creatives – Managing Clients –Profitability – Profitability in Graphic design –Increasing Profitability – importance of ongoing design management.							
							Total:45

TEXT BOOK:

1.	Terry Lee Stone, “Managing the Design Process – Concept Development”, An Essential Manual for the working Designer, 1st Edition, Rockport Publications, 2010 for units I ,II & III
2.	Terry Lee Stone, “Managing the Design Process – Implementing Design”, An Essential Manual for the working Designer, 1stEdition , Rockport Publications, 2010 for units IV & V

REFERENCES:

1.	Gavin Tunstall, “Managing the Building Design Process”, 2nd Edition, Routledge Publications, 2006.
2.	Kathryn Best, “Design Management – Managing Design Strategy, Process and Implementation” 2nd edition, Fairchild Books, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	make use of creativity and perform design centric research	Applying (K3)
CO2	apply strategic thinking and understand informed risk taking	Applying (K3)
CO3	make use of aesthetic considerations and manage the design expectations	Applying (K3)
CO4	organize project management and setup and apply the concepts of planning and budgeting	Applying (K3)
CO5	build the team and manage the creatives and clients	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	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

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

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

22CDE18-RESPONSIVE WEB DESIGN							
Programme & Branch	**BE - Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**PE**	**3**	**0**	**0**	**3**
Preamble	This course helps the students to provide the basic knowledge and helps to develop responsive web based design using wireframes and mockups.						
Unit – I	**Introduction to Responsive Design**						**9**
Static mockup – Specialist invasion – Iterative work flow approach – Micro structure vs Modular structure – Enhancement as Design principle – Creating content inventory.							
Unit – II	**Wireframe**						**9**
Low-fi web based wireframes – Steps to create low-fi web based wireframes – Setting up base mockup – Setting up base style – Adjusting wireframe – Adding navigation – creating variants – Myths about wireframe.							
Unit – III	**Text and Linear Design**						**9**
Text design: Design with plain text – Marking up plain text – converting plain text to HTML. Linear Design: Developing a design Language – Introducing templates – Projects – Think and Sketch – Type and color.							
Unit – IV	**Breakpoints**						**9**
Breakpoint Graph: Documentation – Creating breakpoint graph – Major and Minor breakpoints – Designing breakpoints: Sketching – Content in sketch: Text – Navigation – Tables.							
Unit – V	**Web-Based Design Mockup**						**9**
Hurdles in creating web-based mockups – Static page to Static site generator : Templating – Choosing an SSG – Introducing Dexy – Installing Dexy – Including Style sheets – Adding and Sectioning content – Presenting interactive mockups – Design Guidelines – Creating design documentation.							
							Total:45

TEXT BOOK:

1.	Stephen Hay, “Responsive Design Workflow”, 1st Edition, New Riders Publishers, 2013

REFERENCES:

1.	Clarissa Peterson, “Learning Responsive Web Design A Beginner's Guide”, O'Reilly Media, 2014
2.	Ben Frain, “Responsive Web Design with HTML5 and CSS Develop Future-proof Responsive Websites Using the Latest HTML5 and CSS Techniques”, Packt Publishing, 2020

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	utilize the design principles in responsive design.	Applying (K3)
CO2	make use of low-fidelity web based wireframes.	Applying (K3)
CO3	apply the basic elements to handle text design and linear design	Applying (K3)
CO4	develop breakpoint graph using sketch and its content	Applying (K3)
CO5	build web-based design mockups	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	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

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	25	60				100
CAT2	10	35	55				100
CAT3	15	25	60				100
ESE	20	25	55				100

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

22CDE19-BLOCKCHAIN TECHNOLOGIES							
Programme & Branch	**BE - Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**PE**	**3**	**0**	**0**	**3**
Preamble	This course provides a comprehensive introduction to the theoretical and practical aspects of blockchain technology.						
Unit - I	**Blockchain Technology**						**9**
Distributed systems - The history of blockchain - Introduction to blockchain – definitions - elements - Features - Applications of blockchain technology - Tiers - Types of blockchain - Consensus in blockchain - CAP theorem - Benefits and limitations of blockchain.							
Unit - II	**Decentralization and Cryptography Technical Foundations**						**9**
Decentralization using blockchain – Methods – Routes - Blockchain and full ecosystem decentralization - Smart contract - Decentralized applications – Platforms for decentralization. Cryptography and Technical Foundations– Introduction - Cryptography - Confidentiality - Integrity – Authentication - Cryptographic primitives - Asymmetric cryptography - Public and private keys – RSA - Discrete logarithm problem - Hash functions - Elliptic Curve Digital signature algorithm							
Unit - III	**Bitcoins and Alternative Coins**						**9**
Bitcoin – Transactions – Blockchain - Bitcoin payments - Alternative Coins - Theoretical foundations - Bitcoin limitations – Namecoin - Litecoin – Primecoin – Zcash - Smart Contracts.							
Unit - IV	**Fundamentals of Ethereum**						**9**
Introduction – Ethereum blockchain - Elements of the Ethereum blockchain - Precompiled contracts – Accounts – Block – Ether – Messages – Mining - Clients and wallets - The Ethereum network - Ethereum Development.							
Unit - V	**Hyperledger**						**9**
Projects – Protocol - Hyperledger Fabric – Sawtooth lake – Corda – Blockchains-Outside of Currencies: Internet of Things – Government – Health – Finance.							
							Total:45

TEXT BOOK:

1. Imran Bashir, “Mastering Blockchain Distributed ledgers, decentralization and smart contracts Explained”, Packt Publishing, 1st Edition, 2017.

REFERENCES:

1. Brenn Hill, Samanyu Chopra, Paul Valencourt, “Blockchain Quick Reference: A guide to exploring decentralized blockchain application development”, Packt publishing, 1st Edition 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the basics and various real time applications of blockchain	Applying (K3)
CO2	apply decentralization and cryptography for blockchain applications	Applying (K3)
CO3	make use of blockchain technology for bitcoin, alternative coins and develop smart contracts	Applying (K3)
CO4	develop a distributed application using Ethereum	Applying (K3)
CO5	build an application using Hyperledger	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	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

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

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

22GEE01- FUNDAMENTALS OF RESEARCH							
(Common to all BE/BTech branches)							
Programme & Branch	**B.E– Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course familiarize the fundamental concepts/techniques adopted in research, problem formulation and also disseminate the process involved in collection, consolidation of published literature and rewriting them in a presentable form using latest tools.	
Unit - I	**Introduction to Research**	**9**
Introduction to Research: Types and Process of Research -Outcome of Research - Sources of Research Problem - Characteristics of a Good Research Problem - Errors in Selecting a Research Problem - Importance of Keywords.		
Unit - II	**Literature Review**	**9**
Literature Review: Literature Collection - Methods - Analysis - Citation Study - Gap Analysis - Problem Formulation Techniques.		
Unit - III	**Research Methodology**	**9**
Research Methodology: Appropriate Choice of Algorithms/Methodologies/Methods - Measurement and Result Analysis - Investigation of Solutions for Research Problem - Interpretation - Research Limitations.		
Unit - IV	**Journals and Papers:**	**9**
Journals and Papers: Journals in Science/Engineering - Indexing and Impact factor of Journals. Plagiarism and Research Ethics. Types of Research Papers - Original Article/Review Paper/Short Communication/Case Study.		
Unit - V	**Reports and Presentations**	**9**
Reports and Presentations: How to Write a Report - Language and Style - Format of Project Report - Title Page - Abstract - Table of Contents - Headings and Sub-Headings - Footnotes - Tables and Figures - Appendix - Bibliography etc - Different Reference Formats. Presentation using PPTs. Research Tools.		
		Total:45

TEXT BOOK:

1. Walliman, Nicholas. “Research Methods: The basics”. Routledge, 2017.

REFERENCES:

1. Melville S, Goddard W. “Research Methodology: An Introduction For Science and Engineering Students”. Kenwyn: Juta & Co Ltd., 1996.
2. Kumar, Ranjit. “Research Methodology: A step-by-step guide for beginners”. SAGE Publications Limited, 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	list the various stages in research and categorize the quality of journals.	Analyzing (K4)
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)

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	3	2	2	1	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	2	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	2	1	1		3	3	3	2	2	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	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		40	35	25			100
CAT2		30	40	30			100
CAT3				50	50		100
ESE		25	25	25	25		100

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

22CDE20 - OPTIMIZATION TECHNIQUES							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course provides an insight modern optimization techniques used in various domains. It also introduces the meta-heuristic optimization methods as solutions to multi-objective problems.	
Unit - I	**Optimization Problem**	**9**
Statement of an optimization problem: design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of optimization problems classification based on the existence of constraints – nature of the design variables – physical structure of the problem – nature of the equations involved – permissible values of the design variables – deterministic nature of the variables – separability of the functions – number of objective functions – optimization techniques. Classical optimization techniques: single-variable optimization – multivariable optimization – convex programming problem		
Unit - II	**Linear Programming**	**9**
Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of asystem of linear simultaneous equations – pivotal reduction of a general system of equations – motivation of the simplex method – simplex algorithm. Integer linear programming: Graphical Representation – Gomory's cutting plane method.		
Unit - III	**Nonlinear Programming**	**9**
Constrained optimization techniques– random search methods – complex method – sequential linear programming – transformation techniques – basic approach of the penalty function method – interior penalty function method – convex programming problem –exterior penalty function method – extrapolation techniques in the interior penalty function method – extended interior penalty function methods – penalty function method for problems with mixed equality and inequality constraints – penalty function method for parametric constraints – est problems: welded beam design – speed reducer (gear train) design.		
Unit - IV	**Dynamic Programming**	**9**
Multistage decision processes – types of multistage decision problems – concept of sub optimization and principle of optimality – computational procedure in dynamic programming – illustrating the calculus method of solution – illustrating the tabular method of solution – conversion of a final value problem into an initial value problem – linear programming as a case of dynamic programming – continuous dynamic programming.		
Unit - V	**Modern Methods of Optimization**	**9**
Genetic algorithms – simulated annealing – particle swarm optimization –solution of the constrained optimization problem – ant colony optimization – optimization of fuzzy systems neural-network-based optimization – metaheuristic optimization methods – multilevel andmultiobjective optimization.		
		Total:45

TEXT BOOK:

1.	Singiresu S. Rao, "Engineering Optimization: Theory and Practice", John Wiley and Sons, 5th Edition, 2019

REFERENCES:

1.	H.A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson/Prentice Hall, 2007.
2.	George Bernard Dantzig, MukundNarainThapa, "Linear programming", Springer series in operations research 3rdEdition, 2003

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	investigate the optimization problem and the classical optimization techniques	Applying (K3)
CO2	apply the linear programming model as a solution to various problems with linear functions	Applying (K3)
CO3	make use of non-linear programming model to solve the constrained optimization problems	Applying (K3)
CO4	develop optimal solutions for multistage decision problems using dynamic programming	Applying (K3)
CO5	apply modern optimization techniques to solve decision 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	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

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	35	50				100
CAT2	15	35	50				100
CAT 3	15	35	50				100
ESE	10	40	50				100

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

22CDE21-CREATIVE THINKING							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**PE**	**3**	**0**	**0**	**3**
Preamble	Preamble This course focuses on learners to enrich creative thinking and use in various applications for making better decisions						
Unit – I	**Idea of Critical & Creative Thinking**						**9**
Critical and Creative Thought Are Inseparable - Thinking That Grasps the Logic of Things - Whenever We Are Reasoning Something Through, We Are Engaged in Creative Thinking - Is Creative Genius an Exception? - The Narrow-minded Genius.							
Unit – II	**Creative Thinking Motivation**						**9**
The Interplay Among Inborn Gifts, Environment, and Self Motivation - The Questioning Mind in Newton, Darwin, and Einstein - Creativity Need Not Be Mystified - The Elements of Thought - Intellectual Standards - Critical Thinking Applies to the Arts							
Unit – III	**Creative Thinking & the Foundations of Meaningfulness**						**9**
Figuring Out the Logic of Things - Concepts and Language - Human Thinking - Academic Disciplines – Questioning - Reading, Writing, Speaking, and Listening.							
Unit – IV	**Creative Thinker**						**9**
Be committed to commitment - Be the medium of your medium - Don't be someone else - Be a generator - . Be positive about negatives - Don't think about what others think about - Doubt everything all the time - Feel inadequate - Be practically useless - Be perceptive about perception - Be naturally inspired - Don't be an expert on yourself - Be Stubborn about compromise - Be a weapon of mass creation - Get into what you're into - Challenge the challenging.							
Unit – V	**Ways To Creative Think**						**9**
Mine your mind - Look forward to disappointment - Think with your feelings - Bring chaos to order - Take what you need - Remake, then remake the remake -Be curious about curiosity - Become anonymous - Achieve the perfect work-life balance - Make what you say unforgettable - Don't experiment, BE an experiment - Stop missing opportunities - Contradict yourself more often - Box your way out of boxes.							
							Total:45
TEXT BOOK:							
1.	Richard Paul and Linda Elder, "The Nature and Functions of Critical & Creative Thinking", Thinker's Guide Library, 2012. for Unit I,II &III						
2.	Rod Judkins, "The Art Of Creative Thinking", Hachette Book Publishing, 2015. for unit IV &V						
REFERENCES/ MANUAL / SOFTWARE:							
1.	John Adair," The art of creative thinking, How to be Innovative and Develop Great Ideas",Kogan Page Publisher, 2009						

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	demonstrate the idea of creative thinking	Applying (K3)
CO2	motivate the creative thinking	Applying (K3)
CO3	design the need of creative thinking	Applying (K3)
CO4	apply to be a creative thinker	Applying (K3)
CO5	carryout ways to be a creative thinker	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	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

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

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

22CDE22-USABILITY STUDIES AND EVALUATION							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**PE**	**3**	**0**	**0**	**3**
Preamble	This course provides the insight of interactive system. The evaluation methods can be explored.						
Unit - I	**Usability of Interactive Systems and Universal Usability**						**9**
Introduction – Usability Goals and Measures – Usability Motivations – Universal Usability: Diverse cognitive and perceptual abilities – Personality differences – Cultural and international diversity – Users with disabilities – Accommodating hardware and software diversity – Goals –Guidelines – Golden rules of Interface design – Principles – Theories							
Unit - II	**Development Processes**						**9**
Managing design processes – Organizational Design to Support Usability – Four Pillars of Design – Development Methodologies – Scenario Development – Social Impact Statement for Early Design Review.							
Unit - III	**Interaction Styles**						**9**
3D Interfaces- Tele Operations- Virtual and Augmented Reality- Menu Selection, Form Fill-In and Dialog Boxes- Command and Natural Languages- Interaction Devices							
Unit - IV	**Design Issues**						**9**
Quality of services- User Productivity- Balancing Functions and Fashions- Error Message- Nonanthropomorphic Design- Display Design- Webpage Design- Window Design- Color							
Unit - V	**Information Search and Visualizations**						**9**
Searching in Textual Documents and Database Querying- Multimedia Document Searches- Advance Filtering and Search Interfaces- Information Visualization- Datatype by Task Taxonomy							
							Total: 45
TEXT BOOK:							
1.	Ben Shneiderman, Catherine Plaisant, Maxine S. Cohen & Steven M. Jacobs, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", 5th Edition, Addison Wesley, 2019.						
REFERENCES:							
1.	Helen Sharpand Yvonne Rogress, "Interaction Design beyond Human Computer Interaction", 4thEdition, John Wiley, 2015						

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	describe User Interface Design and Usability	Applying (K3)
CO2	demonstrate emotional interaction	Applying (K3)
CO3	apply data gathering techniques	Applying (K3)
CO4	explore design process	Applying (K3)
CO5	explore different evaluation techniques	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	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

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	15	35	50				100
ESE	20	30	50				100

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

22CDE23 - CYBER SECURITY							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	Nil	**7**	**PE**	**3**	**0**	**0**	**3**
Preamble	This subject will provide the essential understanding of security and its needs, the skills and tools that everyone who wants to work as security personal, and explore advanced security methodologies.						
Unit – I	**Introduction to Cyber Security:**						**9**
Importance of Cyber Security: Scenarios for Security – Understanding the attack surface – Security Evaluation: Legacy Cybersecurity Systems – Transformations in Cybersecurity – Advancements in Security Technology to Security 2.0 – How ML and AI will play a larger role in Cybersecurity.							
Unit – II	**Cybersecurity Technologies:**						**9**
Learning Cybersecurity Technologies: Mobile Security – Advanced Data Security – Cloud Security – Modern Day Regulations – Incidence Response and Forensics – Enterprise Security at Scale – Penetration Testing – DevSecOps – IoT Security – UBA – EDR.							
Unit – III	**Cybersecurity Skills:**						**9**
Cybersecurity Skills: General Cybersecurity Roles – Skills to Acquire in Cybersecurity – Other Skills: Ethical Hacking – Application Security – Cloud Security – DevSecOps – Threat and Vulnerability assessment – Information security and Management – Cyber Security Litigation Support – Regulatory Compliance and Auditing.							
Unit – IV	**Attacker Mindset and Cyber Defense:**						**9**
Attackers: Categories of Hackers – Traits of Hackers – Social Characteristics of Hackers – How Hackers Think – Psychology of Hackers – **Cyber Defense**: Proactive Cyber Defense – Reactive Cyber Defense – Overview of Operational Security – The Significance of Three Security Pillars – Security Operations and Continuous Monitoring – Digital Forensics and Real-time Incident Response with SIEM.							
Unit – V	**Networking, Mentoring and Shadowing:**						**9**
Mentoring – Networking – Shadowing – Cybersecurity Labs: ILT – VILT – Self-study cybersecurity labs – Security Intelligence Resources: Checklist Resources – Cybersecurity Advice and Reliable Information Sources – Cybersecurity Courses – Cybersecurity Threat-intelligence Resources.							
							Total: 45
TEXT BOOK:							
1.	Erdal Ozkaya, " Cybersecurity: The Beginner's Guide A Comprehensive Guide to Getting Started in Cybersecurity", Packt Publishing, 1st Edition, 2019.						
REFERENCES:							
1.	Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publishers, 2011.						
2.	William Stallings, Lawrie Brown, "Computer Security Principles and Practice", Third Edition, Pearson Education, 2015.						

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the cyber security fundamentals to secure systems.	Applying (K3)
CO2	make use of the various cybersecurity technologies	Applying (K3)
CO3	explain the various skills and tools required to work as security personal.	Applying (K3)
CO4	construct a cyber-defense system using the mindset, psychology and characteristics of hacker.	Applying (K3)
CO5	utilize the security intelligence resources to secure the information.	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	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

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

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

22CDE24-ENVIRONMENTAL INFORMATION DESIGN							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course provides a relatively new hybrid of the design field, filled that knowledge gap by putting forth the first formal methodology and which can be defined as the graphic communication of information in the built environment.	
Unit - I	**Environmental Graphic Design**	**9**
Introduction – The Spectrum of Environmental Graphic Design - The importance of Environmental Graphic Design – Digital Information Systems and Environmental Graphic Design - Signage Pyramid's Component Systems - Signage Pyramid and Resource Allocation.		
Unit - II	**The Design Process**	**9**
The Client Is Part of the Process – The Design Process Applied to Environmental Graphic Design- Data Collection and Analysis – Schematic Design – Design Development – Documentation – Bidding – Fabrication/ Installation Observation – Post-installation Evaluation.		
Unit - III	**The Information Content System**	**9**
Kinds of Sign Information Content – Hierarchy of Content – Developing the Sign Information Content System - Navigation: Message Hierarchy and Proximity – Other Factors Affecting the Sign Information Content System – Pictorial Information Content – Signage Master Plans.		
Unit - IV	**The Graphic System**	**9**
Typography Overview - Choosing a Typeface - Typographic Treatment – Typographic Considerations in Signage for People Who Read by Touch – Symbols and Arrows - Diagrams – Other Graphic Elements – Color – Layout - Overview of Sign Graphic Application Processes.		
Unit - V	**The Hardware System**	**9**
Shape - Connotations of Form – Sign Mounting Considerations – Sign Size Considerations – Basic Sign Materials – Electronic Digital Display Units – Stock Sign Hardware Systems - Sign Materials and Codes - Overview of Sign Coatings and Finishes.		
		Total:45

TEXT BOOK:

1.	Chris Calori, David Vanden-Eynden, " Signage and Wayfinding Design: A Complete Guide to Creating Environmental Graphic Design Systems", 2nd Edition, Wiley, 2015.

REFERENCES:

1.	Tomayess Issa, Pedro Isaias, "Sustainable Design HCI, Usability and Environmental Concerns", Springer London, 2022
2.	Thomas Usländer ,"Service-oriented Design of Environmental Information Systems", KIT Scientific Publishing,2010

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the concepts of Digital Information Systems and Environmental Graphic Design	Applying (K3)
CO2	analyze the design process and development	Applying (K3)
CO3	make use of Factors Affecting the Sign Information Content System	Applying (K3)
CO4	choose graphic elements of the graphical system	Applying (K3)
CO5	integrate the elements of the hardware system	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	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

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	25	60				100
CAT2	15	20	65				100
CAT3	15	20	65				100
ESE	10	20	70				100

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

22CDE25- THEORY OF COMPUTATION							
Programme & Branch	**B.E. – Computer Science and Engineering**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	The course helps the learners to know the models of computation, along with their variants in the context of formal languages and their recognizers and to familiarize students with the foundations and principles of computer science. This can be applied in designing compilers and pattern recognition system.	
Unit – I	**Formal proof and Automata**	**9**
Introduction to formal proof – Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Equivalence between NFA and DFA – Finite Automata with Epsilon transitions – Conversion of NFA into DFA – Equivalence and minimization of automata.		
Unit – II	**Regular Expressions and properties of regular languages**	**9**
Regular expression – Equivalence of finite automata and regular expressions – Proving languages not to be regular (Pumping Lemma) – Closure properties of regular languages.		
Unit – III	**Context Free Grammars and Push Down Automata(PDA)**	**9**
Context-Free Grammar (CFG) – Parse trees – Ambiguity in grammars and languages. PushDown Automata – Definition of the pushdown automata (PDA) – Languages of PDA – Equivalence of PDA and CFG – Deterministic Pushdown Automata.		
Unit – IV	**Context Free Languages and Turing Machines**	**9**
Normal forms for CFG – Chomsky Normal Form and Greibach Normal Form – Pumping lemma for CFL – Closure properties of CFL – Turing machines: Basic model – definition and representation – Instantaneous Description –Transition diagram for TM – Language acceptance by TM – TM as Computer of Integer functions – Programming techniques for Turing machines (subroutines).		
Unit – V	**Undecidability**	**9**
language that is not Recursively Enumerable (RE) – An undecidable problem that is RE –Undecidable problems about Turing machine – Post's correspondence problem – The classes P and NP –Kruskal's algorithm – Traveling Salesman Problem.		
		Total:45

TEXT BOOK:

1. Hopcroft J.E., Motwani R. & Ullman J.D., "Introduction to Automata Theory, Languages and Computation", 3rd Edition, Pearson Education, New Delhi, 2011.

