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 onwards)

BACHELOR OF TECHNOLOGY DEGREE
IN
INFORMATION TECHNOLOGY

DEPARTMENT OF INFORMATION TECHNOLOGY

KONGU
Assuring the Best

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 168.

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 7.5 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	20	Average of best 2 tests (20 marks)
	Test - II	20	
	Test - III	20	
2.	Tutorial: (Tutorial/Problem Solving (or) Simulation (or) Simulation & Mini Project (or) Mini Project (or) Case Studies (or) Any other relevant to the course)	15	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:

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

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

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

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 7.50

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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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	✓	✓	✓	✓	✓				✓	✓		✓		
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	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			

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

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
6	22EEO07	Energy Conservation and Management	✓	✓	✓		✓		✓	✓	✓			✓		
6	22EEO08	Microprocessors and Microcontrollers Interfacing	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		
6	22EEO09	Electrical Safety	✓	✓	✓				✓	✓			✓	✓		
6	22EEO10	VLSI System Design	✓	✓	✓	✓	✓				✓		✓	✓		
6	22EEO11	Automation for Industrial Applications	✓	✓	✓	✓			✓		✓			✓		
6	22EIO04	PLC Programming with High Level Languages	✓	✓	✓	✓	✓									
6	22EIO05	Virtual Instrumentation	✓	✓	✓	✓	✓									
6	22CSX04	Foundations of Machine Learning	✓	✓	✓											
6	22CSX05	Web Engineering	✓	✓	✓											
6	22ITX02	Advanced Java Programming	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
6	22ITO02	Internet of Things	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓			
6	22ITO03	Fundamentals of Software Development	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓			
6	22ITO04	Mobile Application Development	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
6	22CDX01	Fundamentals of User Interactive Design	✓	✓	✓	✓										
6	22ADX01	Data Visualization	✓	✓	✓											
6	22ALX01	Data Exploration and Visualization Techniques	✓	✓	✓											
6	22CHO04	Air Pollution Monitoring and Control	✓	✓	✓			✓	✓							
6	22CHO05	Paints and Coatings	✓	✓	✓				✓							
6	22CHO06	Powder Technology	✓	✓	✓			✓	✓					✓		
6	22FTX02	Processing of milk and milk products	✓	✓	✓		✓	✓		✓	✓	✓		✓		
6	22FTX03	Processing of Fruits and Vegetables	✓	✓	✓		✓	✓		✓	✓	✓		✓		
6	22MAO05	Graph Theory and its Applications	✓	✓	✓											
6	22MAX01	Data Analytics using R Programming	✓	✓	✓	✓	✓									
6	22MAO06	Operations Research	✓	✓	✓											

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

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

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
8	22MTO05	Micro and Nano Electromechanical Systems	✓	✓	✓	✓								✓		
8	22AUO03	Public Transport Management	✓	✓				✓	✓	✓				✓		
8	22AUO04	Autonomous Vehicles	✓	✓	✓	✓	✓	✓	✓					✓		
8	22ECO02	Optical Engineering	✓	✓	✓	✓		✓	✓	✓	✓			✓		
8	22EEO17	Smart Grid Technologies	✓	✓	✓	✓	✓			✓				✓		
8	22EEO18	Biomass Energy Systems	✓	✓	✓			✓	✓				✓	✓		
8	22EIO12	Environmental Sensors	✓	✓	✓	✓	✓		✓							
8	22EIO13	Pollution Control and Management	✓	✓	✓	✓	✓	✓		✓						
8	22CSO04	Machine Translation	✓	✓	✓											
8	22CSO05	Fundamentals of Blockchain	✓	✓	✓											
8	22ITO07	Business Continuity Planning	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓			
8	22CDX02	Virtual Reality and Augmented Reality	✓	✓	✓	✓										
8	22ADO03	Business Analytics	✓	✓	✓	✓										
8	22ALO03	Machine Learning for Smart Cities	✓	✓	✓	✓										
8	22CHO09	Industrial Accident Prevention and Management	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓		
8	22CHO10	Electrochemical Engineering	✓	✓	✓											
8	22CHO11	Smart and Functional Materials	✓	✓					✓	✓	✓			✓		
8	22FTO04	Food Ingredients	✓	✓	✓			✓		✓		✓		✓		
8	22FTO05	Food and Nutrition	✓	✓	✓			✓				✓		✓		
8	22CYO09	Chemistry of Nutrition for Women Health	✓	✓	✓											
		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								✓	✓	✓		✓		

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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.Tech - INFORMATION TECHNOLOGY CURRICULUM – R2022
(For the students admitted in the academic year 2022-23)

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
22PHT18	Physics for Information Technology	3	0	0	3	40	60	100	BS
22CSC12	Programming in C	3	0	2	4	50	50	100	PC
22ITC11	Scientific Computing	2	0	2	3	50	50	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 Lab	0	0	2	1	60	40	100	ES
22PHL18	Physics Laboratory for Information Technology	0	0	2	1	60	40	100	BS
22MNT11	Student Induction Program	---	---	---	0	100	0	100	MC
Total Credits to be earned					**22**				

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
22CYT28	Chemistry for Information Technology	3	0	0	3	40	60	100	BS
22ITC21	Data Structures	3	0	2	4	50	50	100	PC
22ITC22	Object Oriented Programming	3	0	2	4	50	50	100	PC
22ITT21	Digital Logic Principles and Design	3	0	0	3	40	60	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
22CYL12	Chemistry 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

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(For the students admitted in the academic year 2022-23)