REFERENCES:

1. Martin J., "Introduction to Languages and the Theory of Computation", 4th Edition, Tata McGraw-Hill, New Delhi, 2010.
2. Linz P., "Introduction to Formal Language and Computation", 4th Edition, Narosa Publishing, 2007.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	design finite automata for the regular languages	Applying (K3)
CO2	construct regular expression for the regular languages	Applying (K3)
CO3	make use of Push Down Automata for the recognition of context free languages.	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	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	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

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

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

22CDE26 - COMPILER DESIGN							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**8**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course provides an insight into the compiler construction process as well as the design techniques for the given programming language.	
Unit – I	**Lexical Analysis**	**9**
Introduction – Language Processors – The structure of a compiler – Lexical Analysis – The Role of the Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – The Lexical-Analyzer Generator – Lex – Finite Automata – From Regular Expressions to Automata.		
Unit – II	**Syntax Analysis**	**9**
Introduction – Context-Free Grammars – Writing a Grammar – Top-Down Parsing – Bottom-Up parsing – Operator Precedence Parser – Introduction to LR Parsing: Simple LR – More Powerful LR Parsers – Parser Generators.		
Unit – III	**Syntax - Directed Translation and Intermediate Code Generation**	**9**
Syntax-Directed Translation – Evaluation orders for SDDs – Intermediate Code Generation – Variants of syntax trees – Three Address Code – Types and Declarations – Translation of Expressions – Control Flow – Backpatching – Switch Statements – Procedure calls.		
Unit – IV	**Machine Independent Optimizations**	**9**
Basic Blocks and Flow Graphs – Optimization of Basic Blocks– Peephole Optimization – The Principal Sources of Optimization – Introduction to Data-Flow Analysis – loops and flow graphs.		
Unit – V	**Code Generation and Storage Management**	**9**
Issues in the design of a code generation – The target Language – Addresses in the Target code – A simple code Generator – Run-Time Environments: Storage organization – Stack allocation of space – Heap Management – Introduction to garbage collection.		
		Total:45

TEXT BOOK:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman, “Compilers: Principles, Techniques and Tools”, 2nd Edition, Pearson India Education Pvt. Ltd., 2014.

REFERENCES:

1. Srikant Y.N. and Priti Shankar, “The Compiler Design Handbook: Optimizations and Machine Code Generation”, 2nd Edition, CRC Press, 2008
2. Kenneth C. Louden, “Compiler Construction – Principles and Practice”, 1st edition, PWS Publishing. 1997

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	make use of regular expression to perform lexical analysis of the source program	Applying (K3)
CO2	design a syntax-analysis tool for the given grammar	Applying (K3)
CO3	develop intermediate code for the source program	Applying (K3)
CO4	employ optimization techniques for the given intermediate code	Applying (K3)
CO5	apply suitable storage allocation technique to generate the target code	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	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

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

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

22CDE27-INFORMATION SECURITY							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Computer Networks**	**8**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course focuses on wide spectrum of topics from legal and ethical issue, risk management, and implementation in the context of information security.

Unit - I	**Information Security and The Need for Security**	**9**
The history of Information Security – CNSS Security model-Components of an Information System – Security in the system life cycle – Security professionals and the organization – Communities of interest – Information Security: Threat and Attacks – Compromises tointellectual property – Deviations in Quality of Service-Espionage – Force of nature – Human Error – Information Extortion – Sabotage-Software attacks – Technical hardware failures – Technical software failures		
Unit - II	**Issues in Information Security and Planning for Security**	**9**
Law and ethics in information Security – Relevant U.S. Laws-International laws and legal bodies – Ethics and Information security –Codes of ethics of professional organizations – Key U.S. Federal agencies – Planning for Security: Information security policy, standards, and practices – The Information security blueprint – Security education, training, and awareness program		
Unit - III	**Risk Management**	**9**
Risk Identification: Planning and organizing the process – Identifying, inventorying and categorizing assets- Classifying and prioritizing threats – Specifying asset vulnerabilities; Risk assessment : Planning and organizing risk assessment- Determining the loss frequency – Calculating risk – Assessing risk acceptability – The FAIR approach to risk assessment – Risk control-Quantitative versus qualitative risk management practices-Recommended risk control practices		
Unit - IV	**Security Technology**	**9**
Access Control: Access control mechanisms – Biometrics – Access control architecture models – Firewalls: Firewall processing modes – Firewall architecture – Selecting the right firewalls – Configuring and managing firewalls – Content filters – Protecting remote connections – Intrusion detection and prevention systems –Honeypots, Honeynets, and padded cell systems – Scanning and analysis tools.		
Unit - V	**Implementing Information Security and Security &Personnel**	**9**
Information security project management – Technical aspects of implementation-Nontechnical aspect of implementation-Information security certification and accreditation-Credentials for information security professionals-Employment policies and practices-Security considerations for temporary employees, consultants, and other workers-Internal control strategies – Privacy and the security of personnel data.		
		Total:45

TEXT BOOK:

1.	Michael E. Whitman and Herbert J. Mattord, “Principles of Information Security”, 6th Edition, Cengage Learning, India, 2018.

REFERENCES:

1.	Charles P. Pfleeger and Shari Lawrence Pfleeger, “Security in Computing”, 5th Edition, Prentice Hall, 2018.
2.	Micki Krause, Harold F. Tipton, “Handbook of Information Security Management”, Vol. 6, 6th Edition, CRC Press, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	make use of the basic concepts in information security and identify the type of attacks in a security breach.	Applying (K3)
CO2	identify the legal, ethical, professional issues in information security and apply security policies, standards and practices	Applying (K3)
CO3	interview the risks involved in information security and carry out risk assessment	Applying (K3)
CO4	utilize security technologies for protecting information	Applying (K3)
CO5	make use of various aspects of implementing information security and, paraphrase the issues and concerns related to staffing the information security	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	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

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

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

22CDE28-COMPUTER GRAPHICS							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**8**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course describes about the basic algorithms of 2D and 3D objects representation and applications of computer graphics	
Unit - I	**Introduction to Graphics**	**9**
Introduction - Graphics applications -Graphics systems – Output Primitive: Line, Circle and - Ellipse drawing algorithms – Attributes of Output Primitives		
Unit - II	**Two Dimensional Modeling**	**9**
Two Dimensional Geometric Transformations – Two Dimensional Clipping and Viewing – Structures and Hierarchical Modeling		
Unit - III	**Three Dimensional Concepts**	**9**
Three-Dimensional Concepts- Three-Dimensional Object Representations- Polygon and Quadric Surfaces- Splines- Curves - Fractal		
Unit - IV	**Three Dimensional Modeling**	**9**
Three-Dimensional Geometric and Modeling Transformations- Three-Dimensional Viewing - Visible-Surface Detection Methods		
Unit - V	**Color Models and Computer Animations**	**9**
Properties of Light – Standard Primaries – Color Model : XYZ– RGB – YIQ – CMY – HSV – Conversion between color Model. Design of Animation sequences – Animation Functions – Raster Animation – Key Frame Systems.		
		Total: 45

TEXT BOOK:

1.	Hearn, Donald and Baker, M. Pauline, "Computer Graphics - C Version", 2nd Edition, Pearson Education, India, 2008

REFERENCES:

1.	Alavala Chennakesava R., Computer Graphics, 1st edition,Prentice-Hall Of India Pvt. Limited,2009
2.	John F. Hughes, Andries Van Dam, Morgan Mcguire, David F. Sklar, James D. Foley , Steven K. Feiner, and Kurt Akeley, "Computer Graphics: Principles & Practice", 3rd Edition, Pearson Education, India, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	interpret the fundamental concepts of computer graphics and the components that constitute 2D and 3D graphics	Applying (K3)
CO2	manipulate 2D objects by applying transformation, clipping, and viewing operations	Applying (K3)
CO3	apply 3D concepts and 3D object representations	Applying (K3)
CO4	perform 3D transformations, viewing, projection and volume	Applying (K3)
CO5	make use of color models and computer animation	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO1 0	PO11	PO12	PS O1	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

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)**

22CDE29-SOFTWARE DEFINED NETWORKS							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Computer Networks**	**8**	**PE**	**3**	**0**	**0**	**3**
Preamble	This course provides an insight on programmability protocols, interfaces, controllers and its applications in various environments like data centers and service provider networks.						
Unit – I	**Introduction to SDN**						**9**
Introduction: Basic packet switching terminology – The modern data center – Traditional switch architecture – Autonomous and dynamic forwarding table. Evolution of switches and control planes – Cost – Data center innovation – Data center needs. The Genesis of SDN: The evolution of networking technology – Forerunners of SDN – Getting started with mininet and experimenting with mininet.							
Unit – II	**SDN and OpenFlow**						**9**
Fundamental characteristics of SDN – SDN operation – SDN devices – SDN controllers – Alternate SDN methods. The OpenFlow specification: OpenFlow overview – OpenFlow 1.0 and OpenFlow basics - OpenFlow 1.1 Additions - OpenFlow 1.2 Additions - OpenFlow 1.3 Additions – OpenFlow Limitations. NetApp Development: Simple forwarding in OpenDayLight controller.							
Unit – III	**SDN Interfaces**						**9**
Alternative definitions of SDN: Potential drawbacks of open SDN – SDN via APIs- SDN via hypervisor based overlays – SDN via opening up the device – Network Functions virtualization – Alternatives overlap and ranking. SDN open source: Open source licensing issues – OpenFlow source code – Switch implementation – Controller implementations – Orchestration and Network virtualization –Simulation, Testing and Tools – OpenStack – Applying SDN open source.							
Unit – IV	**SDN in the Data center**						**9**
Data center definition – Data center demands – Tunneling technologies for the data center – Path technologies in the data center –SDN and shortest path complexity – Ethernet fabrics in the data center – SDN use cases in the data center – Open SDN versus Overlays in the data center – Real-world data center implementation.							
Unit – V	**SDN environments and applications**						**9**
SDN in other environment – Wide area networks – Service provider and carrier networks – Campus networks – Hospitality networks –Mobile networks – In-Line network functions – Optical networks. SDN Applications: Reactive versus Proactive applications – A simple reactive Java application – Creating network virtualization tunnels – offloading flows in the data center – Access control for the campus – Traffic engineering for the service providers –NetApp Development: A simple Firewall.							
							Total:45

TEXT BOOK:

1.	Paul Goransson and Chuck Black, "Software Defined Networks: A Comprehensive Approach", 1st Edition, Morgan Kaufmann,2014.

REFERENCES:

1.	SiamakAzodolmolky, "Software Defined Networking with OpenFlow", Packet Publishing, 1st Edition, 2013.
2.	Thomas D. Nadeau and Ken Gray, "SDN: Software Defined Networks", O'Reilly Media, 1st Edition, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the programmability in the network using software defined network	Applying (K3)
CO2	model a networking task using OpenFlow protocol	Applying (K3)
CO3	identify the networking application using software defined network interfaces and open source tools	Applying (K3)
CO4	build the software defined network architecture in the data centers	Applying (K3)
CO5	utilize and develop various applications of SDN	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	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

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

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

22CDE30-VISUAL DESIGN AND COMMUNICATION							
Programme & Branch	**BE - Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**8**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course provides the origins of visual phenomena and principles for the arrangement of form and goal of design is to create supportive conditions for user experience. This course delivers the designer's intent to narrow the range of possible interpretations and to satisfy the user.	
Unit - I	**Introduction: An Evolving Context for Design**	**9**
Designing for experience: Making sense of experience–Experience and Time–Experience and Media–Denotation and Connotation–The vocabulary of visual messages: Elements - Composition– Code –Style.		
Unit - II	**Getting attention**	**9**
Introduction – Contrast - Figure-Ground – Camouflage – Color - Size constancy – Scale – Proportion – Proximity – Focus – Layering - Symmetry/Asymmetry – Closure – Continuity - Series and Sequences – Pattern - Rhythm and Pacing – Motion.		
Unit - III	**Orienting for use and interpretive behavior**	**9**
Introduction – Affordances – Channel - Medium and Format – Feedback – Way finding – Mapping – Hierarchy - Reading Pattern – Grouping - Edge Relationships – Direction - Point of View.		
Unit - IV	**Interpreting, interacting, and experiencing**	**9**
Introduction - Legibility and Readability - Denotation and Connotation – Framing – Abstraction - Icon, Index, and Symbol – Materiality – Substitution – Metaphor - Parallel Form – Appropriation – Ambiguity - Cognitive Dissonance.		
Unit - V	**Extending and retaining meaning**	**9**
Introduction - Schemas and Stereotypes – Narrative – Archetypes – Mnemonics – Chunking – Redundancy - Graphic Identity - Branding.		
		Total:45

TEXT BOOK:

1. Meredith Davis, Jamer Hunt, " Visual Communication Design An Introduction to Design Concepts in Everyday Experience", 1st Edition, Bloomsbury Publishing, 2017.

REFERENCES:

1. Jacinta Patterson and Joanne Saville, "Viscomm: A Guide to Visual Communication and Design", Cambridge University Press, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the concepts of visual elements in design	Applying (K3)
CO2	develop an attributes of design with visual elements	Applying (K3)
CO3	make use of channels, grouping and patterns	Applying (K3)
CO4	build a interpretation, interaction of visual design	Applying (K3)
CO5	model the elements to make graphical identity	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	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

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	25	60				100
CAT2	15	20	65				100
CAT3	15	20	65				100
ESE	10	20	70				100

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

22CDE31 - SPECIAL EFFECTS							
Programme & Branch	**B.E. – Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**8**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course focuses on learners to think about special effects and features.	
Unit - I	**Interactive Design – Words, Visuals, Space**	**9**
Introduction – Interactive imperative – Fundamentals of Language in IxD – User Conversations - Visual Direction in Interaction Design – Affordances — Size & Distance — Embracing Space.		
Unit - II	**Interactive Design – Time, Responsiveness, Behavior**	**9**
Introduction – Time - Interaction Design for Decision making - Delightfully Tricking Users With Animation - Designing for User Behavior -Reducing Friction for a Smooth Experience - Designing Delightful Interactions.		
Unit - III	**Animation Basics**	**9**
Animation: Most common uses of animation: Cartoons, simulations, scientific visualization – analysis – understanding - teaching - The Past: Cave Paintings - Egyptian murals - the magic lanterns - flipbooks - History of animation: Victorian parlor toys, Techniques of animation, other animation styles, Analyzing Animated Cartoons and their Evolution: History - Silent era - Feature films - commercialanimation		
Unit - IV	**Computer Animation**	**9**
Editorial cartoons: History and origin, Computer animation: Its history and animation methods - Computer animation in Film and TV, Limited animation - History and techniques — Motion capture - Advantages and disadvantages - Introduction to Multimedia and Animation -Introduction to Computer graphics and animation		
Unit - V	**Evaluation**	**9**
Introduction to Motion Picture - Origins of Visual Effects - In-Camera effects – VFX Cues – Tech and Digital Realm – VFX Concepts.		
		Total:45

TEXT BOOK:

1.	Interaction Design Best Practices", UXP in for unit I
2.	Interaction Design Best Practices – Mastering Time, Responsiveness and Behavior, UXP in, for unit II
3.	Dr. Jiang Tan, Äspects of Animation: Steps of Learn Animated Cartoons", Serial Publications Pvt. Ltd., 2016 for unit III & IV.
4.	Jon Gress ,"Visual Effects and Compositing", New Riders, 2014 for unit V.

REFERENCES:

1.	Wallace Jackson, "VFX Fundamentals Visual Special Effects using Fusion 8.0", Apress, 2016.
2.	Isaac Kerlow, "The art of 3D Computer Animation and Effects", Wiley Publishers, 4th Edition, 2009.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	make use of the basic concepts of interactive design in Words, Visuals, Space	Applying (K3)
CO2	interview the basics concepts of Interactive Design in Time, Responsiveness, Behavior	Applying (K3)
CO3	make use of basic animation	Applying (K3)
CO4	develop an application using computer animation	Applying (K3)
CO5	build basic visual effect application	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	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

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

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

22CDO01 - FUNDAMENTALS OF USER EXPERIENCE DESIGN							
(Offered by Department of Computer Science and Design)							
Programme & Branch	**All BE/BTech branches except CSD**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**5**	**OE**	**3**	**1**	**0**	**4**

Preamble	This subject will teach how to create amazing user experiences for products from scratch, user personas and also understand the importance of a good UX design and the role of a UX designer. It deals different stages of designing a UX and the application of various principles of psychology in UX design. Also learn how to conduct user research and market research, which is crucial to creating a great UX.	
Unit – I	**UX Design Process:**	**9+3**
What is UX? – UX Design Vs UI Design – Why is UX so Important – Full Stack Design – UX Design Process – Discovery and Planning – The UX Strategy – UX Research: Discover – Explore – Test – Listen – UX Analysis – Design – Production.		
Unit – II	**User Research:**	**9+3**
User Behavior Basics – The Gestalt Theory – Psychology in UX – User Research – Market Research Vs User Research – Benefits of User Research – Getting to Know Your Users – Grouping Customer Information – How to Conduct User Interviews?.		
Unit – III	**User Personas and Affinity Diagram:**	**9+3**
User Personas: What are User Personas? – Creating a Persona – Four Different Perspectives on Personas – Benefits of Personas – Affinity Diagrams: Affinity Diagram – Work Activity Affinity Diagram – Capture, Grouping and Labeling.		
Unit – IV	**Information Architecture and Visual Design Principles:**	**9+3**
Information Architecture: Navigation – Task Flow – Content Strategy – Site Map – Gestures – Basics of Visual Design – Lines – Shapes – Colors – Font/Typography – Textures – Forms – Design Principles – Alignment – Hierarchy – Contrast – Repetition – Proximity – Balance – Space – Visual Design Tools.		
Unit – V	**Wireframes and Prototyping**	**9+3**
What is Wireframe? – How to Create Wireframes? – Types of Wireframes – Wireframing Tools: Sketch Wireframes – Stenciling and Paper cutouts – Wireframing Software – What is Prototyping – Prototyping Methods – Paper Prototypes – Digital Prototypes – Coding Prototypes – The process of Creating Prototypes – Prototyping Tools.		
Lecture: 45, Tutorial: 15, Total: 60		

TEXT BOOK:

1.	Elvis Canziba “Hands-On UX Design for Developers: Design, Prototype, and Implement Compelling User Experiences from Scratch”, First Edition, Packet Publishing, 2018.

REFERENCES:

1.	Rex Hartson, Pardha S. Pyla, “The UX Book Process and Guidelines for Ensuring a Quality User Experience”, 1st Edition, Morgan Kaufmann Publisher, Elsevier, 2018.
2.	https://www.netsolutions.com/insights/information-architecture/ 2018
3.	https://boldist.co/design/gesture-based-interfaces/
4.	https://www.usertesting.com/blog/affinity-mapping

COURSE OUTCOMES: On completion 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	develop 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	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1				3	2	1		3	2
CO2	3	3	3	2	1				3	2	1		3	2
CO3	3	3	3	2	1				3	2	1		3	2
CO4	3	3	3	2	1				3	2	1		3	2
CO5	3	3	3	2	1				3	2	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	15	35	50				100
CAT2	15	35	50				100
CAT3	15	35	50				100
ESE	15	35	50				100

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

22CDX01 - FUNDAMENTALS OF USER INTERACTIVE DESIGN							
(Offered by Department of Computer Science and Design)							
Programme & Branch	**All BE/BTech branches except CSD**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**6**	**OE**	**3**	**0**	**2**	**4**

Preamble	This course gives perfect introduction to user interface design and explains how to design intuitive user interfaces by focusing on effective human communication.	
Unit - I	**Introduction**	**9**
UI Is Communication Concept - Communication Design Principles- UI Design Situation - Core Principles of UI Is Communication - Effective Communication - Intuitive UI- Necessary And Unnecessary Consistency - Unintuitive UI- Inductive UI- Deductive UI		
Unit - II	**Interaction and Visual Design**	**9**
Interactions -Controls - Commands - Labels And Instructions – Feedback - Task Steps and Navigation - Surfaces - Errors And Notifications - Dynamic Elements - Importance of Visual Design - Graphic Designers – Layout -- Typography And Text – Color - Affordances - Icons And Glyphs- Animations And Transitions - Demanding Attention.		
Unit - III	**Communication Design Process**	**9**
Communicating to People - Emotional Connection – Personality - Attributes - Good Tone -Motivating Users - Minimizing Effort - Forgiveness - Building Trustworthiness - Courageous Design - communication-driven design process- Basic design process – Mistakes - Planning phase - Design phase -Refinement phase.		
Unit - IV	**Material Design and Components**	**9**
Material Design: Introduction, Principles. Material Environment: Surfaces. Elevation. Light and Shadows. Basic Components: App bars Bottom and Top, Bottom Navigation, Buttons, Cards, Text Fields, Navigation Drawer.		
Unit - V	**Advanced Components**	**9**
Advanced Components: Backdrop, Checkboxes, Chips, Date Pickers, Dialogs, Dividers, Image List, Lists, Menus, Progress Indicators, Radio Buttons, Sheets – Bottom and Side, Sliders, Snackbars, Switches, Tabs, Tool Tips, Time Pickers.		

Lecture: 45, Practical:30, Total:75

List of Exercises / Experiments:

1.	Explore Figma Interface in Various tools in toolbar Layers, Assets, Pages Design Panel
2.	Apply design constraints to objects in your workflow
3.	Create Frames and grids and add it in Figma
4.	Apply Auto Layout to either frames or components in Figma
5.	Create and use Figma components in Your Design
6.	Create a style guide for your mobile and web application.
7.	Create a mockup mobile UI screens for any mobile app.
8.	Create a mockup web UI screens for any web application.
9.	Create Prototyping in Figma Prototype Panel Inspect Panel
10.	Create a Prototype for your mockup mobile and web application.
11.	Create a micro interaction in Figma
12.	Create a portfolio for your mockup mobile and web project.

TEXT BOOK:

1.	McKay, Everett N. UI is communication: How to design intuitive, user centered interfaces by focusing on effective communication. Newnes, 2013.

REFERENCES/SOFTWARE/MANUAL:

1.	https://material.io/components
2.	Figma tool
3.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	establish the baseline principles of UI design as a form of effective human communication	Applying (K3), Precision(S3)
CO2	make use of practical communication-based guide to interaction and visual design	Applying (K3), Precision(S3)
CO3	integrate the concepts of Communication-based design process from interaction to visual design	Applying (K3), Precision(S3)
CO4	apply the material design principles and its components used to create a user interface	Applying (K3), Precision(S3)
CO5	design a simple user interface by applying the advanced material components	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	2	1									2	1
CO2	3	2	2	1									2	1
CO3	3	2	2	1									2	1
CO4	3	2	2	1									2	1
CO5	3	2	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	15	35	50				100
CAT2	15	35	50				100
CAT3	15	35	50				100
ESE	15	35	50				100

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

22CDO02 - INTRODUCTION TO MOBILE GAME DESIGN							
(Offered by Department of Computer Science and Design)							
Programme & Branch	**All BE/BTech branches except CSD**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**7**	**OE**	**3**	**0**	**0**	**3**

Preamble	This course helps the students to provide the basic knowledge and practical guide to develop mobile games without prior knowledge or skills that are required to understand its contents.	
Unit - I	**Mobile Game Design Process**	**9**
Introduction – Mobile operating system – Mobile Indie Team: Roles – Basic Game Design Process – Do's and Don'ts of Game Design – Hardware Limitations – Design Constraints – Business models		
Unit - II	**User Interface Design for Mobile Games**	**9**
Roles of UI – UI in video games – Designing the UI: Aesthetics, vectors and rasters, Designing icons – UI Design Practices: Screen Flow, Wireframes, Button Size, Main Screen, Screen rotation, challenges – Mobile Game Engines.		
Unit - III	**Graphics and Audio for Mobile**	**9**
Graphics : Pixels and Vectors – Graphic file formats – 2D & 3D Graphic Assets – Character Designing – Colors for mobile – Audio: Digital Sound Technology – Recording and Playback – Types of Game sounds – Designing Audio – Practices for audio design.		
Unit - IV	**Mobile Game Controls and Coding**	**9**
Mobile Game controls: Input Technology – Touchscreens – Keypads – Touchscreen Gestures – Input Interfaces – Built-in devices – Future technologies – Coding Games: Programming language features – Game programming: C++, Java, HTML5, Xcode – Structure of Game program.		
Unit - V	**Prototyping**	**9**
Prototyping process: Defining – Building – Testing – Fixing – Styles: Horizontal and Vertical – Prototyping Types: Disposable code – Imagination – Pencil and Paper – Visual prototypes – Interactive prototypes – Tools for prototyping – Pitching a mobile game: Game Mechanics – Control scheme and Interface – Game Flow.		
		Total: 45

TEXT BOOK:

1. Dr. Claudio Scolastici, David Nolte, "Mobile Game Design Essentials", Packt Publishing Ltd, 2013

REFERENCES:

1. Manning, J., & Buttfield-Addison, P. (2017). "Mobile Game Development with Unity: Build Once, Deploy Anywhere". O'Reilly Media, Inc.
2. https://techbeacon.com/app-dev-testing/4-fundamentals-mobile-game-design

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	plan the most important design process to develop game	Applying (K3)
CO2	built user interface design for mobile games	Applying (K3)
CO3	make use of 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)

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	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

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	25	60				100
CAT2	10	35	55				100
CAT3	15	25	60				100
ESE	20	25	55				100

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

22CDO03 - INTRODUCTION TO GRAPHICS DESIGN							
(Offered by Department of Computer Science and Design)							
Programme & Branch	**All BE/BTech branches except CSD**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**7**	**OE**	**3**	**0**	**0**	**3**

Preamble	This course provides knowledge of principles of design and how they apply to various graphic designs and provides in- depth knowledge of major design formats and disciplines such as typography, interactive design, motion graphics and package design. This course will benefit the students to apply these design concepts and techniques in upcoming real world scenarios.	
Unit - I	**Fundamentals of Graphic Design**	**9**
Introduction – Graphic design, discipline, career competencies and expectations, importance of design. Basics – Formal elements of design, typographic shapes, HAUS, Laws of perceptual organization. Typography – Elements, Type Classifications, Designing with Type, Spacing, Web Type basics, Expressive typography. Design Process – Design Thinking, Five phase model of design process, Craftsmanship.		
Unit - II	**Concept Generation**	**9**
Concept Generation and Creativity – Design concept, concept generation process, Tools that stimulate creative thinking. Visualization, icons and color – Image classifications and depictions, signs and symbols, Icon design, Media, methods and visualization, Creating, selecting and manipulating images, Basics of visualizing form, drawing, using color. Composition.		
Unit - III	**Proportional systems, Formats and Disciplines**	**9**
Proportional Systems, the grid and Brochure design – Mathematical ratios and proportional systems, Grid. Posters - Purpose of posters, Social Commentary. Book covers – purpose of cover design, designing a cover, designing for a series.		
Unit - IV	**Branding and Advertising**	**9**
Branding and visual identity – Branding, purpose and process of branding, visual identity - purpose and designing, logo - purpose and designing, fundamentals of letterhead design. Advertising - .purpose, who creates advertising? , Role of storytelling and story building, designing ads, The Ad Campaign, Responsible advertising and being proactive.		
Unit - V	**Web, Mobile, Motion Design and Package Design**	**9**
Web, Mobile and Motion design – expectations from interactive experiences, Websites, Website Development, Conceptual development and visual design, Engaging content, Mobile design, Motion design, and Visual basics for screen based media. Package Design – purpose, considerations, Audio CD package design.		
		Total:45

TEXT BOOK:

1. Robin Landa, Graphic Design Solutions, 6thEdition, Cencage Learning,2019

REFERENCES:

1. Valerie Colston, Graphic Design: A Practical Guide for Librarians, 1stEdition, Rowman & Littlefield Publishers, 2019
2. Katherine A. Hughes, Graphic Design- Learn It, Do It, 1stEdition, CRC Press, 2019

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the formal elements, design principles and process.	Applying (K3)
CO2	build the concept generation process and creative thinking for real world design scenarios.	Applying (K3)
CO3	utilize the formats, disciplines and proportional systems.	Applying (K3)
CO4	model branding and logos and identity to products and advertising.	Applying (K3)
CO5	develop visual language in various projects and media channels including web, mobile and motion design and understand package design.	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	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

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

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

22CDX02 - VIRTUAL REALITY AND AUGMENTED REALITY							
(Offered by Department of Computer Science and Design)							
Programme & Branch	**All BE/BTech branches except CSD**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**8**	**OE**	**3**	**0**	**0**	**3**

Preamble	This course introduces the fundamentals of the Virtual Reality and Augmented Reality to efficiently incorporate user experience, identifying and resolving conflicts in real life. It aims to analyze the application of AR and VR in architecture, gaming, entertainment etc.

Unit - I	**Design ,Art Across Digital Realities and eXtended Reality**	**9**

How Humans Interact with Computers-Modalities Through the Ages-Types of Common HCI Modalities -The Current State of Modalities for Spatial Computing Devices - Current Controllers for Immersive Computing Systems-A Note on Hand Tracking and Hand Pose Recognition-Designing for Our Senses, Not Our Devices-Sensory Design-Five Sensory Principles. Virtual Reality for Art-3D Art Optimization-Introduction-Draw Calls- Using VR Tools for Creating 3D Art -Acquiring 3D Models Versus Making Them from Scratch.

Unit - II	**Hardware, SLAM, Tracking**	**9**

How the Computer Vision That Makes Augmented Reality Possible Works-A Brief History of AR- Select an AR Platform-Mapping-Platforms- Apple's ARKit- Other Development Considerations –Lighting-The AR Cloud- The Dawn of the AR Cloud-The Bigger Picture—Privacy and AR Cloud Data.

Unit - III	**Creating Cross-Platform Augmented Reality and Virtual Reality**	**9**

Virtual Reality and Augmented Reality: Cross-Platform Theory-The Role of Game Engines-Understanding 3D Graphics-Portability Lessons from Video Game Design-Simplifying the Controller Input-Virtual Reality Toolkit: Open Source Framework for the Community-Three Virtual Reality and Augmented Reality Development Best Practices.

Unit - IV	**Enhancing Data Representation: Data Visualization and Artificial Intelligence in Spatial Computing**	**9**

Data and Machine Learning Visualization Design and Development in Spatial Computing-Introduction-Understanding Data Visualization-Principles for Data and Machine Learning Visualization-2D Data Visualizations versus 3D Data Visualization-Animation-Data Representations, Infographics, and Interactions-3D Reconstruction and Direct Manipulation of Real-World Data.

Unit - V	**Character AI ,Behaviors and Use Cases in Embodied Reality**	**9**

Introduction - Behaviors -Current Practice: Reactive AI-More Intelligence in the System: Deliberative AI-The Virtual and Augmented Reality Health Technology Ecosystem-VR/AR Health Technology Application Design - Standard UX Isn't Intuitive-The Fan Experience: SportsXR.

Total:45

TEXT BOOK:

1. Creating Augmented and Virtual Realities by Erin Pangilinan, Steve Lukas, Vasanth Mohan Released March 2019,Publisher(s): O'Reilly Media, Inc.,ISBN: 9781492044147

REFERENCES:

1. Paul Mealy,Virtual & Augmented Reality For Dummies,ISBN: 978-1-119-48134-8 July 2018

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the fundamentals of Design ,Art Across Digital Realities and extended Reality	Applying (K3)
CO2	make use of the components of Hardware, SLAM, and Tracking	Applying (K3)
CO3	apply the concept by creating Cross-Platform Augmented Reality and Virtual Reality	Applying (K3)
CO4	apply the techniques for enhancing Data Representation of Data Visualization and Artificial Intelligence in Spatial Computing	Applying (K3)
CO5	demonstrate the character of AI ,behaviors and Use Cases in Embodied Reality	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	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

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

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

22GEO01 - GERMAN LANGUAGE LEVEL 1							
(Offered by Department of Electronics and Communication Engineering)							
Programme& Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**All**	**OE**	**4**	**0**	**0**	**4**

Preamble	This course serves as an introduction to the German language and awareness towards German lifestyle and cultural aspects of Germany and German speaking countries. One can learn to introduce oneself and able to gain the basic day to day vocabulary. On keen learning one would be able to understand the sentence structure and be able to reciprocate to basic questions	
Unit – I	**Good Day (Guten Tag)**	**12**
Greetings, Self-introduction and introducing others, Numbers, Alphabets, Countries and languages spoken. Grammar – W questions, Simple sentences, Verb conjugation and personal pronoun.		
Unit – II	**Friends & Colleague (Freund und Kollegen):**	**12**
Hobbies, Profession, Week, Months, Season and Generate Profile. Grammar – Articles, Plural, Verbs – have and to be, Yes/No questions.		
Unit – III	**n the City (In der Stadt):**	**12**
Name of places/buildings in the city, asking for directions, Understanding means of transport. Grammar – definite and indefinite articles, Negation articles and Imperative		
Unit – IV	**Food and Appointment (Essen und Termin):**	**12**
Food, Shopping, initiate conversations to understand and do shopping. Grammar – Accusative case, Verbs with Accusative. Understanding time and reciprocating, Appointments, Asking excuse, Family. Grammar – Prepositions: *am, um, von...bis,* Possessive articles- *mein, dein*.., Modal verbs- *müssen, können, wollen*		
Unit – V	**Socializing (Zeit mit Freunden):**	**12**
Planning together, Birthday, Invitation, Restaurant, looking for specific information in texts. Grammar – Separable verbs, Prepositions with Accusative case, Past tense of have and to be, Personal pronoun with Accusative.		
		Total:60

TEXT BOOK:

1.	Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber, “Netzwerk Deutsch als Fremdsprache A1–ursbuch, Arbeitsbuch und Glossar with 2 CDs”, Goyal Publishers, Delhi, 2015.

REFERENCES:

1.	https://ocw.mit.edu – Massachusetts Institute of Technology Open Courseware
2.	https://www.dw.com/en/learn-german - Deutsche Welle, Geramany’s International Broadcaster

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	understand structure of language and introducing each other	Remembering (K1)
CO2	understand vocabulary on seasons and basic verbs	Understanding (K2)
CO3	ask for directions in a new place and avail transport as required	Understanding (K2)
CO4	understand food habits of German and ask for appointments.	Understanding (K2)
CO5	learn to socialize in a German speaking country	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								1	2	3		3		
CO2								1	2	3		3		
CO3								1	2	3		3		
CO4								1	2	3		3		
CO5								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	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)

22GEO02 - JAPANESE LANGUAGE LEVEL 1							
(Offered by Department of Electronics and Communication Engineering)							
Programme& Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**All**	**OE**	**4**	**0**	**0**	**4**

Preamble	The basic level of Japanese which provides understanding of Hiragana, Katakana and 55 Kanjis also enables one to greet, introduce oneself and other person and also provides the ability to understand basic day to day conversations	
Unit – I	**Introduction to Hiragana and Katakana:**	**12**
Chart 1, Chart 2, Chart 3, Annexures 1 and 2 and basic Japanese rules along with similar sounded vocabularies for each chart.		
Unit – II	**Introduction to Nouns, various particles and usages:**	**12**
Forming simple sentences, asking questions, positioning differentiation and owning fundamentals – new particles and usages		
Unit – III	**Introduction of Verbs, time and place markers:**	**12**
Usage of action words in sentences and framing them – place and time markers usages – giving and receiving – omission of certain particles in a sentence.		
Unit – IV	**Introduction of Adjectives, Adverbs and usages:**	**12**
Describing nouns and verbs and framing them to relate day to day conversations- positive and negative ending of the same – introduction of the likes and dislikes expressions		
Unit – V	**Introduction to Counters and Kanji:**	**12**
How to use numbers-How to use quantifiers-Present form of adjectives and Nouns-Other necessary particles-How to use numbers and quantifiers – 55 kanji characters		
		Total:60

TEXT BOOK:

1. "MINNA NO NIHONGO–Japanese for Everyone", 2nd Edition, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2017.

REFERENCES:

1. Margherita Pezzopane, "Try N5", 2nd Edition, Tankobon Softcover, Japan, 2017.
2. Sayaka Kurashina, "Japanese Word Speedmaster", 2nd Edition, Tankobon Softcover, Japan, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	read and understand typical expression in Hiragana and Katakana	Remembering (K1)
CO2	greet and introduce oneself and other	Understanding (K2)
CO3	communicate day to day conversations – basic level	Understanding (K2)
CO4	understand the Kanjis in Japanese Script	Understanding (K2)
CO5	comprehend concept of numbers, days, months, time and counters	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								1	2	3		3		
CO2								1	2	3		3		
CO3								1	2	3		3		
CO4								1	2	3		3		
CO5								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	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)

22GEO03 - DESIGN THINKING FOR ENGINEERS							
(Offered by Department of Computer Science and Engineering)							
Programme & Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5**	**OE**	**3**	**1**	**0**	**4**

Preamble	Design Thinking is human-centered problem solving tool which emphasize on empathy, collaboration, co-creation and stakeholder feedback to unlock creativity and innovation, to devises feasible and viable idea/solutions.	
Unit – I	**Design Thinking and Explore:**	**9+3**
Design Thinking: Key Principles and Mindset – Five Phases, Methods and Tools of Design Thinking – User Guide – Foundation Building for Design Thinking – **Explore**: Methods & Tools – STEEP Analysis – Strategic Priorities – Activity System – Stakeholder Mapping – Opportunity Framing.		
Unit – II	**Empathize**	**9+3**
Empathize: Methods & Tools – Field Observation – Deep User Interview – Empathy Map – User Journey Map - Need Finding – User Insights - User Persona Development.		
Unit – III	**Experiment**	**9+3**
Experiment: Methods & Tools – Ideation – SCAMPER – Analogous Inspiration – Deconstruct & Reconstruct – User Experience Journey – Prototyping– Idea Refinement.		
Unit – IV	**Engage**	**9+3**
Engage: Methods & Tools – Story Telling – Art of Story Telling – Storyboarding – Co-Creation with Users – Collect Feedback from Users.		
Unit – V	**Evolve**	**9+3**
Evolve: Methods & Tools – Concept Synthesis – Strategic Requirements –Evolved Activity Systems – Activity System Integration – Viability Analysis – Innovation Tools using User Needs, CAP, 4S – Change Management - Quick Wins.		
Lecture:45, Tutorial:15, Total:60		

TEXT BOOK:

1.	Lee Chong Hwa, "Design Thinking The Guidebook", Design Thinking Master Trainers of Bhutan, 2017. (E-Book)

REFERENCES:

1.	Jeanne Liedtka and Tim Ogilvie, "Designing for Growth: A Design Thinking Tool Kit for Managers", Columbia University Press, 2011.
2.	Jeanne Liedtka, Tim Ogilvie, and Rachel Brozenske, "The Designing for Growth FieldBook: A Step-by-Step Project Guide", Columbia University Press, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Construct design challenge and reframe the design challenge into design opportunity.	Applying (K3)
CO2	Interview the user, and know the feelings of users to foster deep user understanding and be able to uncover the deep user insights and needs.	Applying (K3)
CO3	Develop ideas and prototypes by brain storming using the ideation tools.	Applying (K3)
CO4	Organize the user walkthrough experience using ideal user experience journey.	Applying (K3)
CO5	Develop smart strategies & implementation plan that will deliver/achieve the idea/solution deduced from earlier phases.	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	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

ASSESSMENT PATTERN – THEORY

Tests	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT 1	10	20	70				100
CAT 2	10	15	75				100
CAT 3	10	15	75				100
ESE	10	15	75				100

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

22GEO04 - INNOVATION AND BUSINESS MODEL DEVELOPMENT							
(Offered by Department of Mechatronics Engineering)							
Programme & Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**6**	**OE**	**3**	**1**	**0**	**4**

Preamble	This course will inspire the students to think innovation concepts and ideas for business model developments.	
Unit - I	**Innovation and Design Thinking:**	**9+3**
Innovation and Creativity– Types of innovation – challenges in innovation- steps in innovation management- 7 concerns of design. Design Thinking and Entrepreneurship – Design Thinking Stages: Empathize – Define – Ideate – Prototype – Test. Design thinking tools: Analogies – Brainstorming – Mind mapping		
Unit - II	**User Study and Contextual Enquiry:**	**9+3**
Explanatory research – primary and secondary data – classification of secondary data – sources of secondary data – qualitative research – focus groups – depth interviews – analysis of qualitative data – survey methods – observations- Process of identifying customer needs –organize needs into a hierarchy –establish relative importance of the needs- Establish target specifications		
Unit - III	**Product Design:**	**9+3**
Techniques and tools for concept generation, concept evaluation – Product architecture –Minimum Viable Product (MVP)- Product prototyping – tools and techniques– overview of processes and materials – evaluation tools and techniques for user-product interaction		
Unit - IV	**Business Model Canvas (BMC):**	**9+3**
Lean Canvas and BMC - difference and building blocks- BMC: Patterns – Design – Strategy – Process–Business model failures: Reasons and remedies		
Unit - V	**IPR and Commercialization:**	**9+3**
Need for Intellectual Property- Basic concepts - Different Types of IPs: Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design– Patent Licensing - Technology Commercialization – Innovation Marketing		
Lecture:45, Tutorial:15, Total:60		

TEXT BOOK:

1. Rishikesha T.Krishnan, “8 Steps To Innovation: Going From Jugaad To Excellence”, Collins India, 2013.

REFERENCES:

1. Peter Drucker, “Innovation and Entrepreneurship”, Routledge CRC Press, London, 2014.
2. Eppinger, S.D. and Ulrich, K.T. “Product design and development”, 7th edition, McGraw-Hill Higher Education, 2020.
3. Alexander Osterwalder, “Business model generation: A handbook for visionaries, game changers, and challengers”, 1st edition, John Wiley and Sons; 2010
4. Indian Innovators Association, “Patent IPR Licensing – Technology Commercialization – Innovation Marketing: Guide Book for Researchers, Innovators”, Notion Press, Chennai, 2017

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	understand innovation need and design thinking phases	Understanding (K2)
CO2	identify, screen and analyse ideas for new products based on customer needs	Analysing (K4)
CO3	develop and analyse the product concepts based on the customer needs and presents the overall architecture of the product.	Analysing (K4)
CO4	predict a structured business model for MVP	Applying (K3)
CO5	practice the procedures for protection of their ideas' IPR	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	3	3	3	3	2	2	2	2	3	3	3	3		
CO3	2	2	3	3	3	3	3	3	3	3	3	3		
CO4				3	2	2	2	3	3	3	3	3		
CO5				3	2	2		3	2	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	30	40	10			100
CAT2	20	30	40	10			100
CAT3	30	30	40				100
ESE	20	30	30	20			100

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

22GEO05 - GERMAN LANGUAGE LEVEL 2							
(Offered by Department of Electronics and Communication Engineering)							
Programme& Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	German Language Level 1	**All**	**OE**	**4**	**0**	**0**	**4**

Preamble	This course aims to help the learner to acquire the vocabulary as per the Common European framework of German language A1 level competence. This course will help to assimilate the basic grammar structures and gain vocabulary to understand and reciprocate in daily life situations on a broader sense. A thorough learner will be able to gain a comprehensive understanding of the German grammar and confidently articulate in day today situations

Unit – I	**Contacts(Kontakte):**	**12**
Understanding Letters, simple instructions, speaking about language learning, finding specific information in text, Acknowledging the theme and understanding conversations, Making appointments. Grammar – Preposition with Dative, Articles in Dative and Accusative possessive articles.		
Unit – II	**Accomodation(Die Wohnung):**	**12**
Understanding Accommodation advertisements, describing accommodation and directions, responding to an invitation, Expressing feelings, Colours. Grammar – Adjective with to be verb, Adjective with *sehr/zu*, Adjective with Accusative, prepositions with Dative		
Unit – III	**Are you Working?(Arbeiten Sie):**	**12**
Daily Schedule, speaking about past, understanding Job openings advertisements, Opinions, Telephonic conversations, Speaking about Jobs. Grammar – Perfect tense, Participle II – regular and irregular verbs, Conjunctions – *und, oder, aber*		
Unit – IV	**Clothes and Style(Kleidung und mode):**	**12**
Clothes, Chats on shopping clothes, reporting on past, Orienting oneself in Supermarkets, Information and research about Berlin. Grammar – Interrogative articles and Demonstrative articles, Partizip II – separable and non-separable verbs, Personal pronouns in Dative, Verbs with Dative		
Unit – V	**Health and Vacation(Gesundheit und Urlaub):**	**12**
Personal information, Human Body parts, Sports, Understanding instructions and prompts, health tips. Grammar – Imperative with *du/Ihr*, Modal verbs – sollen, müssen, nicht dürfen, dürfen. Suggestions for travel, Path, Postcards, weather, Travel reports, Problems in hotel, Tourist destinations. Grammar – Pronoun: *man*, Question words – *Wer, Wen, Was, Wem*, Adverbs – *Zuerst, dann, Später, Zum Schl*		
		Total:60

TEXT BOOK:

1.	Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber, “Netzwerk Deutsch als Fremdsprache A1–ursbuch, Arbeitsbuch und Glossar with 2 CDs”, Goyal Publishers, Delhi, 2015.
2.	

REFERENCES:

1.	https://ocw.mit.edu – Massachusetts Institute of Technology Open Courseware
2.	https://www.dw.com/en/learn-german - Deutsche Welle , Geramany’s International Broadcaster

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	understand letters and simple texts	Remembering (K1)
CO2	assimilate vocabulary on Accommodation and invitation	Understanding (K2)
CO3	comprehend concept of time, telephonic conversation and job-related information	Understanding (K2)
CO4	understand how to do shopping in a German store	Understanding (K2)
CO5	understand body parts and how to plan personal travel	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								1	2	3		3		
CO2								1	2	3		3		
CO3								1	2	3		3		
CO4								1	2	3		3		
CO5								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	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)

22GEO06-GERMAN LANGUAGE LEVEL 3							
(Offered by Department of Electronics and Communication Engineering)							
Programme& Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	German Language Level 2	**All**	**OE**	**3**	**0**	**0**	**3**

Preamble	This course provides enriching information about various everyday situations in personal and professional life and enhances the vocabulary and speaking ability to respond to and also seek information in those situations. It also equips one to express opinions and negotiate appointments. With diligent learning one can capture all basic grammatical structure to answer confidently in everyday situations.

Unit – I	**All about food (Rund Ums Essen):**	**9**
Understand information about person, Speak about food, Introduce self and others, Understand and explain a picture base story, To justify something, To speak about feelings, To express opinions, To answer questions on a text, To describe a restaurant. Grammar: Possessive Articles in Dative, Yes/No questions, Reflexive verbs, Sentence with 'weil'		
Unit – II	**School days (Nach der Schulzeit):**	**9**
Understand School reports, Speak and write comments about schooldays, To speak about habits, Understand and provide City-Tipps, To Understand School types in Germany and speak about it. Grammar: Modal verbs in Past tense, Positional Verbs, Two-way prepositions in Dativ and Akkusativ.		
Unit – III	**Media in everyday life (Medien in Alltag):**	**9**
To speak about advantages and disadvantages of Media, formulate comparisons, Express your own opinion, Talk about Movies, Understand and Write Movie reviews. Grammar: Comparative degree, Comparative Sentences with 'Als' and 'Wie', Subordinate clause with 'dass', Superlative degree.		
Unit – IV	**Feelings and expressions (Gefühle):**	**9**
Express thanks and congratulations, Talk about feelings, To understand information about festivals and speak about it, To describe a city, Express joy and regrets, Understand and write Blog entries, Write appropriate heading. Grammar: Subordinate Clause with 'Wenn', Adjectives to be used along with definite articles.		
Unit – V	**Profession and Travel (Beruf und Reisen):**	**9**
To have a conversation at ticket counter, To talk about leisure activities, To gather information from Texts, Introduce people, Express career preferences, Ideate the dream job, To prepare and make telephone calls, To understand text about Workplace. Ask for information, Express uncertainty, Understand and give directions, Understand a newspaper article, Say your own opinion, Talk about the way to work, Describe a statistic, Understand information about a trip, Talk about travel. Grammar: Adjective to be used along with indefinite articles, Prepositions, verb – 'werden', Subordinate clause – indirect questions, All units will include elements for reading, writing, speaking and listening.		

Total:45

TEXT BOOK:

1.	Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber, "Netzwerk Deutsch als Fremdsprache A1–ursbuch, Arbeitsbuch und Glossar with 2 CDs", Goyal Publishers, Delhi, 2015
2.	

REFERENCES:

1.	Rosa-Maria Dallapiazza , Eduard von Jan, Till Schonherr, "Tangram 2 (German)" , Goyal Publishers, Delhi, 2011.
2.	https://www.dw.com/en/learn-german - Deutsche Welle , Geramany's International Broadcaster

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	understand German food style, restaurant and be able express oneself.	Remembering (K1)
CO2	understand German school system and discuss about habits and provide City-Tipps	Understanding (K2)
CO3	analyze and compare media in everyday life.	Understanding (K2)
CO4	express feelings, describe a city and write blog entries.	Understanding (K2)
CO5	seek and provide information in a professional setup, give directions to others and talk about travel	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								1	2	3		3		
CO2								1	2	3		3		
CO3								1	2	3		3		
CO4								1	2	3		3		
CO5								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	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)

22GEO07-GERMAN LANGUAGE LEVEL 4							
(Offered by Department of Electronics and Communication Engineering)							
Programme& Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**German Language Level 3**	**All**	**OE**	**3**	**0**	**0**	**3**

Preamble	This course imparts knowledge about interacting with external world, understanding various cultural aspects, behaviour and addressing relationships in personal and professional front. It helps one to understand reports from various media and at work. Enhance learner's grammatical exposure and cover the core basic grammatical concepts which would lay the foundation to have a better hold of the language. With focused learning one should be able to read and respond to reports, write simple formal and informal letters and text messages and be able to engage in simple conversations in known situations.	
Unit – I	**Learning (Lernen):**	**9**
Understanding and describing learning problems, Understanding and giving advice, Giving reasons, Understanding reports about everyday work life, Talking about everyday working life, Understanding a radio report, Understanding and making a mini-presentation. Grammar: Conjunctions- denn,weil, Konjuntiv II: Sollte(suggestions), Genitive, Temporal prepositions – bis, über + Akkusativ,ab+dativ		
Unit – II	**Athletic (Sportlich):**	**9**
Expressing enthusiasm, hope, disappointment, Understanding and writing fan comments, Formulating follow-ups, Making suggestions and reacting, Making an appointment, Understanding a report about an excursion, Understanding difficult texts, Introducing a tourist attraction. Grammar: Conjunctions – deshalb, trotzdem, Verbs with Dativ and Akkusativ		
Unit – III	**Living Together (Zusammen Leben):**	**9**
To complain, apologize & give in, As for something, Understand experience reports, Report on the past, Talk about pets, Respond to information, Write and correct a story. Grammatik: Konjunctiv II- könnte, Subordinate clauses – als and Wenn.		
Unit – IV	**Good Entertainment (Gute Unterhaltung):**	**9**
Talk about music style, Buy concert tickets, Introduce a musician / band, Understand newspaper reports, Give more detailed information about a person, Understand information about painting, Understand description of a picture, Describe a picture. Grammatik: Interrogative Articles: Was fuer eine? , Pronouns – man/jemand/niemand and alles/etwas/nichts , Relative sentences in Nominativ		
Unit – V	**Passage of time and Culture (Zeitablauf & Kultur):**	**9**
Talk about wishes, Express wishes, Give Suggestions, Understand a conversation, Plan something together, To ask others something, Understand a text, Exchange information, Talk about proverbs, write a story. Understand information about other cultures, Discuss about behavior, Express intentions, Use the appropriate salutation, Understand tips in a text, Talk about forms of addressing others, Give more information, Discuss about clichés and write about them. All units will include elements for reading, writing, speaking and listening. Grammatik: Konjunctiv II (Wishes, Suggestions), Verbs with prepositions, W- questions with prepositions, Relative sentences in Akkusativ, Subordinate clauses with damit and Um…Zu.		
		Total:45

TEXT BOOK:

1.	Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber, "Netzwerk Deutsch als Fremdsprache A1–ursbuch, Arbeitsbuch", Goyal Publishers, Delhi, 2015.

REFERENCES:

1.	Rosa-Maria Dallapiazza, Eduard von Jan, Till Schonherr, "Tangram 2 (German)", Goyal Publishers, Delhi, 2011.
2.	https://www.dw.com/en/learn-german - Deutsche Welle, Geramany's International Broadcaster

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	leverage learning in Workplace, understanding reports and make presentation.	Remembering (K1)
CO2	reciprocate to different situations, make appointment and understand texts.	Understanding (K2)
CO3	handle relationships and respond appropriately to exchange information	Understanding (K2)
CO4	familiarize to various channels of entertainment	Understanding (K2)
CO5	know about various cultural aspects, usage of proverbs and cliches.	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								1	2	3		3		
CO2								1	2	3		3		
CO3								1	2	3		3		
CO4								1	2	3		3		
CO5								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	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)

22GEO08 - JAPANESE LANGUAGE LEVEL 2							
(Offered by Department of Electronics and Communication Engineering)							
Programme& Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Japanese Language Level 1**	**All**	**OE**	**4**	**0**	**0**	**4**

Preamble	The basic level of Japanese which provides understanding of Hiragana, Katakana and 110 Kanjis and provides the ability to understand basic conversations and also enables one to request other person and also understand Casual form	
Unit – I	**Introduction to groups of verbs:**	**12**
tai form-Verb groups-te form-Give and ask permission to do an action-Present continuous form-Restrict other person from doing an action-nouns-Basic Questions		
Unit – II	**Introduction to Casual Form:**	**12**
nai form-Dictionary form-ta form-Polite style and Casual style differences-Conversation in plain style-Place of usage of Polite style and Casual style		
Unit – III	**Express opinions and thoughts:**	**12**
Introduction to new particle-Express someone one's thought-Convey the message of one person to another-Ask someone if something is right -Noun modifications		
Unit – IV	**Introduction to If clause and remaining Kanjis:**	**12**
If clause tara form-Express gratitude for an action done by other person-Hypothetical situation-Particles to use in case of Motion verbs-50 Kanjis		
Unit – V	**Introduction to giving and receiving with te form and "when, even if" usages:**	**12**
Providing to and getting from differences - Understanding of situations and framing sentences using when and even if..etc.		
		Total:60

TEXT BOOK:

1.	"MINNA NO NIHONGO–Japanese for Everyone", 2nd Edition, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2017

REFERENCES:

1.	Margherita Pezzopane, "Try N5", 2nd Edition, Tankobon Softcover, Japan, 2017.
2.	Sayaka Kurashina, "Japanese Word Speedmaster", 2nd Edition, Tankobon Softcover, Japan, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	differentiate groups of verbs and its forms	Remembering (K1)
CO2	understand Polite form and Casual form of Japanese	Understanding (K2)
CO3	comprehend personal communication and express greetings	Understanding (K2)
CO4	understand the Kanjis in Japanese Script and If clause	Understanding (K2)
CO5	comprehend concept of “even if”, “when” and job-related information	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								1	2	3		3		
CO2								1	2	3		3		
CO3								1	2	3		3		
CO4								1	2	3		3		
CO5								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	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)

22GEO09 - JAPANESE LANGUAGE LEVEL 3							
(Offered by Department of Electronics and Communication Engineering)							
Programme& Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Japanese Language Level 2**	**All**	**OE**	**3**	**0**	**0**	**3**

Preamble	The intermediate level of Japanese which provides understanding of all forms ofverbs, adverbs, conjunctions, etc. which includes 150 Kanji's and provides the ability to comprehend conversations encountered in daily life	
Unit – I	**Introduction to Potential verbs:**	**9**
Causes and Reasons-Favouring Expressions-Expressing a State-Potential Verb Sentences-Simultaneous actions-Verb Groups-te Form-Customary Actions-Nouns-Basic Questions and Kanji's.		
Unit – II	**Introduction to Transitive and Intransitive verbs:**	**9**
Consequence of verbs- Embarrassment about Facts- Consequence of Verbs with an Intentions-Affirmative Sentences- Conjunctions-Basic Questions and kanji's.		
Unit – III	**Introduction to Volitional forms:**	**9**
Expressions of Speakers Intention-Expressing Suggestion or Advice-Usage of Adverbs and Quantifiers-Basic Questions and kanji's.		
Unit – IV	**Introduction to Imperative and Prohibitive verbs:**	**9**
Commanding person- Interrogatives-Expressions of Third Person-Actions and its Occurrence - Possibilities of an Action-Changing of States Basic Questions and Kanji's.		
Unit – V	**Introduction to Conditional form and Passive verbs:**	**9**
Description of Requirement and Speaker's Judgement, HabitualActions, Directions and suggestions-Passive forms of Verbs-Basic Questions and Kanji's.		
		Total:45

TEXT BOOK:

1.	"MINNA NO NIHONGO–Japanese for Everyone", 2nd Edition, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2017.

REFERENCES:

1.	Margherita Pezzopane, "Try N5", 2nd Edition, Tankobon Softcover, Japan, 2017.
2.	Sayaka Kurashina, "Japanese Word Speedmaster", 2nd Edition, Tankobon Softcover, Japan, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	read and understand BasicVocabularies.	Remembering (K1)
CO2	understand Conversations used in daily life.	Understanding (K2)
CO3	comprehend personal communication and express greetings.	Understanding (K2)
CO4	understand the Kanji's in Japanese Script.	Understanding (K2)
CO5	comprehend Coherent conversations in everyday situations.	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								1	2	3		3		
CO2								1	2	3		3		
CO3								1	2	3		3		
CO4								1	2	3		3		
CO5								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	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)

22GEO10 -JAPANESE LANGUAGE LEVEL 4							
(Offered by Department of Electronics and Communication Engineering)							
Programme& Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**JAPANESE LANGUAGE LEVEL 3**	**All**	**OE**	**3**	**0**	**0**	**3**

Preamble	The intermediate level of Japanese provides understanding of expressions of verbs, its pattern, Relationships which also includes 150 Kanji's and also provides the ability to understand relationship among the people.	
Unit – I	**Introduction to Reasoning:**	**9**
Causes and Sequences-Causes and Effects-Interrogative Patterns-Adjective as a Noun -Basic Questions and Kanji's		
Unit – II	**Introduction to Exchanging of things:**	**9**
Expressions for Giving and Receiving of Things-Polite Expression of Request-Indicating a Purpose of Actions-Basic Quantifiers-Basic Questions and kanji's.		
Unit – III	**Introduction to States of an Action:**	**9**
Sentence Pattern to Indicate Appearance-Degree of Action and State-Adjectives as Adverbs- Convey information -Basic Questions and kanji's.		
Unit – IV	**Introduction to Causative Verbs:**	**9**
Causative Forms of Verbs-Asking Opportunity to do something-Hypothetical Questions-Judgement and Course of an actions-Basic Questions and Kanji's.		
Unit – V	**Introduction to Relationship in Social Status:**	**9**
Honorific expressions- Respectful expressions- Humble expressions-Polite expressions-Basic Questions and Kanji's.		
		Total:45

TEXT BOOK:

1. "MINNA NO NIHONGO–Japanese for Everyone", 2nd Edition, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2017.

REFERENCES:

1. Margherita Pezzopane, "Try N5", 2nd Edition, Tankobon Softcover, Japan, 2017.
2. Sayaka Kurashina, "Japanese Word Speedmaster", 2nd Edition, Tankobon Softcover, Japan, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	read and Understand Relationship of a Person.	Remembering (K1)
CO2	understand Conversations Used in Everyday Activities.	Understanding (K2)
CO3	comprehend Contents at Near Natural Speed.	Understanding (K2)
CO4	understand the Kanji's in Japanese Script..	Understanding (K2)
CO5	comprehend Orally Presented Materials.	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								1	2	3		3		
CO2								1	2	3		3		
CO3								1	2	3		3		
CO4								1	2	3		3		
CO5								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	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)

22GEO11 - FRENCH LANGUAGE LEVEL 1							
(Offered by Department of Electronics and Communication Engineering)							
Programme& Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Fundamentals of French Language**	**All**	**OE**	**4**	**0**	**0**	**4**

Preamble	This course provides a foundation of the French language as well as an understanding of the French culture and lifestyle of France and other French-speaking nations. The student will be learning how to introduce him/herself and acquire basic everyday vocabulary. By following the structured curriculum and practicing the same as per the learning process, one can comprehend the structure of sentences and respond to basic communications	
Unit – I	**Introduction**	**12**
French and French culture, alphabets, pronunciation, accents, rules, and terms for pronunciation (mas-fem), Salutations, numbers.		
Unit – II	**Daily Life**	**12**
Subject Pronoun, Francophonie's, adjectives – colors, week, months, seasons.		
Unit – III	**Articles and Verbs**	**12**
Articles - Indefinite, definite, partitive, and contracted, (examples), introductions to verbs, 1st group of verb		
Unit – IV	**In the City**	**12**
2nd group of verbs, irregular verbs (avoir, etre, faire …..) present yourself & negative sentences. (faire and Jouer verb with the expressions)		
Unit – V	**Food and Culture**	**12**
Prepositions – preposition of places (country, cities and etc), Imperative mode, invitations, culture – food (wine, cheese ….) Future (recent future)		
		Total:60

TEXT BOOK:

1.	A1 – saison

REFERENCES:

1.	Apprenons les francais – 0 and 1
2.	Grammaire – langue et de civilization francaises – Mauger G, Les idees – 0 and 1

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Understand the grammatical structure of the language and introduce self to others.	Remembering (K1)
CO2	Understand basic verbs and appropriate vocabulary.	Understanding (K2)
CO3	Ask for directions and arrange for transportation, etc, as needed.	Understanding (K2)
CO4	Understand the food habits of France and ask for appointments	Understanding (K2)
CO5	Learn to socialize in French-speaking countries	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								1	2	3		3		**2**
CO2								1	2	3		3		2
CO3								1	2	3		3		2
CO4								1	2	3		3		2
CO5								1	2	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	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)

22GEO12 -FRENCH LANGUAGE LEVEL 2							
(Offered by Department of Electronics and Communication Engineering)							
Programme& Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Fundamentals of French Language**	**All**	**OE**	**4**	**0**	**0**	**4**

Preamble	This course is designed to assist students in developing vocabulary in accordance with the Common European Framework of Reference for Languages at the A2 level. This course will aid in the integration of basic grammar structures as well as the acquisition of vocabulary necessary to comprehend and respond in everyday circumstances. The learner will be able to develop a thorough comprehension of French grammar and confidently express themselves in everyday circumstances.	
Unit – I	**French and You**	**12**
Habits, Strengths & Weakness, Recommendations, Sentiments, Motivations, about favorite films and Types of screens in the movie world, Verbs (Regulars and irregulars), Reflexive Verbs, Prepositions		
Unit – II	**Eat and Repeat**	**12**
Favorite foods, Recopies, Types of meals, Describing House and Kitchen, Presentation of the recipe, Comparatives, Possessive pronouns, Present continuous tense, Simple conditional form		
Unit – III	**Vacation**	**12**
Invitations, presentation, Greetings, Goodbyes, Activities on vacation, past experiences, Describing favorite place, Recommendations on various tours, Past perfect, Past imperfect tense		
Unit – IV	**Likes and Views**	**12**
Favorite persons & things, Giving advice, Experience, Moods, Illness, Discomforts, Symptoms, Roleplay (Doctor & Patient, Guide & Tourist, Pharmacist & Patient), Past perfect, Past indefinite, Imperative		
Unit – V	**Then and Now**	**12**
Habits, customs, circumstances of the past and present, Debates on past and present situations and feelings. Past imperfect tense, Past perfect and Present comparatives.		
		Total:60

TEXT BOOK:

1.	A2 – Saison

REFERENCES:

1.	Apprenons les francais – 0 and 1
2.	Grammaire – langue et de civilization francaises – Mauger G .Les idees – 0 and 1

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Understand the French language in deep and its usage	Remembering (K1)
CO2	Preparation of their Favorite recipes, Know the Objects used in Kitchen and house.	Understanding (K2)
CO3	Converse about their vacation, their Favorite Destination	Understanding (K2)
CO4	Understand complex verbs and be able to communicate about their past experiences	Understanding (K2)
CO5	Know the difference between Past and Present and Compare them.	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								1	2	3		3		
CO2								1	2	3		3		
CO3								1	2	3		3		
CO4								1	2	3		3		
CO5								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	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)

22GEO13- FRENCH LANGUAGE LEVEL 3							
(Offered by Department of Electronics and Communication Engineering)							
Programme& Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Fundamentals of French Language**	**All**	**OE**	**3**	**0**	**0**	**3**

Preamble	This course gives knowledge regarding a variety of personal and professional circumstances, as well as improving vocabulary and speaking abilities to reply to and seek information in those settings. It also gives you the ability to articulate yourself and arrange appointments. With perseverance, one can master all of the essential grammatical structures needed to respond confidently in everyday circumstances. It almost gives you an idea of how Natives communicate.	
Unit – I	**Start Over**	**9**
Use of periphrases, Discuss a day in life, work, problems in the world, Predictions about the future (actions and situations), Hypothetical situations, Imperfect and future tense.		
Unit – II	**Prohibitions and More**	**9**
Prohibitions, Obligations, Habits to change, social customs, Use of the subjunctive, Describe synopsis of Movie and its relation to real life, Debate on books vs movies, usage of connectors, Object Direct and Indirect.		
Unit – III	**Let's be Creative**	**9**
Write a letter by describing the problem, talk about desires and Necessities, propose solutions, Recommendations and Suggestions, Create an Advertisement, Give Instructions, Imperative negative, Use of Object Direct, and Indirect		
Unit – IV	**Travel and Communication**	**9**
Talk about Tours, Types of tourism and communication, Send messages, petitions, Talk to people on the telephone, Roleplay (Tourists and Guide, Tourists and Travel agents), Past Pluscumperfect, All Past tenses.		
Unit – V	**Let's Talk**	**9**
Expression of Interests, Sentiments, Feelings, Sensations, Manias etc. Certain suggestions to make a better future, the use of superlatives, Exclamatory phrases, subjunctives.		
		Total:45

TEXT BOOK:

1.	B1 – Saison

REFERENCES:

1.	Apprenons les francais – 0 and 1
2.	Grammaire – langue et de civilization francaises – Mauger G Les idees – 0 and 1

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Learn on Future tense.	Remembering (K1)
CO2	Understand Permissions and Prohibitions.	Understanding (K2)
CO3	Knowing about Letter writing, Creating Ads, Expressing Desires, and Instructing Others.	Understanding (K2)
CO4	Understanding rules for travel and Enhancing communications.	Understanding (K2)
CO5	Expressing the feelings and emotions using advanced grammar	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								1	2	3		3		**2**
CO2								1	2	3		3		2
CO3								1	2	3		3		2
CO4								1	2	3		3		2
CO5								1	2	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	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)

22GEO14 - SPANISH LANGUAGE LEVEL 1							
(Offered by Department of Electronics and Communication Engineering)							
Programme& Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Fundamentals of Spanish Language**	**All**	**OE**	**4**	**0**	**0**	**4**

Preamble	This course provides a foundation of the Spanish language as well as an understanding of the Spanish culture and lifestyle of Spain and other Spanish-speaking nations. The student will be learning how to introduce him/herself and acquire basic everyday vocabulary. By following the structured curriculum and practicing the same as per the learning process, one can comprehend the structure of sentences and respond to basic communications.	
Unit – I	**Greetings and Good byes (Los Saludos y Despidirse):**	**12**
Greetings,Self-Introduction , Formal and Informal ways of introducing oneself and others, Alphabets& Numbers, Countries and Languages Spoken, Parts of Grammar – Noun, Personal Pronoun, Describe surroundings and its vocabulary		
Unit – II	**Vida Cotidiana (Daily Life):**	**12**
Time of the day, Days of the week, Months of the year, Seasons, Verb (To be, To Have), Adverbs, Likes and Dislikes, Personality and physical description, simple sentences		
Unit – III	**Friends and Family (Amigos y La Familia):**	**12**
Vocabulary of family, Animals, Professions, Parts of the body, Opinions on family cultures, Articles – Definite and Indefinite, Hobbies, Regular and Irregular verbs.		
Unit – IV	**In the City (En la Cuidad):**	**12**
Buildings in the city, Name of the places, asking for directions, Helping each other, Description of house and its components, Modes of Transport, Grammar - Possessive articles, prepositions		
Unit – V	**Food and Culture(La comida y cultura):**	**12**
Food (types and varieties) , shopping, ordering at a restaurant, inviting to parties, Roleplay (as diner and customer, salesman and customer…etc.) Past tense (all three tenses-Past Participle, Indefinite past and past imperfect- (to be and to have)		
		Total:60

TEXT BOOK:

1.	Chicos Chicas Libro de Alumno nivel 1, Ma Angeles Palomino , edelsa, GRUPO DIDASCALIA, S.A., plaza cuidad de salta,3-28043 MADRID(ESPANA).

REFERENCES:

1.	https://nuevadelhi.cervantes.es/en/spanish_courses/students/spanish_general_courses/spanish_courses_level_a1.htm

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	understand the grammatical structure of the language and introduce self to others.	Remembering (K1)
CO2	understand basic verbs and appropriate vocabulary.	Understanding (K2)
CO3	ask for directions and arrange for transportation, etc, as needed.	Understanding (K2)
CO4	understand the food habits of Spain and Latin countries and ask for appointments	Understanding (K2)
CO5	learn to socialize in Spanish speaking countries	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								1	2	3		3		**2**
CO2								1	2	3		3		2
CO3								1	2	3		3		2
CO4								1	2	3		3		2
CO5								1	2	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	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)

22GEO15 - SPANISH LANGUAGE LEVEL 2							
(Offered by Department of Electronics and Communication Engineering)							
Programme& Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Fundamentals of Spanish Language**	**All**	**OE**	**4**	**0**	**0**	**4**

Preamble	This course aims to help the Learner to acquire the vocabulary as per theframework of Spanish language A2 level competence. This course will help to assimilate the basicgrammar structures and gain vocabulary to understand and reciprocate in daily life situations on a broader sense. A thorough learner will be able to gain a comprehensive understanding of the Spanish grammar and confidently articulate in day today situations.	
Unit – I	**Spanish and You (El Español y tú)**	**12**
Habits, Strengths & Weakness, Recommendations, Sentiments, Motivations, About favorite films and Types of screens in the movie world, Verbs(Regulars and irregulars), Reflexive Verbs, Prepositions		
Unit – II	**Eat and Repeat (**Comer y repetir**)**	**12**
Favorite foods, Recipies, Types of meals, Describing House and Kitchen, Presentation of recipe, Comparatives, Possessive pronouns, Present continuous tense, Simple conditional form		
Unit – III	**Its Vacation Time (**Tiempo de vacaciones)	**12**
Invitations, presentation, Greetings, Goodbyes, Activities on vacation, past experiences, Describing favorite place, Recommendations on various tours, Past perfect, Past imperfect tense, Usage of Todavia or No		
Unit – IV	**Likes and Views (**Gustasyvistas)	**12**
Favorite persons & things, Giving advices, Experience, Moods, Illness, Discomforts, Symptoms, Roleplay (Doctor & Patient, Guide & Tourist, Pharmacist & Patient), Past perfect, Past indefinite, Imperative		
Unit – V	**Then and Now(Antes y Ahora)**	**12**
Habits, customs, circumstances of the past and present, Debates on past and present situations and feelings. Past imperfect tense, Past perfect and Present comparatives.		
		Total:60

TEXT BOOK:

1.	AULA INTERNACIONAL 2 (A2) Jaime Corpas, AgusinGarmendia, Nuria Sanchez, Carmen Soriano Goyal Publishers and Distributors Pvt LTD, 86, UB Jawahar Nagar, Kamla Nagar, Delhi-110007.

REFERENCES:

1.	https://nuevadelhi.cervantes.es/en/spanish_courses/students/spanish_general_courses/spanish_courses_level_a1.htm

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	understand the Spanish language in deep and its usage	Remembering (K1)
CO2	prepare for their Favorite recipes, Know the Objects used in Kitchen and house.	Understanding (K2)
CO3	converse about their vacation, their Favorite Destination	Understanding (K2)
CO4	understand complex verbs and be able to communicate about their past experiences	Understanding (K2)
CO5	know the difference between Past and Present and Comparing them.	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								1	2	3		3		**2**
CO2								1	2	3		3		2
CO3								1	2	3		3		2
CO4								1	2	3		3		2
CO5								1	2	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	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)

22GEO16 - SPANISH LANGUAGE LEVEL 3							
(Offered by Department of Electronics and Communication Engineering)							
Programme& Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Fundamentals of Spanish Language**	**All**	**OE**	**3**	**0**	**0**	**3**

Preamble	This course provides enriching information about various everyday situations in personal and professional life and enhances the vocabulary and speaking ability to respond to and also seek information in those situations. It also equips one to express opinions and negotiate appointments. With diligent learning one can capture all basic grammatical structure to answer confidently in everyday situations. It almost gives a basic idea on how Natives speak.	
Unit – I	**Start Over(Volver a Empezar)**	**9**
Use of periphrases, Discuss a day in life, work, problems in the world, Predictions about future (actions and situations),Hypothetical situations, Imperfect and future tense.		
Unit – II	**Prohibitions and More(Prohibiciones y mas)**	**9**
Prohibitions, Obligations, Habits to change, social customs, Use of subjunctive, Describe synopsis of Movie and its relation to real life, Debate on books vs movies, usage of connectors, Object Direct and Indirect.		
Unit – III	**Let's be Creative (Seamoscreatives)**	**9**
Write a letter by describing the problem,talk about desires and Necessities, propose solutions, Recommendations and Suggestions, Create an Advertisement, Give Instructions, Imperative negative, Use of Object Direct and Indirect.		
Unit – IV	**Travel and Communication (Viajar y comunicar)**	**9**
Talk about Tours, Types of tourism and communication, Send messages, petitions, Talk to people on telephone, Role play(Tourists and Guide, Tourists and Travel agents), Past Pluscumperfect, All Past tenses.		
Unit – V	**Let's Talk(Hablemos)**	**9**
Expression of Interests, Sentiments, Feelings, Sensations, Manias etc. Certain suggestions to make a better future, use of superlatives, Exclamatory phrases, subjunctive.		
		Total:45

TEXT BOOK:

1.	Aula International 3 (B1) [Paperback] Jaime Corpas, Agusin Garmendia, Nuria Sanchez, Carmen Soriano Goyal Publishers and Distributors Pvt LTD, 86, UB Jawahar Nagar, Kamla Nagar, Delhi-110007.

REFERENCES:

1.	https://nuevadelhi.cervantes.es/en/spanish_courses/students/spanish_general_courses/spanish_courses_level_a1.htm

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	learn on Future tense.	Remembering (K1)
CO2	understand about Permissions and Prohibitions.	Understanding (K2)
CO3	knowing about Letter writing, Creating Ads, Expressing Desires and Instructing Others.	Understanding (K2)
CO4	understanding rules for travel and Enhance communications.	Understanding (K2)
CO5	expressing the feelings and emotions using advanced grammar	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								1	2	3		3		**2**
CO2								1	2	3		3		2
CO3								1	2	3		3		2
CO4								1	2	3		3		2
CO5								1	2	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	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)

22GEO17 - ENTREPRENEURSHIP DEVELOPMENT							
(Offered by Department of Mechatronics Engineering)							
Programme & Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Engineering Economics & Management**	**7**	**OE**	**3**	**0**	**0**	**3**

Preamble	The purpose of this course to create entrepreneurial awareness among engineering students.	
Unit – I	**Entrepreneurship Concepts:**	**9**
Entrepreneurship & Entrepreneur- Role in Economic Development - Factors affecting Entrepreneurship- Creativity and Innovation - Entrepreneurship vs Intrapreneurship- Entrepreneurial Motivation factors – Types of Entrepreneurship & Entrepreneurs - Characteristics of Entrepreneurs - Entrepreneurship Development in India		
Unit – II	**Entrepreneurial Ventures and opportunity assessment:**	**9**
New venture creation – Bootstrapping, Minipreneurship, Start-ups, Acquiring, Franchising & Social venturing - Venture development stages - Models of market opportunity- Opportunity assessment: Critical Factors In Opportunity Assessment, Idea vs Opportunity, Evaluation process, Global opportunities for entrepreneurs.		
Unit – III	**Business Plan:**	**9**
Designing Business Model- Business Model Canvas- Objectives of a Business Plan - Business Planning Process – Structure of a Business Plan – Technical, Marketing, Financial Feasibility assessment - Competitive analysis - Common errors in Business Plan formulation - Presentation of the Business Plan: The 'Pitch'- case studies		
Unit – IV	**Financing and accounting:**	**9**
Forms of entrepreneurial capital – Sources of Financial capital: debt financing- Commercial banks and other sources, equity financing: Initial Public offering (IPO), Private placement - Venture capitalists - Angel investors-New forms of financing: Impact investors, Micro-financing, Peer-to-Peer Lending, Crowd funding - Natural capital. Preparing Financial Budget, Break even analysis, Taxation-Direct and indirect taxes, Insolvency and Bankruptcy- Case Study		
Unit – V	**Small Business Management:**	**9**
Definition of Small Scale Industries: Strengths and Weaknesses, Sickness in Small Enterprises: Symptoms -Causes and remedies- Indian Startup Ecosystem – Institutions supporting small business enterprises, Business Incubators – Government Policy for Small Scale Enterprises - Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger, FDI and Sub-Contracting		
		Total:45

TEXT BOOK:

1.	Donald F. Kuratko,"Entrepreneurship: Theory, Process, Practice", 11th Edition, Cengage Learning, Boston, 2020.

REFERENCES:

1.	Robert D. Hisrich, Michael P. Peters & Dean A. Shepherd, Sabyasachi Sinha "Entrepreneurship", 11th Edition, McGraw Hill, Noida, 2020.
2.	Charantimath Poornima .M, "Entrepreneurship Development and Small Business Enterprises", 3rd Edition, Pearson Education, Noida, 2018.
3.	Gordon E & Natarajan K, "Entrepreneurship Development", 6th Edition, Himalaya Publishing House, Mumbai, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	understand the importance of entrepreneurship and demonstrate the traits of an entrepreneur	Applying (K3)
CO2	identify suitable entrepreneurial ventures and business opportunity	Applying (K3)
CO3	assess the components of business plan	Analyzing (K4)
CO4	appraise the sources of finance and interpret accounting statements	Applying (K3)
CO5	interpret the causes of sickness of small scale enterprises and its remedies	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	1	1		3	2		
CO2	1	2	2	2		2	2	1	1		3	2		
CO3	2	2	2	2	2	2	2	2	2	2	3	2		
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- 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	30	20			100
CAT3	30	30	40				100
ESE	10	30	40	20			100

* ±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**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5 / 6**	**OE**	**3**	**0**	**2**	**4**

Preamble	This course is designed especially for NCC Cadets. This course will help develop character, camaraderie, discipline, secular outlook, the spirit of adventure, sportsman spirit and ideals of selfless service amongst cadets by working in teams, learning military subjects including weapon training.	
Unit - I	**NCC Organisation & National Integration**	**9**
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 & Drill**	**9**
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 arms- ceremonial drill- guard mounting. (WITH DEMONSTRATION)		
Unit - III	**Weapon Training**	**9**
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**	**9**
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)**	**9**
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 by 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.

COURSE OUTCOMES: On 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)

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	3	3	3	3				
CO2					3									
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	-	-	-	-	-	-	-
CAT2	-	-	-	-	-	-	-
CAT3	-	-	-	-	-	-	-
ESE	The examination and award of marks will be done by the Ministry of Defence, Government of India which includes all K1 to K6 knowledge levels. The maximum marks for the End Semester Examination is 500 marks. It will be converted to 100 marks.						

22GEX02 - NCC STUDIES (AIR WING) – I							
(Offered by Department of Information Technology)							
Programme & Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5 / 6**	**OE**	**3**	**0**	**2**	**4**

Preamble	This course is designed especially for NCC Cadets. This course will help develop character, camaraderie, discipline, secular outlook, the spirit of adventure, sportsman spirit and ideals of selfless service amongst cadets by working in teams, honing qualities such as self-discipline, self-confidence, self-reliance and dignity of labour in the cadets.	
Unit–I	**NCC Organization and National Integration**	**9+3**
NCC Organization – History of NCC- NCC Organization- NCC Training- NCC Uniform – Promotion of NCC cadets – Aim and advantages of NCC Training - NCC badges of Rank - Honors' and Awards – Incentives for NCC cadets by central and state govt. History and Organization of IAF - Indo-Pak War-1971 - Operation Safed Sagar. National Integration - Unity in diversity - contribution of youth in nation building - national integration council - Images and Slogans on National Integration.		
Unit–II	**Drill and Weapon Training**	**9+3**
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 arms - ceremonial drill - guard mounting.(WITH DEMONSTRATION). Main Parts of a 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).		
Unit–III	**Principles of Flight**	**9+3**
Laws of motion-Forces acting on aircraft – Bernoulli's theorem - Stalling - Primary control surfaces – secondary control surfaces - Aircraft recognition.		
Unit-IV	**Aero Engines**	**9+3**
Introduction of Aero engine -Types of engine - piston engine - jet engines - Turbo prop engines-Basic Flight Instruments - Modern trends.		
Unit–V	**Aero Modeling**	**9+3**
History of aeromodeling - Materials used in Aero-modeling - Types of Aero-models – Static Models - Gliders - Controlline models - Radio Control Models - Building and Flying of Aero-models.		

Lecture:45, Tutorial:30, Total:75

TEXT BOOK:

1.	"National Cadet Corps - A Concise handbook of NCC Cadets", Ramesh Publishing House, NewDelhi, 2014.

REFERENCES/ MANUAL / SOFTWARE:

1.	"Cadets Handbook – Common Subjects SD/SW", DGNCC, New Delhi.
2.	"Cadets Handbook – Specialised Subjects SD/SW", DGNCC, New Delhi.
3.	"NCCOTA Precise", DGNCC, New Delhi.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	build sense of patriotism, secular values and shall be transformed into motivated youth who will carry out nation building through national unity and social cohesion.	Applying (K3)
CO2	demonstrate the sense of discipline with smartness and have basic knowledge of weapons and their use and handling	Applying (K3)
CO3	illustrate various forces and moments acting on aircraft	Applying (K3)
CO4	outline the concepts of aircraft engine and rocket propulsion	Applying (K3)
CO5	design, build and fly chuck gliders/model air planes and display static models.	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	3	3	3	3				
CO2					3									
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	-	-	-	-	-	-	-
CAT2	-	-	-	-	-	-	-
CAT3	-	-	-	-	-	-	-
ESE	The examination and award of marks will be done by the Ministry of Defence, Government of India which includes all K1 to K6 knowledge levels. The maximum marks for the End Semester Examination is 500 marks. It will be converted to 100 marks.						

22MBO01 - COST ACCOUNTING FOR ENGINEERS							
(Offered by Department of Management Studies)							
Programme& Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**5**	**OE**	**3**	**1**	**0**	**4**

Preamble	To provide an In-depth study of the Cost Accounting principles and techniques for identification, analysis and classification of costs components to facilitate decision Making.	
Unit – I	**Introduction to Cost Accounting**	**9 + 3**
Introduction to Cost Accounting: Meaning - Scope, objectives and significance of Cost Accounting its relationship with financial accounting and management accounting– cost centres – cost units – Elements of cost – classification of cost – preparation of cost sheet.		
Unit – II	**Cost Ascertainment – Elements of cost**	**9 + 3**
Material Costs: Procurement of materials – Inventory management and control – scrap, spoilage, defectives and wastage **Labour Costs:** Time Keeping, Time booking and payroll – Labour turnover – principles and methods of remuneration and incentive schemes. **Overheads:** Collection, classification and apportionment and allocation of overheads.		
Unit – III	**Basic Costing Methods**	**9 + 3**
Operating Costing - Meaning - Preparation of Operating Cost Sheet - Transport Costing - Power Supply Costing - Hospital Costing.		
Unit – IV	**Advanced Costing Methods**	**9 + 3**
Features of Job Costing - Batch Costing - Preparation of Cost Sheet Under Job Costing, and Batch Costing - Process Costing - Process Loss - Normal and Abnormal Loss.		
Unit – V	**Cost Accounting Techniques**	**9 + 3**
Budget and Budgetary Control: Budgetary control as a management Tool – Installation of Budgetary control system classification of budgets – Fixed and Flexible Budgeting. **Standard Costing and Variance Analysis:** Budgetary control and standard costing – Suitability of standard costing – Standard costing as a management Tool – Cost variances – Direct material cost variances – Direct labour cost variances – Overhead variances – Sales variance.		
Lecture: 45, Tutorial: 15, Total:60		

TEXT BOOKS

1.	JawaharLal, SeemaSrivastava, Manisha Singh, " Cost Accounting, Text, Problems and Cases", 6th Edition, McGraw Hill Education, New Delhi, 2020.
2.	William Lanen, Shannon Anderson and Michael Maher, "Fundamentals of cost Accounting",7th Edition, McGraw Hill Education, New Delhi, 2020.

REFERENCES

1.	M.N.Arora and PriyankaKatyal, "Cost Accounting", 5th Edition, Vikas publishing House, New Delhi, 2023.
2.	Ravi M.Kishore, " Cost and Management Accounting", 6th Edition, Taxmann, New Delhi, 2021
3.	M.N.Arora, "Cost and Management Accounting",11th Edition, Vikas Publishing, New Delhi, 2021.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	understand the conceptual frame work of cost accounting	Understanding (K2)
CO2	understand the basic concepts and process in determination of cost of product and services	Understanding (K2)
CO3	use the basic costing methods in different business situation	Applying (K3)
CO4	demonstrate the advanced costing methods in various decision making situation	Applying (K3)
CO5	prepare various types of budgets and determine variance in different situations.	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	3	1		
CO2										2	3	1		
CO3										2	3	1		
CO4										2	3	1		
CO5										2	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	30	70					100
CAT2	15	35	50				100
CAT 3	15	35	50				100
ESE	25	25	50				100

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

22MBO02 ECONOMIC ANALYSIS FOR DECISION MAKING							
(Offered by Department of Management Studies)							
Programme& Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Basic understanding of differential calculus**	**6**	**OE**	**3**	**1**	**0**	**4**

Preamble	The course aims at introducing a few vital techniques required for carrying out economic analysis for making informed managerial decisions.	
Unit – I	**Economic Optimization**	**9 + 3**
Economic Optimization: Theory of firm – Business versus Economic profit – Revenue relations – Cost relations – Profit relations – Marginal versus incremental concept.		
Unit – II	**Forecasting**	**9 + 3**
Forecasting: Forecasting applications – Techniques –Naire method – Moving average – Exponential smoothing - Trend analysis – Linear Trend – Growth Trend – Sales, cost and revenue forecasting.		
Unit – III	**Production and Cost Analysis**	**9 + 3**
Production: Production function – Returns to scale and returns to factor – Total, managerial and average product – Law of diminishing returns – Optimal input usage – Production function estimation. **Cost Analysis:** Economic and Accounting costs – Time in cost analysis – Short run cost – Long run cost – cost relations – cost volume – profit analysis.		
Unit – IV	**Competitive Market Analysis**	**9 + 3**
Competitive Market Analysis: Characteristics of competitive markets – Profit maximisation – Marginal analysis in competition – competitive market supply curve – Equilibrium in competitive markets - Monopoly – Monopolistic competition.		
Unit – V	**Game theory and Competitive Strategy**	**9 + 3**
Game Theory Basics - Prisoner's Dilemma - Saddle Point - Two Person Zero Sum Game - Games without Saddle Points - Dominance Rule - Mixed Strategies.		
Lecture: 45, Tutorial: 15, Total:60		

TEXT BOOKS

1.	Mark Hirschey, “Managerial Economics”, 12th Edition, Cengage Learning, New Delhi, 2022.
2.	Geetika, PiyaliGhosh, Purba Roy Choudhury, “Managerial Economics”, 3rd Edition, McGraw Hill Education, New Delhi, 2019.

REFERENCES

1.	Gupta. G, “Managerial Economics”, 2nd Edition, McGraw Hill Education, New Delhi, 2019.
2.	Ahuja. H. L, “Principles of Microeconomics”, 22nd Edition, S. Chand Publishing, New Delhi, 2019.
3.	PanneerSelvam R, P. Sivasankaran, P. Senthilkumar., “Managerial Economics”, 1st Edition, Cengage Learning, New Delhi, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Understand revenue, cost and profit relations and apply techniques to find best course of action.	Applying (K3)
CO2	Apply appropriate forecasting techniques for estimating sales, cost and revenue.	Applying (K3)
CO3	Understand the relation between inputs and output of production system and perform cost – volume – profit analysis	Applying (K3)
CO4	Apply market equilibrium concepts in monopoly and monopolistically competitive markets.	Applying (K3)
CO5	Understand game theory and apply in different strategic decisions	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					1	3			
CO2					2					1	3			
CO3					2					1	3			
CO4					2					1	3			
CO5					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	35	35	30				100
CAT2	15	45	40				100
CAT 3	15	35	50				100
ESE	5	40	55				100

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

22MBO03 MARKETING ANALYTICS							
(Offered by Department of Management Studies)							
Programme& Branch	**All BE/BTech Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Basic understanding of differential calculus**	**7**	**OE**	**3**	**1**	**0**	**4**

Preamble	Marketing analytics enables marketers to measure, manage and analyze marketing performance to maximize its effectiveness and optimize return on investment (ROI). This course exposes the students with the tools to measure customer value and apply analytic tools to various marketing decisions.	
Unit – I	**Market & Marketing Analytics**	**9 + 3**
Introduction - Introduction to marketing analytics, Models & Metrics **Market Insight** - Market sizing. **Market Segmentation** –Segmentation, Targeting & Positioning		
Unit – II	**Business & Competition**	**9 + 3**
Competitive Analysis - Competitor identification, analysis, and actions **Business Strategy** –Scenarios, Decision Model, Metrics **Business Operations** - Forecasting		
Unit – III	**Product and Price**	**9 + 3**
Product and Service Analytics - Conjoint analysis and product/service metrics **Price Analytics** - Pricing techniques and assessment		
Unit – IV	**Distribution & Promotion**	**9 + 3**
Distribution Analytics –Characteristics, Channel evaluation and selection, Multichannel distribution and metrics. **Promotion Analytics** - Promotion budget estimation and allocation, Metrics		
Unit – V	**Sales**	**9 + 3**
Sales Analytics - Metrics for sales, profitability, and support		
Lecture: 45, Tutorial: 15, Total:60		

TEXT BOOKS

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.

REFERENCES

1.	Tommy Blanchard, "Data Science for Marketing Analytics", 1st Edition, Packt Publishing, UK, 2019.
2.	Mike Grigsby, "Marketing Analytics", 2nd Edition, Kogan Page, UK, 2018.
3.	David A. Aaker, V. Kumar, Robert P. Leone, George S. Day., "Marketing Research", 1st Edition, Wiley, New Delhi, 2019.

COURSE OUTCOMES: On completion 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	PO7	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, 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	15	35	50				100
CAT 3	15	15	70				100
ESE	25	25	50				100

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

22MAO01 - MATHEMATICAL FOUNDATIONS FOR MACHINE LEARNING							
(Offered by Department of Mathematics)							
Programme & Branch	**All B.E/.BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5**	**OE**	**3**	**1**	**0**	**4**

Preamble	To impart the basic knowledge in linear algebra, decomposition of matrices, continuous optimization, linear regression and support vector machines which provide the foundations for machine learning and deep learning.	
Unit – I	**Vector Spaces:**	**9+3**
Real Vector spaces (Definition & Problems) – Subspaces – Linear Combinations – Linear dependence and independence – Basis and dimension – Row space, Column space and Null Space.		
Unit – II	**Linear Transformations:**	**9+3**
Introduction – Rank and nullity. – Dimension theorem – Kernel and range – Change of basis – Composition and inverse transformations – Matrices of linear transformations.		
Unit – III	**Inner Product Spaces:**	**9+3**
Norms – Inner products – Length and Distance – Angle and Orthogonality – Orthonormal Basis – Gram-Schmidt Process – QR-Decomposition.		
Unit – IV	**Matrix Decomposition and Vector Calculus:**	**9+3**
Matrix Decomposition: Cholesky decomposition – Singular Value Decomposition. Vector Calculus: Differentiation of Univariate Functions – Partial Differentiation and Gradients – Gradients of Vector valued functions – Gradients of matrices – Useful Identities for Computing Gradients – Higher Order Derivatives – Linearization and Multivariate Taylor Series.		
Unit – V	**Optimization:**	**9+3**
Introduction – Classification of Optimization Problems – Constrained multivariable optimization with inequality constraints – Kuhn Tucker conditions – Lagrange's multiplier method –- Unconstrained optimization: Steepest descent method – Newton's method.		
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 for 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 for Units – IV, V.

REFERENCES:

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.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	understand the concepts of vector spaces.	Understanding (K2)
CO2	interpret the concepts of linear transformations.	Understanding (K2)
CO3	apply the concept of inner product space and decompose the given matrix by means of orthonormal vectors.	Applying (K3)
CO4	demonstrate the knowledge of factorisation of matrices and vectors in Machine learning.	Understanding (K2)
CO5	identify suitable optimization algorithms for machine learning applications.	Applying (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	3	1												
CO2	3	1												
CO3	3	2												
CO4	3	3	3	1										
CO5	3	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	15	65	20				100
CAT2	15	65	20				100
CAT3	15	50	60				100
ESE	10	40	50				100

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

22MAO02 - NUMERICAL COMPUTING							
(Offered by Department of Mathematics)							
Programme & Branch	**All B.E/.BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**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.		
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+3**
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.

REFERENCES:

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.

COURSE OUTCOMES: On completion 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 simultaneous linear equations by numerical methods.	Applying (K3)
CO3	compute intermediate values of given evenly (or) unevenly spaced data.	Applying (K3)
CO4	apply the concepts of numerical differentiation and integration in real time applications.	Applying (K3)
CO5	identify 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 – 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	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							
(Offered by Department of Mathematics)							
Programme & Branch	**All B.E/.BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5**	**OE**	**3**	**1**	**0**	**4**

Preamble	To provide an in-depth knowledge in random variables, random process, correlation and promote the ability to apply suitable queuing models to real time applications.	
Unit – I	**Random Variables:**	**9+3**
Discrete and Continuous random variables – Probability Mass and Probability density functions – Mathematical expectation and Variance – Moments – Moment generating functions.		
Unit – II	**Random processes:**	**9+3**
General concepts and definitions – Classification – Stationary process – Markov chains – Transition probabilities – Poisson process.		
Unit – III	**Correlation and Spectral densities:**	**9+3**
Auto Correlation – Cross Correlation – Properties (Without Proof) – Power spectral density – Cross spectral density – Properties (Without Proof) – Wiener- Khintchine relation – Relationship between cross power spectrum and cross correlation function.		
Unit – IV	**Queuing Theory:**	**9+3**
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-Markovian Queues and Queue Networks:**	**9+3**
Introduction to Non-Markovian queues – M/G/1 queue – Pollaczek-Khintchine formula – Series queues – Open and Closed queuing networks		
		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.

REFERENCES:

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.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply random variables 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.	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	1												
CO2	3	2												
CO3	3	2												
CO4	3	3	3										2	
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	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							
(Offered by Department of Mathematics)							
Programme & Branch	**All B.E/.BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5**	**OE**	**3**	**1**	**0**	**4**

Preamble	To impart the basic knowledge in presentation of data, descriptive statistical measures and provide skills to apply correlation, suitable non- parametric tests and control charts to control the variations in real time applications.	
Unit – I	**Organization and Presentation of Data:**	**9+3**
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: $\bar{X}$-chart – R-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 for Units I,II, V
2.	S.C.Gupta, V.K.Kapoor, "Fundamentals of Mathematical Statistics", 12th Edition, Sultan Chand & Sons, New Delhi, 2022. for Units III, IV.

REFERENCES:

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., "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.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	demonstrate the classification of data and present the data in various forms.	Understanding (K2)
CO2	compute and interpret descriptive statistical measures using numerical and graphical techniques.	Applying (K3)
CO3	apply statistical methods like correlation, regression analysis in analysing and interpreting experimental data.	Applying (K3)
CO4	use appropriate non-parametric test to analyze experimental data.	Applying (K3)
CO5	identify suitable control charts for monitoring processes..	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												
CO2	3	2												
CO3	3	3	2											
CO4	3	3	1											
CO5	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	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)

22PHO01 - THIN FILM TECHNOLOGY
(Offered by Department of Physics)

Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	**Nil**	**5**	**OE**	**3**	**1**	**0**	**4**

Preamble	This course aims to impart the essential knowledge on deposition, characterization and application of thin films in various engineering fields, and also provides motivation towards innovations.	
Unit – I	**Theories and models of thin film growth:**	**9+3**
Introduction – Theories of thin film nucleation: Impingement, Adsorption and Thermal accommodation – The capillarity model – The atomistic models – Structural consequences of thin film nucleation – The four stages of film Growth – The incorporation of defects during growth.		
Unit – II	**Vacuum technology:**	**9+3**
Principle and working of vacuum pumps: Roots vacuum pump, Rotary pump, Diffusion pump, Turbo molecular pump, Cryogenic pump, Ion pump, Ti-sublimation pump – Measurement of Pressure: Bayet-Albert gauge, Pirani and Penning gauge – Cold cathode and hot cathode ionization gauges – Pressure controlling system (qualitative).		
Unit – III	**Deposition of thin films - Physical methods:**	**9+3**
Thermal evaporation – Electron beam evaporation – Pulsed laser deposition – Ion plating – DC sputtering – RF sputtering – Magnetron sputtering – Reactive sputtering – Molecular beam epitaxy - Demonstration of deposition of thin films by RF sputtering.		
Unit – IV	**Deposition of thin films – Chemical methods:**	**9+3**
Chemical vapor deposition – Sol-gel method – Chemical bath deposition – Hydro thermal methods – Electroplating deposition – Electroless deposition – Spray Pyrolysis - Spin coating.		
Unit – V	**Characterization and Applications of thin films:**	**9+3**
Characterization: X-ray diffraction, Energy dispersive X-ray analysis, Atomic probe microscopy, Scanning Tunneling Microscope, X-ray Photoemission Spectroscopy, UV-vis spectroscopy and Four probe resistivity – Applications (qualitative): Thin film solar cells, Thin film gas sensors, Thin films for information storage and Optical coatings.		
Lecture: 45, Tutorial: 15, Total: 60		

TEXT BOOK:

1.	Maissel L.I. and Glang R, Hand book of Thin Film Technology, Reprint, McGraw Hill Inc., New York, 1970, (Unit I – IV)
2.	Sam Zhang, Lin Li and Ashok Kumar, Materials Characterization Techniques, 1st edition, CRC Press, Boca Raton, 2008 (Unit V)

REFERENCES:

1.	Ohring M, Material Science of Thin Films, 2nd Edition, Academic Press, New Jersey, 2001
2.	Goswami A, Thin Film Fundamentals, Reprint, New Age International (P) Ltd, New Delhi, 2003
3.	Chopra K. L, Thin Film Phenomena, Illustrated, McGraw Hill Inc., New York, 1969

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

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	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

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	20	40	40				100
ESE	20	40	40				100

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

22PHO02 - HIGH ENERGY STORAGE DEVICES
(Offered by Department of Physics)

Programme& Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	OE	3	1	0	4

Preamble	This course aims to impart the essential knowledge on the fundamental principles and application areas of proven technologies and materials for energy storage solutions, together with an overview of development trends in this engineering field.	
Unit – I	**Introduction to Energy Storage:**	**9+3**
An overview of energy storage systems (qualitative): Thermal energy storage, mechanical energy storage, chemical energy storage, electrical energy storage, electrochemical energy storage, electrostatic energy storage, magnetic energy storage and optical energy storage – General criteria of energy storage systems – Conventional batteries: fundamentals and applications – Grid connected and off grid energy storage systems and requirements.		
Unit – II	**Thermal storage and Mechanical Storage:**	**9+3**
Thermal storage: Thermal properties of materials, principle of operations, efficiency factors, large scale and medium scale operations – Merits and demerits of thermal storage system – Recent development in thermal storage systems. Mechanical Storage: Types of mechanical storage systems, principle of operations, emerging advances and technologies in mechanical storage systems – Flywheel.		
Unit – III	**Magnetic storage, Electro-optic, Optical and Chemical Storage:**	**9+3**
Magnetic storage: Principle of operation, emerging challenges and a review on devices and technology. Electro-optic and optical storage: Emerging devices and upcoming technologies (qualitative). Chemical storage: Power to gas – Hydrogen and Methane. Power to liquid – Bio fuels – Aluminum-Boron, silicon, and zinc.		
Unit – IV	**Electrochemical Storage:**	**9+3**
Materials, Principle of operation, positive electrode materials, negative electrode materials, electrolytes. Li-ion batteries: Principle of operation, battery components, design of electrodes, cell and battery fabrications – Building block cells – Battery modules and packs –Li-polymer batteries – Applications – Future developments: Sodium-battery, magnesium battery, aluminum battery and silicon battery.		
Unit – V	**Fuel Cells, Hydrogen storage and Super capacitors:**	**9+3**
Fuel Cells: Introduction to fuel cells, PEM (polymer electrolyte membrane), Hydrogen PEM fuel cell, direct methanol fuel cell, alkaline fuel cells and solid oxide fuel cells. Hydrogen storage systems: Solid state hydrogen storage tanks, gas phase hydrogen storage tanks, cryogenic hydrogen storage tanks and liquid phase hydrogen storage tanks. Super capacitors: Features of super capacitors, basic principle of operation, performance and technologies of super capacitors.		
		Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

1. Robert A. Huggins, Energy Storage, Springer, 2010, (Unit I – V)
2. Ehsani, Y. Gao, S. Gay, A. Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles, CRC Press, New York, 2005 (Unit I - V)

REFERENCES:

1. Yuping Wu, Lithium-Ion Batteries: Fundamentals and Applications (Electrochemical Energy Storage and Conversion), CRC Press, United Kingdom, 2015
2. Trevor M. Letcher, Storing Energy: with Special Reference to Renewable Energy Sources, 2nd edition, Elsevier, 2022
3. D. Linden and T. S. Reddy, Handbook of Batteries, 4th edition, McGraw Hill, Newyork, 2011

COURSE OUTCOMES: On completion 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)

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	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

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	20	40	40				100
ESE	20	40	40				100

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

22PHO03 - STRUCTURAL AND OPTICAL CHARACTERIZATION OF MATERIALS
(Offered by Department of Physics)

Programme& Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	OE	3	1	0	4

Preamble	This course aims to impart the essential knowledge on the characterization of materials using X-ray diffraction, Raman spectroscopy, UV-visible spectroscopy, Electron microscopy and Scanning tunneling microscopy and their application in various engineering fields, and also provides motivation towards innovations.	
Unit – I	**Introduction to Characterization Techniques and X-Ray Diffraction:**	**9+3**
Importance of materials characterization – Classification of characterization techniques – Crystalline materials – Reciprocal lattice – Theory of X-ray diffraction – Powder and Single crystal X-ray diffraction: Instrumentation (qualitative), XRD pattern, systematic procedure for structure determination (qualitative), crystallite size determination (Scherrer equation), strain calculation – Applications.		
Unit – II	**Electron Microscopy:**	**9+3**
Need of electron microscopy – Electron specimen interaction: Emission of secondary electrons, backscattered electrons, characteristic X-rays, transmitted electrons, specimen interaction volume – Resolution – Scanning electron microscope and transmission electron microscope: Schematic diagram and working – Different types of filaments – Field emission scanning electron microscope –Wavelength dispersive X-ray analysis – Three parameter equation for quantitative composition analysis.		
Unit – III	**Scanning Tunneling Microscopy:**	**9+3**
Introduction to quantum mechanical tunneling – Basic principles of scanning tunneling microscopy – Two modes of scanning: constant height mode and constant voltage mode – Instrumentation and working – Applications.		
Unit – IV	**Raman Spectroscopy:**	**9+3**
Introduction – Pure rotational Raman spectra – Vibrational Raman spectra – Polarization of light and Raman effect – Structure determination – Instrumentation and working – Near-Infra-Red Raman Spectroscopy – Applications.		
Unit – V	**Ultra Violet &Visible Spectroscopy:**	**9+3**
Regions of UV-Visible radiation – Colour and light absorption – Chromophore concept – Beer's and Lambert's laws – Theory of electronic transition – Frank-Condon principle – Instrumentation and working – Applications.		
		Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

1.	Cullity B. D. and Stock S. R, Elements of X-ray diffraction, 3rd Edition, Pearson Education, India, 2003 (Unit I)
2.	Banwell C. N, McCash E. M, Choudhury H. K, Fundamentals of Molecular Spectroscopy, 5th Edition, Tata McGraw-Hill Publ., New Delhi, 2013 (Unit II-V)

REFERENCES:

1.	Holt D. B. and Joy D. C, SEM micro characterization of semiconductors, 1st Edition, Academic Press, New Delhi, 1989
2.	Willard H. H., Merritt L. L., John A Dean, and Settle Jr. F. A, Instrumental methods of Analysis 7th Edition, Wadsworth Publishing Company, United States, 1988
3.	Elton N. Kaufman, Characterization of Materials (Volume1 & 2), 2nd, Wiley-Interscience, New Jersey, 2012

COURSE OUTCOMES: On completion 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)

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	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

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	25	35	40				100
CAT3	30	30	40				100
ESE	20	40	40				100

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

22CYO01 - INSTRUMENTAL METHODS OF ANALYSIS

(Offered by Department of Chemistry)

Programme & Branch	All BE / BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	OE	3	1	0	4

Preamble	Instrumental methods of analysis aim to prepare the students to have all-encompassing knowledge of spectral methods in order to identify the molecules and reaction mechanism for the process to enhance application towards the industries.	
Unit – I	**Absorption and Emission Spectroscopy**	**9+3**
Basic concepts of Absorption and Emission Spectroscopy – representation of spectra – basic elements of practical spectroscopy – signal to noise ratio - techniques for signal to noise enhancement – resolving power – Fourier transform spectroscopy – evaluation of results – basic principles, instrumentation and applications of Atomic Absorption, Atomic Fluorescence and Atomic Emission Spectroscopy.		
Unit – II	**IR, Raman and NMR Spectroscopy**	**9+3**
Infrared Spectroscopy – correlation of IR Spectra with molecular structure, instrumentation, samplings technique and quantitative analysis. Raman Spectroscopy – Classical and Quantum theory instrumentation, Structural analysis and quantitative analysis. Nuclear Magnetic resonance Spectroscopy – basic principles – pulsed Fourier transform NMR spectrometer – Structural elucidation using NMR spectra and quantitative analysis.		
Unit – III	**Surface Studies**	**9+3**
Surface Study – X-Ray Emission Spectroscopy (XES), X- Ray Photo Electron Spectroscopy (XPS) - Auger Electron Spectroscopy (AES) - Transmission Electron Microscopy (TEM) - Scanning Electron Microscopy (SEM) - Surface Tunneling Microscopy (STEM) - Atomic Force Microscopy (AFM).		
Unit – IV	**Mass Spectroscopy**	**9+3**
Mass spectroscopy – Ionization methods in mass spectroscopy – mass analyzer – ion collection systems - correlation of molecular spectra with molecular structure - Instrumentation design and application of Fourier Transform Mass Spectroscopy (FT-MS) and Ion Microprobe Mass Analyzer (IMMA).		
Unit - V	**Thermal Analysis**	**9+3**
Thermal Analysis: principles and instrumentations and applications of Thermogravimetry (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC), evolved gas detection, Thermo Mechanical Analysis and Thermometric Titration.		

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

1. Chatwal. G. R., Anand, Sham K., “Instrumental Methods of Chemical Analysis” 5th Edition, Himalaya Publishing House, 2019.

REFERENCES:

1. B.K. Sharma, Instrumental Method of Chemical Analysis, Krishna Prakashan Media (P) Ltd. 2019.
2. Willard,H.H, Merritt,L.L, Dean,J.A, and Settle, F.A, “Instrumental methods of analysis” CBS Publishers & Distributors, 7 Ed, 2004.
3. Kaur. H, “Instrumental Methods of Chemical Analysis”, XII Edition, Pragati prakashan, Meerat, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	illustrate the basics of spectroscopy to understand the instrumentation of various spectral techniques.	Understanding (K2)
CO2	apply the IR, Raman and NMR for quantitative analysis of the sample.	Applying (K3)
CO3	apply the various techniques for the better understanding of surface morphology.	Applying (K3)
CO4	explain the principle, instrumentation of mass spectroscopy for the analysis of organic sample.	Understanding (K2)
CO5	illustrate the thermal analysis for the identification of thermal stability of the compounds.	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	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)

22CYO02 - CHEMISTRY CONCEPTS FOR COMPETITIVE EXAMINATIONS

(Offered by Department of Chemistry)

Programme & Branch	**All BE / BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5**	**OE**	**3**	**1**	**0**	**4**

Preamble	This course aims to refresh the knowledge of chemistry required for competitive examinations and equip the students with a capacity to solve the problems in chemistry while participating various competitive examinations including TNFUSRC-FORESTER (paper-II: General science-chemistry), UPSC-IAS (prelims: General science-chemistry), GATE (thermodynamics concept for chemical & mechanical engineering).
Unit – I	**Periodic Classification of Elements** **9+3**
Mendeleev's periodic table-Law and classification of elements- Modern periodic law-Modern periodic table and its characteristics - Periodic properties – important aspects of s, p & d block elements -Reactivity series and Uses - Alloys-Uses of Alloys- Properties of nano metals and oxides.	
Unit – II	**Chemical Equations and Bonding** **9+3**
Chemical Equations: Types of ions and radicals- oxidation and reduction-redox reactions - balancing ionic equations. **Chemical Bonding:** Octet rule -types of chemical bond -formation of ionic and covalent bond- common properties of ionic and covalent compounds- differences between ionic and covalent compounds-Coordinate covalent bond- Coordination compounds – nomenclature and isomerism - application in analytical chemistry.	
Unit – III	**Acids, Bases, Salts and Metallurgy** **9+3**
Acid- base theory – Bronsted- Lowry theory- conjugate acid-base- Lewis concept- HSAB- applications- pH scale- Importance of pH in everyday life-salts-classification of salts-uses of salts. **Metallurgy:** introduction-terminologies in metallurgy-differences between minerals and ores-occurrence of metals- metallurgy of aluminum, copper and iron.	
Unit – IV	**Carbon and its Compounds** **9+3**
Introduction-compounds of carbon-modern definition of organic chemistry- bonding in carbon and its compounds-allotropy-physical nature of carbon and its compounds-chemical properties of carbon compounds-homologous series-hydrocarbons and their types-functional groups- classification of organic compounds based on functional group-ethanol-ethanoic acid.	
Unit – V	**Thermodynamics** **9+3**
Introduction- some important terms in thermodynamics-thermodynamic system, process, properties and energy- first law of thermodynamics: mathematical expression and interpretation- applications of first law of thermodynamics-molar heat capacity-reversible isothermal expansion/compression of an ideal gas-adiabatic expansion of an ideal gas-isobaric and isochoric processes in ideal gases- second laws of thermodynamics: entropy- entropy change for isolated system (system and surroundings)- entropy change for system only (ideal gas)- entropy change for mixing of ideal gases-entropy of physical changes- entropy of chemical changes-Maxwell relations.	
	Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

1.	Steven S. Zumdahl, Susan A. Zumdahl and Donald J. DeCoste , "Chemistry", 10th Edition, Cengage Learning, 2018., for Units-I, II, III, IV.
2.	Wiley editorial board. "Wiley Engineering Chemistry". 2nd Edition, Wiley India Pvt. Ltd, New Delhi, Reprint 2019, for Units- I, II, III, V.

REFERENCES:

1.	B.R. Puri, L.R. Sharma, Principles of Inorganic Chemistry, 33rd Edition, Vishal Publishing Co., 2020.
2.	Paula Bruise, "Organic Chemistry", 8th Edition, Pearson Education, 2020.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the basic concept of periodic classification of elements to explain the periodic properties and reactivity series of s, p & d block elements.	Applying (K3)
CO2	utilize the concepts of chemical equation and bonding to solve the problems in balancing ionic equation and differentiate ionic and covalent compounds.	Applying (K3)
CO3	apply the concept of acid, base, salts and metallurgy to explain HSAB concepts, Importance of pH in everyday life, classification of salts and metallurgy of Al, Cu & Fe.	Applying (K3)
CO4	make use of the concept of carbon and its compounds to explain bonding and classification of carbon compounds.	Applying (K3)
CO5	utilize the important terms and concepts of thermodynamics to explain the first law and second law of thermodynamics with examples.	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	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	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)

22CYO03 – ORGANIC CHEMISTRY FOR INDUSTRY

(Offered by Department of Chemistry)

Programme & Branch	All BE / BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	OE	3	1	0	4

Preamble	Organic Chemistry for Industry aims to equip the students to have wide-range knowledge on organic chemistry in order to meet the industrial needs.	
Unit – I	**Basic aspects of Organic Chemistry**	**9+3**
Organic intermediates: carbocations, carbanions, free radicals, carbenes and nitrenes, their method of formation, stability and synthetic applications- Nucleophilic uni- and bimolecular reactions (SN1 and SN2)- Elimination reactions (E1 & E2; Hoffman & Saytzeff's rule).		
Unit – II	**Molecular Rearrangements**	**9+3**
Reactions involving electron deficient, carbon, nitrogen, oxygen centers, emphasis on synthetic utility of the rearrangements - Migration of carbon: Wagner-Meerwein, Pinacol-pinacolone, benzyl-benzilic acid rearrangement – Migration of nitrogen: Beckmann rearrangement, Hofmann, Curtius, Lossen rearrangements- Migration of oxygen: Bayer-Villiger oxidation.		
Unit – III	**Synthetic Reagents & Applications**	**9+3**
Lithium aluminium hydride- sodium borohydride- selenium-di-oxide- osmium tetroxide- phenyl isothiocyanate- N-bromosuccinamide (NBS)- lead tetraacetate - dicyclohexylcarbodiimide (DCC) – pyridinium chlorochromate (PCC) – Swern oxidation –p-toluenesulphonyl chloride – trifluoroacetic acid- lithium diisopropylamide (LDA) – 1,3- dithiane (reactive umpolung) - crown ethers-Trimethyl silyl iodide - dichlorodicyanobenzoquinone (DDQ) – Gilman reagent– phase transfer catalysts- Wilkinson's catalysts.		
Unit – IV	**Unit Operations**	**9+3**
Extraction: Liquid equilibria-extraction with reflux-extraction with agitation-counter current extraction. **Filtration:** Theory of filtration- pressure and vacuum filtration-centrifugal filtration. **Distillation:** Azeotropic and steam distillation. **Evaporation**: Types of evaporators-factors affecting evaporation. **Crystallization:** Crystallization from aqueous-non- aqueous solutions factors affecting crystallization-nucleation.		
Unit – V	**Unit Processes**	**9+3**
Nitration: Nitrating agents-aromatic nitration-kinetics and mechanism of aromatic nitration- process equipment for technical nitration-mixed acid for nitration. **Halogenation:** Kinetics of halogenations-types of halogenations-catalytic halogenations-Case study on industrial halogenation process. **Fermentation**: Aerobic and anaerobic fermentation. Production of Antibiotics: Penicillin and Streptomycin-Production of Vitamins: B2 and B12.		
		Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

1. P.S.Kalsi," Organic Reactions and their Mechanisms", 5th Edition, New Age International publishers, 2020, for Unit-I, II, III, V.
2. Arun Bahl, B.S.Bahl, "Advanced Organic Chemistry", 6th Edition, S Chand, 2022, for Unit-IV, V.

REFERENCES:

1. V.K.Ahluwalia, Rakesh Parashar, "Organic Reaction Mechanisms" Fourth Edition, 2011
2. Jonathan Clayden, Nick Greeves, Stuart Warren, "Organic Chemistry", 2nd Edition, Oxford University Press, 2014.
3. Paula Yurkanis Bruice, "Organic Chemistry",8th Edition, Pearson, 2020.

COURSE OUTCOMES: On completion 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)

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	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)

22MAO05 - GRAPH THEORY AND ITS APPLICATIONS							
(Offered by Department of Mathematics)							
Programme & Branch	**All B.E/.BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**6**	**OE**	**3**	**1**	**0**	**4**

Preamble	To develop rigorous logical thinking and analytical skills by graph theoretic concepts which helps for solving real time engineering problems in networks, computer architecture, compiling techniques, model checking, artificial intelligence, software engineering, expert systems, software/hardware correctness problem.	
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 - Shortest paths – Shortest path algorithms: Dijkstra's algorithm – Warshall's algorithm.		
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 - Minimum Spanning tree – Minimal spanning tree algorithms: Prim's algorithm – Kruskal's algorithm.		
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	**Matrix Representation and Applications:**	**9+3**
Matrix Representation: Incidence matrix – Circuit matrix - Cut-set matrix – Path Matrix – Adjacency matrix – Properties - The Chinese Postman Problem – Fleury's Algorithm – Travelling salesman problem.		
Unit – V	**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.		
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 for 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 for Units IV,V.

REFERENCES:

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.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply basic graph theoretic concepts in finding shortest path.	Applying (K3)
CO2	intrepret 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	apply the concepts of matrix representation of graph structures.	Applying (K3)
CO5	identify the maximal flow in network by means of suitable algorithms.	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	1												
CO3	3	1												
CO4	3	2	2											
CO5	3	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	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)

22MAX01 - DATA ANALYTICS USING R PROGRAMMING							
(Offered by Department of Mathematics)							
Programme & Branch	**All B.E/.BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**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.	
Unit – I	**Introduction to R:**	**9**
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**
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**
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**
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**
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:30, Total:75

TEXT BOOK:	
1.	Kun Ren, "Learning R Programming", 1st Edition, Packt Publishing Ltd, UK, 2016 for Units I, II.
2.	Mark Gardener, "Beginning R-The Statistical Programming Language",1st Edition, John Wiley & Sons,Inc, USA, 2012 for Units III,IV, V.

REFERENCES:	
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.
4.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	understand the basics of fundamentals of R.	Understanding (K2) Manipulation (S2)
CO2	apply the concepts of decision, looping structures and functions in real time problems.	Applying (K3) Manipulation (S2)
CO3	apply R programming to descriptive statistics.	Applying (K3) Manipulation (S2)
CO4	apply the libraries for data manipulation and data visualization in R.	Applying (K3) Manipulation (S2)
CO5	use R studio to identify the probability and test statistical hypothesis.	Applying (K3) Manipulation (S2)

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	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									

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	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							
(Offered by Department of Mathematics)							
Programme & Branch	**All B.E/.BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**6**	**OE**	**3**	**1**	**0**	**4**

Preamble	To provide the skills for solving the real time engineering problems involving linear objective functions, transportation models and also impart knowledge in finding optimal solutions to problems involving limited resources, project management techniques and game 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	**Game Theory:**	**9+3**
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:

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- 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.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	formulate and solve linear programming problems.	Applying (K3)
CO2	apply transportation and assignment algorithms in engineering problems.	Applying (K3)
CO3	use game theory concepts in practical situations.	Applying (K3)
CO4	identify the minimum processing times for sequencing problems	Applying (K3)
CO5	apply the concepts of CPM and PERT in scheduling the project networks.	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	3											
CO2	3	2	1											
CO3	3	2	1											
CO4	3	2	1											
CO5	3	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	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							
(Offered by Department of Mathematics)							
Programme & Branch	**All B.E/.BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**6**	**OE**	**3**	**1**	**0**	**4**

Preamble	To provide the skills for applying various number theoretic algorithms, congruences, primality tests in cryptography and network security and impart knowledge of basic cryptographic techniques.	
Unit – I	**Divisibility Theory:**	**9+3**
Division algorithm – Base-b representations – Number patterns – Prime and composite 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 – 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 for Units I ,II, III.
2.	William Stallings, "Cryptography and Network Security: Principles and Practice", 7th Edition, Pearson Education, New Delhi, 2019 for 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.

COURSE OUTCOMES: On completion 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	PSO1	PSO2
CO1	3	2												
CO2	3	1												
CO3	3	1												
CO4	3	2	1		2									
CO5	3	2	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	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)

22PHO04 - SYNTHESIS, CHARACTERIZATION AND BIOLOGICAL APPLICATIONS OF NANOMATERIALS
(Offered by Department of Physics)

Programme & Branch	**All BE/BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**6**	**OE**	**3**	**1**	**0**	**4**

Preamble	This course aims to impart the knowledge on the fundamentals of nanomaterials, synthesis of nanomaterials, analysis of nanomaterials, carbon tubes and biological applications of nanomaterials.	
Unit – I	**Introduction to nanomaterials**	**9+3**
Nanoscience and nanotechnology – Scientific revolution – Nanoscale – Nanosized effects – Surface-to-volume ratio – Quantum confinement effect – Classification of nanomaterials based on dimension – Properties of nanomaterials – Metal nanoparticles – Ceramic nanoparticles – Semiconductor nanoparticles – Polymer nanomaterials.		
Unit – II	**Synthesis of nanomaterials**	**9+3**
Physical, chemical and mechanical methods of preparation – Top down approaches and bottom up approaches – Physical Vapor Deposition method – Colloidal precipitation method – Sol-Gel method – Chemical precipitation method – Green synthesis method of nanomaterials.		
Unit – III	**Characterization of nanomaterials**	**9+3**
X-ray diffraction analysis – Grain size calculation – Lattice parameters - Cell volume – Photoluminescence analysis – Emission peak analysis – UV visible spectroscopy analysis – Bandgap estimation – HRTEM & AFM analysis (qualitative) – particle size analysis – BET (qualitative).		
Unit – IV	**Carbon nanotubes**	**9+3**
Allotropes of carbon – Diamond – Graphite – Graphene – Fullerenes – Carbon nanotubes – Properties – SWCNT – MWCNT – Structure of Carbon nanotubes – Preparation: Laser ablation method – CVD – Applications.		
Unit – V	**Biological applications**	**9+3**
Antibacterial activity – Mechanism – Antifungal activity – Microorganism – Gram positive bacteria – Gram negative bacteria – Disc diffusion method – Antioxidant activity – DPPH method – Anticancer activity – Cytotoxity – MTT method –Toxicity of nanoparticles.		
Lecture: 45, Tutorial: 15, Total: 60		

TEXT BOOK:

1. Charles P Poole Jr., and Frank J. Ownes ,. “Introduction to Nanotechnology”, John Wiley Sons, Inc., 2003.

REFERENCES:

1. C. Kittel., “Introduction to Solid State Physics”, Wiley Eastern Ltd., (2005).
2. Tamilarasan K. and Prabu K., “Materials Science”, 1st Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 2018.

COURSE OUTCOMES: On completion 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)

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	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

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	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
(Offered by Department of Physics)

Programme& Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	6	OE	3	1	0	4

Preamble	This course aims to impart the knowledge on crystals, physics of crystal growth and crystal growth methods.	
Unit – I	**Introduction to Crystals**	**9+3**
Classification of solids – Crystalline and amorphous – Single and polycrystalline materials – Space lattice – Bravais lattice – Lattice planes – Miller indices – Indices of crystal direction – Symmetry – Symmetry elements in cubic crystal – Physical properties.		
Unit – II	**Theories of Crystal Growth**	**9+3**
Phase rule – Phase diagrams – Binary phase diagrams – Alloy and compounds – Binary system with complete solid solution and no solid solution (eutectic) – Invariant reactions – Eutectic, peritectic and peritectoid (qualitative) – Nucleation concept – Homogeneous, heterogeneous nucleation – Classical theory – Energy of formation of nucleus – Kinetic theory of nucleation (qualitative) – Atmospheric nucleation.		
Unit – III	**Melt growth**	**9+3**
Bulk crystal growth methods – Melt growth methods – Bridgman (vertical and horizontal) and Czochralski methods – Liquid encapsulated technique (LEC) for semiconductors – Vermeil growth technique for growing gem crystals – Zone melting.		
Unit – IV	**Solution growth**	**9+3**
Low temperature solution growth – High temperature solution growth – Electro crystallization – Crystal growth in gel – Growth of biological crystals – Hydrothermal technique.		
Unit – V	**Vapour growth**	**9+3**
Physical vapour transport – chemical vapour transport. Epitaxial growth techniques – Liquid phase epitaxy – Vapour phase epitaxy: chloride, hydride, metalorganic – Molecular beam epitaxy – Chemical beam epitaxy.		

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

1. Introduction to Crystallography Philips, Read Books (9 June 2011), India.

REFERENCES:

1. B. D. Cullity Addison, Elements of X-ray diffraction, Wesley Publishers, 1977.
2. Santhana Raghavan and Dr. P. Ramasamy, Crystal growth processes and methods, KRU publications, 1999.
3. Leonid V. Azaroff, Introduction to Solids, Tata McGraw Hill Publishing Company.
4. C. Kittel Wiley, Introduction to Solid State Physics, Eastern University Edition.

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

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	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

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	20	50	30				100
ESE	20	50	30				100

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

22CYO04 - CORROSION SCIENCE AND ENGINEERING

(Offered by Department of Chemistry)

Programme & Branch	All BE / BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	6	OE	3	1	0	4

Preamble	Corrosion science and engineering aims to equip the students to have a wide-range of knowledge on corrosion and prevention methods in order to meet the industrial needs.	
Unit – I	**Corrosion and its Units**	**9+3**
Introduction- electro chemical mechanism Vs chemical mechanism - emf series and Galvanic series – galvanic corrosion – area effect in anodic and cathodic metal coatings – prediction using emf series and galvanic series - Pilling Bedworth's ratio and it consequences (Problems) – units of corrosion rate: mdd (milligrams per square decimeter per day), mmpy (millie miles per year) and mpy (mils per year) –- importance of corrosion prevention in various industries: direct and indirect effects of determining corrosion rates - weight loss method, weight gain method and chemical analysis of solution.		
Unit – II	**Thermodynamics of Corrosion**	**9+3**
Electrode potentials, Electrical double layer, Gouy−Chapman model, Stern model, Bockris – Devanathan−Müller model - free energy and oxidation potential - criterion of corrosion (Problems) - basis of Pourbaix Diagrams - Pourbaix diagrams of water, magnesium, aluminium and Iron - limitations and applications.		
Unit – III	**Kinetics of Corrosion**	**9+3**
Electrochemical polarization – Evan's diagram – activation polarization – concentration polarization - mixed potential theory(Wagner and Traud) – application of mixed potential theory – effect of metal in acid solution – cathodic protection of iron in acid solution – effect of cathodic reaction – effect of cathodic area – passivity – Flade potential – theories of passivity - adsorption theory – oxide film theory – film sequence theory.		
Unit – IV	**Types of Corrosion**	**9+3**
Introduction - (i) Crevice - differential aeration corrosion (ii) pitting – mechanism and factors (iii) intergranular- chromium depletion theory, weld decay and knife line attack (iv) stress - SCC mechanism, corrosion fatique- Cavitation damage – fretting damage (v) stray current corrosion - causes and its control.		
Unit - V	**Prevention of Corrosion**	**9+3**
Inhibitors – types of inhibitors, chemisorption of inhibitors, effect of concentration, effect of molecular structure, vapour phase inhibitors – prevention of corrosion at the design stage and in service conditions – control of catastrophic oxidation and hydrogen disease – Langelier saturation index and its uses - corrosion prevention by surface coatings – phosphating and its uses -principles and procedures of cathodic protection: sacrificial anodes and external cathodic current impression- painting, vitreous enamels, plastic lining.		
		Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

1. E. McCafferty, Introduction to Corrosion Science, 2nd Edition, Springer, 2017.

REFERENCES:

1. R. Winston, Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering, Revised 4th Edition, Wiley publisher, 2008.
2. Fontanna, "Corrosion Engineering", (Materials Science and Metallurgy series), McGraw Hill international Ed., 2005.

COURSE OUTCOMES: On completion 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)

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	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

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)

22CYO05 - CHEMISTRY OF COSMETICS IN DAILY LIFE

(Offered by Department of Chemistry)

Programme & Branch	**All BE / BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**6**	**OE**	**3**	**1**	**0**	**4**

Preamble	This course aims to provide knowledge on chemistry of cosmetics for engineering students.	
Unit - I	**Formulation of Cosmetic Product**	**9+3**
Introduction - basic sciences of cleansing – surfactant and adsorption, surfactant micelles, surfactants and cleansing, surfactants and foam (foam formation, stability, drainage, rupture and collapse and defoaming) - basics of dispersions - electrical charges associated with surfaces and barriers – basics of emulsion (stability, Ostwald ripening, prevention of creaming and sedimentation).		
Unit - II	**Structuring Materials and Regulation for Cosmetics**	**9+3**
Introduction - water/hydrophilic base materials, oleaginous/hydrophobic base materials and amphiphilic substances - adding functions and effects - materials that add or improve functional value, emotional value and materials for quality control – cosmetic and personal care product safety – potential contaminants in cosmetics – regulations related to cosmetics – cosmetic regulation in india - future challenges in cosmetics material development.		
Unit - III	**Polymers in Cosmetic Products**	**9+3**
Polymers in Cosmetics - polymer solubility and compatibility, polymer conformation - polymers that modify surfaces - film-forming polymers in cosmetics and personal care products - hair-conditioning polymers - polymers for the treatment of skin - polymers as controlled release matrices - dendritic polymers - polymeric antimicrobials and bacteriostats.		
Unit - IV	**Natural Products and Fragrance in Cosmetics**	**9+3**
Introduction – natural products – extraction methods - encapsulation and controlled release - allergens in cosmetics – testing for allergens - aroma chemicals - fragrance creation and duplication - fragrance applications -– malodor – fragrance allergies and sensitivities.		
Unit - V	**Preparation of Cosmetics**	**9+3**
Cosmetics in day to day life – characteristics, types, formulation, preparation and evaluation methods of lipstick, shampoo, powder, nail lacquer, creams, toothpaste and hair dye.		

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

1.	Kazutami Sakamoto, Robert Y. Lochhead, Howard I. Maibach, Yuji Yamashita, Cosmetic Science and Technology: Theoretical Principles and Applications, Elsevier, 2017 , for Units- I, II, III, IV, V.
2.	Gaurav Kumar Sharma, Jayesh Gadiya, Meenakshi Dhanawat A text book of cosmetic formulation, 2018, for Unit-V.

REFERENCES:

1.	R.K. Nema, K.S. Rathore , B.K. Dubey, Textbook of Cosmetics, CBS Publishers and Distributors, 2017.
2.	Bruno Burlando, Elisa Bottini-Massa, LuisellaVerotta, Laura Cornara, Herbal Principles in Cosmetics: Properties and Mechanisms of Action, CRC Press, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	outline the formulation of cosmetics products.	Understanding (K2)
CO2	identify the structuring materials and regulation involved in cosmetics development.	Applying (K3)
CO3	interpret the polymers and its role in cosmetics.	Understanding (K2)
CO4	develop knowledge about natural products and Fragrance in Cosmetics.	Applying (K3)
CO5	apply the knowledge of cosmetics to explain the characteristics, formulation, preparation and quality control of different cosmetic products used in day to day life.	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	1												
CO2	3	2	1											
CO3	3	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	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)

22CYO06 – NANOCOMPOSITE MATERIALS
(Offered by Department of Chemistry)

Programme& Branch	All BE / BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	6	OE	3	1	0	4

Preamble	This course aims to equip the students to have knowledge on processing, characterization, properties, features and applications of nanocomposites.	
Unit – I	**Introduction of nanocomposites**	**9+3**
Introduction – nanocomposites – nanocomposites past and present – nomenclature – composite materials: introduction to solids - atomic and molecular solids – role of statistics in materials – primary, secondary and tertiary structure – transitions.		
Unit - II	**Properties and features of nanocomposites**	**9+3**
Properties: physics of modulus – continuum measurements – yield – fracture – rubbery elasticity and viscoelasticity – composites and nanocomposites – surface mechanical properties –diffusion and permeability – features of nanocomposites: basics of polymer nanocomposites - nano reinforcements – matrix materials – hazards of particles.		
Unit - III	**Processing of nanocomposites**	**9+3**
Viscosity: types of flow, experimental viscosity, non-newtonian flow -low-viscosity processing: solvent processing, particle behavior, in situ polymerization, post-forming, hazards of solvent processing - melt, high shear and direct processing: melting and softening, melt processes with small shears or low-shear rates flow, meltprocesses with large deformations or high-shear rates, thermo-kinetic processes.		
Unit - IV	**Characterization of nanocomposites**	**9+3**
Introduction to characterization – experiment design – sample preparation – imaging –structural characterization – scales in nanocomposites – texture – electromagnetic energy –visualization – physicochemical analysis – characterization of physical properties.		
Unit - V	**Applications of nanocomposites**	**9+3**
Nanocomposites – optical, structural applications – nanoparticulate systems with organic matrices – applications – biodegradable protein nanocomposites – applications-polypropylene nanocomposites – application as exterior automatic components – hybrid nanocomposite materials – application for corrosion protection.		
		Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

1.	Thomas E. Twardowski, “Introduction to Nanocomposite Materials – Properties, Processing, Characterization”, DesTech Publications, April 2007, for Units-I, II, III, IV.
2.	Klaus Friedrich, Stoyko Fakivov, Zhony Shang, “Polymer Composites from Nano – to Macro – scale”, Springer USA, 2005, for Units-I, II, V.

REFERENCES:

1.	Pulickel M. A, Linda S. S, Paul V.B, “Nanocomposite Science and Technology”, Wiley-VCH, 2006.
2.	Vikas Mittal, Characterization techniques for polymer nanocomposites, Wiley-VCH, 2012.

COURSE OUTCOMES: On completion 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)

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	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)

22MAO08 - NON-LINEAR OPTIMIZATION							
(Offered by Department of Mathematics)							
Programme & Branch	**All B.E/.BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**OE**	**3**	**0**	**0**	**3**

Preamble	The course focuses on the basic concepts, various techniques and applications of engineering optimization.	
Unit – I	**Classical Optimization Techniques:**	**9**
Introduction to Optimization – Statement of an Optimization problem – Mathematical formulation – Multi variable optimization with equality constraints – Lagrange multipliers method – Multi variable optimization with inequality constraint – Kuhn Tucker conditions.		
Unit – II	**Non-Linear Programming: One-Dimensional Minimization Method:**	**9**
Introduction – Unimodal function – Elimination Methods: Unrestricted search – Exhaustive search – Dichotomous search – Interval halving method – Fibonacci method – Golden section method – Direct root methods: Newton method – Secant method.		
Unit – III	**Non-Linear Programming: Unconstrained Optimization Techniques:**	**9**
Introduction to Unconstrained optimization – Direct Search Methods: Grid search method – Univariate method – Hookes and Jeeve's method – Powell's method.		
Unit – IV	**Unconstrained Optimization Techniques (Indirect Methods):**	**9**
Gradient of a Function – Indirect Search Methods: Steepest descent method – Fletcher-Reeves method – Newton's method – Marquardt method.		
Unit – V	**Non-Linear Programming: Constrained Optimization Techniques:**	**9**
Introduction – Characteristics of a Constrained Problem – Direct Methods: Random search method – Sequential linear programming – Indirect methods: Transformation techniques – Exterior penalty function method – Interior penalty function method.		
		Total:45

TEXT BOOK:

1. S.S.Rao, Engineering Optimization Theory and Practice, 5th 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.

COURSE OUTCOMES: On completion 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	PSO2
CO1	3	3	2											
CO2	3	2												
CO3	3	3	1											
CO4	3	3	3											
CO5	3	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	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							
(Offered by Department of Mathematics)							
Programme & Branch	**All B.E/.BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**OE**	**3**	**0**	**0**	**3**

Preamble	To provide the skills for solving the real time engineering problems involving linear and non-linear objective functions and also impart knowledge in finding optimal solutions to problems 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- 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.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	formulate and solve linear programming problems.	Applying (K3)
CO2	solve Integer Programming problems that exist in real time applications.	Applying (K3)
CO3	demonstrate the theoretical workings of dynamic programming method to find shortest path for given network.	Applying (K3)
CO4	use the appropriate queuing model for a given practical application.	Applying (K3)
CO5	apply the concept of non-linear programming for solving the problems involving non-linear constraints and objectives.	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	3											
CO2	3	2	1											
CO3	3	2	1											
CO4	3	2	1											
CO5	3	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	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)

22CYO07 - WASTE AND HAZARDOUS WASTE MANAGEMENT
(Offered by Department of Chemistry)

Programme & Branch	All BE / BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	7	OE	3	0	0	3

Preamble	Waste and Hazardous waste management aims to equip the students to have a wide-range of knowledge on waste management.	
Unit – I	**Solid Waste Management**	**9**
Solid wastes: definition, sources, types, composition of solid waste- Solid waste management system: collection, separation, processing and transformation of solid waste – combustion, aerobic composting, vermicomposting, pyrolysis, landfill-classification, types, methods and control of leachate in landfills - recycling of material found in municipal solid waste- recycling of paper and cardboard, recycling of plastics, recycling of glass.		
Unit – II	**Hazardous Waste Management**	**9**
Hazardous wastes: definition, nature and sources of hazardous waste, classification and characteristics of hazardous waste- chemical class of hazardous waste, generation, segregation, treatment and disposal: waste reduction, waste minimization, recycling - chemical treatment: acid base neutralization, chemical precipitation, oxidation/reduction, hydrolysis, electrolysis, chemical extraction and leaching, ion exchange, photolytic reaction- thermal treatment methods: incineration – biodegradation of hazardous waste: aerobic, anaerobic, reductive dehalogenations - land treatment and composting.		
Unit – III	**E- Waste & Biomedical Waste Management**	**9**
E-Waste Management: definition, sources, classification, collection, segregation, treatment and disposal. **Biomedical Waste Management :** Introduction-definition –components of biomedical waste-waste generation –waste identification and waste control-waste storage-labeling and color coding-handling and transportation-waste treatment and disposal- autoclave, hydroclave , microwave treatments- chemical disinfection – sanitary and secure landfill.		
Unit – IV	**Pollution From Major Industries And Management**	**9**
Introduction- sources and characteristics - waste treatment flow sheets for selected industries such as textiles, tanneries, pharmaceuticals, sugar, petroleum refinery, fertilizer and dairy industries.		
Unit – V	**Solid Waste Management and Legislation**	**9**
Solid waste management plan - solid waste (management and handling) rules - biomedical waste (management and handling) rules- plastic waste management rules - e-waste management rules - hazardous and other wastes (management and transboundary movement) rules - construction and demolition waste management rules.		
		Total: 45

TEXT BOOK:

1.	George Tchobanoglous, Hillary Theisen, Samuel a Vigil, Integrated solid waste management (Engineering principle and management issues) McGraw hill Education (India) Pvt. Ltd., 2015, for Unit-I, II, V.
2.	SC Bhatia, Handbook of Industrial pollution and control (Volume-1), CBS Publisher and Distributers, New Delhi, 2002, for Unit-II, III, IV, V.

REFERENCES:

1.	Manual on Municipal Solid Waste management, Central public Health and Environmental Engineering Organization (CPHEEO), Govt. of India, May 2000.
2.	Michael D. LaGrega, Phillip L. Buckingham, Jeffrey C. Evans, Hazardous waste management, MEDTEC, 2015.
3.	Majeti Narasimha Vara Prasad, Meththika Vithanage, Anwesha Borthakur, “Handbook of Electronic Waste Management: International Best Practices and Case Studies” 1st Edition, Butterworth-Heinemann, 2019.

COURSE OUTCOMES: On completion 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)

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			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

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)

22CYO08 - CHEMISTRY IN EVERY DAY LIFE
(Offered by Department of Chemistry)

Programme& Branch	All BE / BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	7	OE	3	0	0	3

Preamble	This course aims to prepare the students to have the knowledge on oils, fats, sugar, adulterants in food, creams, milk powder, soil, fertilizer, pesticides, insecticides, fungicides and herbicides in order to know its chemistry in our everyday activities.	
Unit – I	**Oils, Fats and Sugar**	**9**
Distinction between oils and fats – properties – classification – edible oils – vegetable oils –animal oils – manufacture of oils by solvent extraction – refining of crude vegetable oils – processing of animal fats – manufacture of cane sugar – manufacture of sucrose from beet root.		
Unit – II	**Adulterants in food**	**9**
Food Adulteration and prevention – common food adulterants – food additives – food colorants– preservatives – flavourants – food poisoning – analysis of adulterants in edible oils, coffee powder, chilli powder, turmeric powder, meat , fish, ghee and milk – harmful effects of food adulterants		
Unit – III	**Creams and Milk powder**	**9**
Creams: Composition-chemistry of creaming process- Factors influencing cream separation (Mention the factors only) - Estimation of fat in cream - Milk powder: Need for making powder-drying process- spraying, drum drying, jet drying and foam drying-principles involved in each.		
Unit – IV	**Soil and Fertilizers**	**9**
Soil analysis: Composition of soil - Organic and Inorganic constituents-Soil acidity - buffering capacity of soils -Liming of soil - Fertilizers: primary nutrients –role of Nitrogen, potassium and phosphorous on plant growth –Complex fertilizers and mixed fertilizers and its composition - Secondary nutrients – micronutrients and their functions in plants -optimal addition of Fertilizers to obtain estimated yield.		
Unit – V	**Pesticides, Insecticides, Fungicides and Herbicides**	**9**
Pesticides – Classification – general methods of application and toxicity, Safety measures when using pesticides-Insecticides: Inorganic pesticides – borates - Organic pesticides – D.D.T. and BHC-Plant derivatives: pyrethrin and Nicotine - Synthetic organic pesticides: Endrin and Aldrin (Chemical name - Structure- functions and uses)-Fungicides: Inorganic (Bordeaux mixture) and organic (dithiocarbamate) fungicides - Industrial fungicides: Creosote fractions - Herbicides: Selective and non-selective - 2, 4-dicholorophenoxyacetic acid and 2,4,5-tricholorophenoxyaceticacid (structure and function).		
		Total: 45

TEXT BOOK:

1.	Sharma B K , Industrial Chemistry, Goel publishing house, New Delhi, 2011, for Units- I, II, IV
2.	Alex V Ramani, Food Chemistry, MJP Publishers, Chennai, 2009, for Units -II, III, V.

REFERENCES:

1.	Dilip Kumar Das, Introductory Soil Science, 1st Edition, Kalyani Publishers, Reprint 2002.
2.	K. Bagavathi Sundari– “Applied Chemistry”, MJP Publishers, Chennai, 2006.
3.	Ashutosh Kar, Medicinal Chemistry, Wiley Eastern limited, New Delhi, 1993.

COURSE OUTCOMES: On completion 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)

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	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)

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE-638060

(AUTONOMOUS)

BOARD OF COMPUTER SCIENCE AND ENGINEERING

DEGREE & PROGRAMME : **BE & Computer Science and Design**

HONOURS DEGREE TITLE: **VIRTUAL AND AUGMENTED REALITY**

The following courses are identified to earn additional 18 credits to get a Honours degree with specialization in **VIRTUALAND AUGMENTED REALITY**

S.No	Course Code	Course Title	Credits	Prerequisites	Semester
1.	22CDH01	Immersive Design Theory	4	Nil	5
2.	22CDJ01	Game Design 3D Modeling and Texturing	4	Nil	6
3.	22CDJ02	Real-time Game Engine	4	Nil	6
4.	22CDJ03	Augmented Reality Application Development	3	Nil	7
5.	22CDJ04	Virtual Reality Application Development	3	Nil	7
		TOTAL	**18**		

BoS Coordinator

BoS Chairman

22CDH01 - IMMERSIVE DESIGN THEORY							
Programme & Branch	**B.E & Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5/6/7**	**HN**	**3**	**1**	**0**	**4**
Preamble	This course opens a world of possibilities to extend the physical spaces around us by enhancing them with digital content. In Designing Immersive 3D Experiences, designers, and even developers, will learn how to take their traditional 2D knowledge of design and expand it into three dimensions. Understanding How to design in 3D and then transfer that knowledge into XR is essential for the designers of today and tomorrow. Also this course lays out a holistic approach to extended reality development that considers factors from color palettes and lighting to sound stages and typography.						
Unit – I	**Introduction to Extended Reality**						**9+3**
Extended Reality: The tech behind the acronyms - You are already using extended reality - Prosthetic knowledge - Looking ahead – Technology Check: - Is any of this actually new? - The world in the palm of your hand - Projection mapping - Head-mounted displays - Spatial computing Reality check.							
Unit – II	**Immersive Design for 3D**						**9+3**
The Immersive Experience: The world in 3D - Affordances - Multimodal experiences - Experience design – Ideation: Identify the why - Innovation and practicality - Outside influence - Keep it human - The answer to your questions - Creating The Prototype: Fake it 'til you make it - Sketch transparently - The power of prototypes - Use what you know - Process work.							
Unit – III	**UX/UI for Immersive Design**						**9+3**
The UX of XR: Approachable design - Seamless user flow - Know thy audience - Making reality accessible - UX challenge - The UI of XR: The z-axis - 3D interface metaphors - Time and space – Microinteractions - Inspiration is all around you.							
Unit – IV	**Human Factors and Background of Immersive Design**						**9+3**
Human Factors: Designing the whole experience - Theories of perception - Creating hierarchy in 3D - Human centered - The Uncontrollable Background: Expecting the unexpected - Figure-ground - Location, location, location - Getting emotional - Control is overrated.							
Unit – V	**Extended Reality(XR) Development**						**9+3**
Augmented Typography: Legibility and readability - Creating visual contrast - Take control - Design with purpose - Color for XR: Color appearance models - Light interactions - Dynamic adaptation – Reflection - Sound Design: Hearing what you see - Spatial sound - Augmented audio - Voice experiences - Power of sound.							
							Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1.	Renee Colette Stevens, "Designing Immersive 3D Experiences: A Designer's Guide to Creating Realistic 3D Experiences for Extended Reality ", 1st Edition, New Riders, ASIN : B095BQT1VT, 2021.

REFERENCES:

1.	Abhishek Kumar "Immersive 3D Design Visualization with Autodesk Maya and Unreal Engine 4", 1st Edition, Apress, ISBN: 978- 1484265963, 2020.
2.	Cornel Hillmann"UX for XR: User Experience Design and Strategies for Immersive Technologies ", 1st Edition, Apress, ISBN: 978- 1484270196, 2021.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Understand the fundamentals of immersive design	Applying (K3)
CO2	Outline the phases of immersive design for 3D such as immersive experience, ideation and prototype.	Applying (K3)
CO3	Make use of user experience (UX) / user interface (UI) design concepts for immersive design.	Applying (K3)
CO4	Identify the human factors and background involves in immersive design	Applying (K3)
CO5	Explain the extended reality (XR) development factors from color palettes and lighting to sound stages and typography.	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										2	1
CO2	3	2	1										2	1
CO3	3	2	1										2	1
CO4	3	2	1										2	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	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)**

22CDJ01 - GAME DESIGN 3D MODELING AND TEXTURING							
Programme & Branch	**BE & Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5/6/7**	**HN**	**3**	**0**	**2**	**4**
Preamble	Learning concepts of 3D and concepts of game asset making and usage of assets in real-time engines.						
Unit – I	**Overview of Asset Creation**						**9**
Introduction to 3D - Commercial Software Versus Open-Source Software - History of Blender - Blender Basics: The User Interface – Your First scene in Blender - Beginning a Project: Project Overview - Character Design.							
Unit – II	**3D Modeling**						**9**
Blender Modeling Tools - Working with Vertices, Edges, and Faces - Making Selections - Using Mesh Modeling Tools - Using Modeling Add-Ons - Using Other Useful Blender Options and Tools - Character Modeling.							
Unit – III	**3D Texturing**						**9**
Unwrapping and UVs - Unwrapping in Blender - Working with UVs in Blender - Painting Textures - Texture Painting in Blender - Creating the Base Texture - Texturing in Other Software - Materials and Shaders - Understanding Materials – Channels - Shading Your Character.							
Unit – IV	**3D Rigging & Animation**						**9**
Character Rigging - Understanding the Rigging Process - Working with Armatures - Rigging Your Character – Skinning - Creating Custom Shapes - Reusing Your Character in Different Scenes - Animating Your Character - Working with Animation Editors - Animating a Walk Cycle.							
Unit – V	**Particles & Physics and The Game Engine**						**9**
Making particles – Making Hair - Fluid Dynamics - Smoke - Soft Body Physics - Cloth Dynamics - The Game Engine: Game Engine Physics - Creating Your Own Droid - Silly Soccer Game.							
List of Exercises / Experiments:							
1. Create a Bottle using Curves.							
2. Create a weapon using basic modeling tools.							
3. Create an interior or exterior scene and with the other props based on the requirement.							
4. Create the maps and textures using UV Unwrapping techniques for the above developed models							
5. Set up the Lighting for the above scene and render it							
6. Create a 3D Character and with appropriate Texture and Render it.							
7. Set up Rig for the any of the above 3d model							
8. Make Realistic Animations for the above models.							
9. Design the various frames for exploding rocket using particles.							
10. Create an application for shooting things via object/emitter.							
Lecture:45, Practical:30, Total:75							
TEXT BOOK:							
1.	Oliver Villar, “Learning Blender – A Hands-On Guide to creating 3D animated characters” – Third Edition, Addison-Wesley Publishers, ISBN- 978-0134663463, 2017. (Unit I to IV)						
2.	Lance Flavell, “Beginning Blender Open Source 3D Modeling, Animation and Game Design” – First Edition, APress Publishers, ISBN - 978-1430231264, 2010. (unit V)						
REFERENCES / SOFTWARE/ MANUAL:							
1.	John M Blain, “The Complete Guide to Blender Graphics Computer Modeling and Animation”- Third Edition, A K Peters/CRC Press Publishers, ISBN- 978-1498746458, 2017.						
2.	Danan Thilakanathan, “3D Modeling for Beginners: Learn everything you need to know about 3D Modeling” - Createspace Independent Publishers, ISBN - 978-1530799626, 2016.						
3.	Gordon C. Fisher, “Blender 3D Basics: The Complete Novice's Guide to 3d Modeling and Animation”, Packt Pub Ltd, ISBN - 978-1849516907, 2012.						
4.	David S. Ebert, F. Kenton Musgrave, Darwyn Peachey, Ken Perlin, and Steven Worley, “Texturing and Modeling: A Procedural Approach" – Third Edition, Morgan Kaufmann Publishers, ISBN - 978-1558608481, 2003.						
5.	Joe Hocking, “Unity in Action: Multiplatform Game Development in C#" – Second Edition, Manning Publishers, ISBN - 978-1617294969, 2018.						
6.	Blender software						
7.	Laboratory Manual						

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Relate the concept of 3D and identify the basic requirements to being a project in Blender.	Applying (K3), Precision (S3)
CO2	Make real time objects using different types of modelling tools in Blender.	Applying (K3), Precision (S3)
CO3	Explore the concept of 3D texturing, materials and shaders.	Applying (K3), Precision (S3)
CO4	Illustrate the concept of 3D rigging and animation and build a character using 3D animation	Applying (K3), Precision (S3)
CO5	Develop animation concepts for games and applications using Particles and Physics.	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	1	2		2								1	2
CO2	3	1	2		3								1	2
CO3	3	1	2		3								1	2
CO4	3	1	2		3								1	2
CO5	3	1	2		3								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	50	25				100
CAT2	20	55	25				100
CAT3	20	50	30				100
ESE	20	40	40				100

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

22CDJ02 - REAL-TIME GAME ENGINE							
Programme & Branch	**BE & Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5/6/7**	**HN**	**3**	**0**	**2**	**4**

Preamble	Learning Basics of Real-time Game Engine and concepts of game design and basic programming for games	
Unit – I	**Introduction to Real-time Game Engine**	**9**
Introduction to Unity - : Game Objects - Models, Materials, and Textures- The Basics of Models- Textures, Shaders, and Materials - Terrain- Environments- Lights and Cameras.		
Unit – II	**Real-time Game Engine Essentials**	**9**
Collision- Prefabs- Graphical User Interfaces- Character Controllers- Particle Systems- Animations- Animators- Audio- Polish and Deploy - Wrap Up.		
Unit – III	**Programming Basics**	**9**
Primitive Types and Variables – Operators and Expressions- Conditional Statements-Loops-Arrays-methods-Recursion-creating and using objects-Exception handling-strings and text processing. Defining classes-text files- practices on C# programs.		
Unit – IV	**2D Game Development**	**9**
Introducing 2D Game Development in C# - Downloading and Installing Development Tools -2D Graphics, Coordinates, and Game State- The Game Window- Textured Primitives- Coordinate System and Camera- Font Output- A Simple Game Object- Simple Game State- Getting Things Moving- Sprites, Camera, Action - Building Your First 2D Game.		
Unit – V	**3D Game Development**	**9**
Introduction to 3D Game Development- Elements of a 3D Game - The Torque Game Engine -3D Programming Concepts- Game Programming- Game Play- The Changes- Control Modules- Client Control Modules- Server Control Modules.		

List of Exercises / Experiments:

1. Create a game design document for your concept
2. Create a Setup Terrain with detailed rocks, trees, grass, fog, water surface.
3. Create Object meshes with collision
4. Create 2D sprites.
5. Set Up First person camera and Third person camera to create a walkthrough
6. Create and develop a Simple Game Object
7. Create a Movement Script for Player.
8. Create 2D Sprite animations.
9. Compile the elements of 3D Game
10. Create an Environmental Open world scene for the given game.

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Mike Geig," Teach Yourself Hours in 24 Unity Game Development", Pearson Education, Inc., ISBN-13: 978-0-672-33696-6 ISBN-10: 0-672-33696-6, 2014 (UNIT I,II)
2.	Svetlin Nakov & Co "FUNDAMENTALS OF COMPUTER PROGRAMMING WITH C#" ,The Bulgarian C# Programming Book, ISBN 978-954-400-773-7, 2013.(UNIT-III)
3.	Jebediah Pavleas,Jack Keng-Wei Chang,kelvin Sung,and Robert Zhu,"Learn 2D Game Development with c#",2014.(UNIT-IV)
4.	Kenneth C. Finney ,"3D Game Programming All in One", series Edition Andre Lamothe ,ISBN: 1-59200-136-X,2004.(UNIT-V)

REFERENCES:

1.	Matthew Johnson James A. Henley," Learning 2D Game Development with Unity® A Hands-On Guide to Game Creation", Addison Wesley,ISBN-13: 978-0-321-95772-6,ISBN-10: 0-321-95772-5,2014
2.	https://www.c-sharpcorner.com/article/create-ui-slider-with-text-that-shows-percentage-value-using-c-sharp-script-in-unity/
3.	https://docs.unity3d.com/Manual/Quickstart2DCreate.html
4.	Sue Blackman," Beginning 3D Game Development with Unity 4:All-in-One, Multi-Platform Game Development",Second Edition apress,ISBN-13 (pbk): 978-1-43024899-6 ,ISBN-13 (electronic): 978-1-4302-4900-9,2013.
5.	Unity Hub: Unity 2022, Microsoft Visual Studio
6.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	Explore the fundamentals of Game Design and Development	Applying (K3), Precision (S3)
CO2	Create Complete 2D & 3D Games in Unity & C#	Applying (K3), Precision (S3)
CO3	Learn Game Design & Development by Building Projects	Applying (K3), Precision (S3)
CO4	Understand the basics of Scripting	Applying (K3), Precision (S3)
CO5	Gain Knowledge on Production pipelines of games	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	1										2	1
CO2	3	2	1										2	1
CO3	3	2	1										2	1
CO4	3	2	1										2	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	25	50	25				100
CAT2	20	55	25				100
CAT 3	20	50	30				100
ESE	20	40	40				100

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

22CDJ03 - AUGMENTED REALITY APPLICATION DEVELOPMENT							
Programme& Branch	**BE & Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5/6/7**	**HN**	**2**	**0**	**2**	**3**

Preamble	This course aims to give hands on Hands on Experience in Augmented reality Software design and development.	
Unit – I	**Introduction to Augmented Reality**	**6**
Augmented Reality - Overview of AR - What is Augmented Reality - Why Augmented Reality - Types of Augmented Reality - Marker based vs Markerless AR - Other types of AR - AR Presence in various sectors - Use cases of AR and benefits.		
Unit – II	**Overview for AR Development**	**6**
Real-time Engine Overview - Real-time Engine basics - UI and Navigation of Real-Time Game Engine - AR Plugins Overview - Types of Plugins - Plugins Setup - Vuforia and AR Foundation Setup.		
Unit – III	**Hands on Experience in AR**	**6**
Working with Setting up assets - Image Targets and Image Tracking - Multiple Image Tracking - Multiple Image Detection - 3D Object Recognition - 3D Object Tracking - Markerless Tracking.		
Unit – IV	**User Interface and Testing Compatibility**	**6**
Virtual Buttons - Application User Interface - World Space User Interface - Screen space User Interface - Technical Issues - AR Compatibility - Testing Methodology.		
Unit – V	**Build and Deploy**	**6**
Build Settings - Player Settings - Types of Platforms - Bug Analysis - Bug fixing - Optimization - Application Output - Publish.		

List of Exercises / Experiments:

1. Setting Up Vuforia /AR Foundation.
2. Create Image Markers using Vuforia
3. Working with Augmented interactions
4. Program for Custom Augmentation Controllers
5. Set up AR camera for Plane Detection.
6. Working with Light Estimation
7. Working with Depth Estimation.
8. Create AR Face Filters
9. Working with Face Mesh
10. Build an app for AR face filters app.

Lecture:30, Practical:30, Total:60

TEXT BOOK:

1.	Dieter Schmalstieg, Tobias Höllerer, “Augmented Reality: Principles and Practice”, First Edition, Publisher(s): Addison-Wesley Professional, ISBN: 9780133153217 , June 2016

REFERENCES:

1.	Augmented Reality: A Review, Donna R. Berryman, Pages 212-218 | Published online: 04 May 2012
2.	Augmented Reality (AR) tutorial for beginners using Unity - https://youtu.be/gpaq5bAjya8
3.	Unity Hub: Unity 2022, Microsoft Visual Studio, Toolkits: Vuforia Engine, AR Foundation, Spark AR
4.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Explore the Fundamentals of Augmented Reality	Applying (K3), Precision (S3)
CO2	Summarize different forms of Augmented Reality and their applications.	Applying (K3), Precision (S3)
CO3	Develop the experimental design using Augmented Technology	Applying (K3), Precision (S3)
CO4	Get Exposure to Industry testing methods and their user interface	Applying (K3), Precision (S3)
CO5	Hands on Experience on Augmented Reality deployment to digital platforms	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	1										2	1
CO2	3	2	1										2	1
CO3	3	2	1										2	1
CO4	3	2	1										2	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	25	55	20				100
CAT2	20	65	15				100
CAT3	20	65	15				100
ESE	20	70	10				100

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

22CDJ04 - VIRTUAL REALITY APPLICATION DEVELOPMENT							
Programme& Branch	**BE & Computer Science and Design**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5/6/7**	**HN**	**2**	**0**	**2**	**3**

Preamble	This course helps the students to develop Virtual Reality Applications. It aims to give both theoretical and hands-on experience in VR application design and deployment in a chosen environment.	
Unit – I	**VR Overview**	**6**
Unity game engine - VR Introduction - Motion Tracking Build Settings - Enabling VR in unity project - previewing VR in unity - Hardware - software - VR sample project - Creating your first VR project - Framerate in Editor - Camera movement & Node - Image Effect for VR - Render scale. coroutines in C#.		
Unit – II	**Intro to Vive and Oculus**	**6**
Vive and Oculus project setup - Using the Vive and Oculus controllers - Interaction - input and selection - Create your first Vive or Oculus app.		
Unit – III	**VR Game Movements and interaction**	**6**
VR Eye Ray caster - VR Input - VR Interactive Item - Interaction in menu scene - Interaction in Maze scene - Interaction in Flyer scene - Gaze, the reticule - Rotation & Position of the head in VR - Touchpad keyboard interaction during VR Game Play - First Person Game in VR - Fade Blink transition in VR - Flyer VR movement Maze-Table top style game movement - Shooter Movement - world space UI - 360 degree.		
Unit – IV	**Optimization for VR in unity & Project**	**6**
VR Optimization fundamentals - The Profiler, Geometry - Overdraw, levels of details - Draw call Batching - Light Mapping - Light probes - Reflection probes - Occlusion culling - Anti-Aliasing - Texture - Shader - Quality Settings.		
Unit – V	**Deploy your VR project**	**6**
Developing to the Oculus DKS - Developing to the Gear VR - Publishing to the oculus store.		

List of Exercises / Experiments:

1. Create a Virtual 3DOF Environment
2. Create Image Markers using Vuforia
3. Create a Locomotion in VR Environment
4. Create VR Spatial Sound
5. Creating a 6DOF Environment
6. Working with 6DOF Control Systems
7. Creating a VR Experience Using HDRIs
8. Create UI and Controls for a VR application.
9. Setup an VR Environment and add interactions to objects
10. Deploy the VR project to device

Lecture:30, Practical:30, Total:60

TEXT BOOK:

1.	Jonathan Linowes, " Unity Virtual Reality Projects: Explore the world of virtual reality by building immersive and fun VR projects using Unity 3D" - First Edition, Packt Pub Ltd, ISBN: 978-1783988556 , (2015-09) (Unit I,II)
2.	Jonathan Linowes, " Unity Virtual Reality Projects: Learn Virtual Reality by developing more than 10 engaging projects with Unity" Second Edition, Packt Pub Ltd, ISBN: 978-1788478809 2018 (Unit III,IV,V)

REFERENCES:

1.	https://www.instructables.com/id/How-to-Make-a-Virtual-Reality-Game-for-Beginners/
2.	https://learn.unity.com/project/vr-in-unity-a-beginner's-guide
3.	Unity Hub: Unity 2022, Microsoft Visual Studio
4.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Analyze the Fundamentals of Virtual Reality ecosystem	Applying (K3), Precision (S3)
CO2	Classify the different forms of Virtual Reality and their applications.	Applying (K3), Precision (S3)
CO3	Breakdown the various VR interactions and movements in virtual space.	Applying (K3), Precision (S3)
CO4	Implement the Industry optimizing methods.	Applying (K3), Precision (S3)
CO5	Prepare the experience on Virtual Reality Application deployment	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	1										2	1
CO2	3	2	1										2	1
CO3	3	2	1		1								2	1
CO4	3	2	1		1								2	1
CO5	3	2	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	25	65	10				100
CAT2	20	65	15				100
CAT3	20	65	15				100
ESE	20	70	10				100

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