SEMESTER – III									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
22ITT31	Design and Analysis of Algorithms	3	0	0	3	40	60	100	PC
22ITT32	Python Programming and Frameworks	3	0	0	3	100	0	100	PC
22ITT33	Computer Organization	3	1	0	4	40	60	100	PC
22ITT34	Information Theory and Coding	3	1	0	4	40	60	100	ES
22EIT35	Microprocessors and Embedded Systems	3	0	0	3	40	60	100	ES
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									
22ITL31	Design and Analysis of Algorithms Laboratory	0	0	2	1	60	40	100	PC
22ITL32	Python Programming and Frameworks Laboratory	0	0	2	1	100	0	100	PC
22EIL33	Digital Logic and Microprocessors Laboratory	0	0	2	1	60	40	100	ES
Total Credits to be earned					**23**				

SEMESTER – IV									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
22MAT43	Discrete Mathematics	3	1	0	4	40	60	100	BS
22ITT41	Database Management Systems	3	0	0	3	40	60	100	PC
22ITT42	Web Technology	3	0	0	3	40	60	100	PC
22ITT43	Formal Languages and Automata Theory	3	0	0	3	40	60	100	PC
22ITT44	Operating Systems	3	1	0	4	40	60	100	PC
Practical / Employability Enhancement									
22ITL41	Database Management Systems Laboratory	0	0	2	1	60	40	100	PC
22ITL42	Web Technology Laboratory	0	0	2	1	60	40	100	PC
22GEL41	Professional Skills Training - I	0	0	80	2	100	0	100	EC
22EGL31	Communication Skills Development Laboratory	0	0	2	1	60	40	100	HS
Total Credits to be earned					**22**				

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(For the students admitted in the academic year 2022-23)

SEMESTER–V									
Course Code	Course Title	Hours/Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
22ITT51	Computer Networks	3	0	0	3	40	60	100	PC
22ITT52	Machine Learning	3	0	0	3	40	60	100	PC
22ITC51	Software Engineering	3	0	2	4	50	50	100	PC
22ITC52	User Interface Design	3	0	2	4	50	50	100	PC
	Professional Elective - I	3	0	0	3	40	60	100	PE
	Open Elective - I	3	1/0	0/2	4	40/50	60/50	100	OE
Practical/Employability Enhancement									
22ITL51	Networks Laboratory	0	0	2	1	60	40	100	PC
22ITL52	Machine Learning Laboratory	0	0	2	1	60	40	100	PC
22GEL51	Professional Skills Training II	0	0	80	2	100	0	100	EC
Total Credits to be earned					**25**				

SEMESTER–VI									
Course Code	Course Title	Hours/Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
22ITT61	Devops	3	0	0	3	40	60	100	PC
22ITT62	Mobile Communication	3	0	0	3	40	60	100	ES
	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									
22ITL61	Cloud Computing Laboratory	0	0	2	1	60	40	100	PC
22ITL62	Internet of Things Laboratory	0	0	2	1	60	40	100	ES
22ITP61	Project Work I	0	0	8	4	100	0	100	EC
22MNT31	Environmental Science	2	0	0	0	100	0	100	MC
22GEP61	Comprehensive Test and Viva	---	---	---	2	100	0	100	EC
Total Credits to be earned					**21**				

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(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									
22GET71	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									
22ITP71	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									
22ITP81	Project Work II Phase II	0	0	8	4	50	50	100	EC
Total Credits to be earned					**10**				

Total Credits: 168

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(For the students admitted in the academic year 2022-23)

LIST OF PROFESSIONAL ELECTIVE COURSES

Course Code	Course Name	L	T	P	C	Domain/Stream
	Semester V					
	Elective I					
22ITE01	Computer Graphics	3	0	0	3	AP
22ITE02	Search Methods for Problem Solving	3	0	0	3	CI
22ITE03	Game Design and Development	3	0	0	3	NW
22ITE04	Big Data Analytics	3	0	0	3	CI
22ITE05	Information Security Principles	3	0	0	3	GE
22ITE06	Algorithmic Thinking in Bioinformatics	3	0	0	3	CI
22ITE07	Design Thinking	3	0	0	3	GE
22ITE08	Enterprise Application Development using Java	2	0	2	3	AP
	Semester VI					
	Elective II					
22ITE09	3D Modelling and Mixed Reality Applications	3	0	0	3	AP
22ITE10	Knowledge Representation	3	0	0	3	CI
22ITE11	5G Wireless Networks	3	0	0	3	NW
22ITE12	Cryptography and Network Security	3	0	0	3	NS
22ITE13	Deep Learning	3	0	0	3	CI
22ITE14	Coding and Security	3	0	0	3	AP
	Semester VII					
	Elective III					
22ITE15	Digital Image Processing for Computer Vision	3	0	0	3	AP
22ITE16	Software Testing	3	0	0	3	SD
22ITE17	Native Mobile Application Development	3	0	0	3	SD
22ITE18	Software Defined Networks	3	0	0	3	NW
22ITE19	Video Analytics	3	0	0	3	CI
22ITE20	Contemporary Cryptography	3	0	0	3	NS
22GEE01	Fundamentals of Research	3	0	0	3	GE
	Elective IV					
22ITE21	Ethical Hacking	3	0	0	3	NS
22ITE22	Natural Language Processing	3	0	0	3	CI
22ITE23	Social Network Analysis	3	0	0	3	CI
22ITE24	Mobile and Wireless Security	3	0	0	3	NS
	Elective V					
22ITE25	Cyber Forensics	3	0	0	3	NS
22ITE26	Multicore Architecture	3	0	0	3	AP

22ITE27	Business Intelligence and its Applications	3	0	0	3	CI
22ITE28	Constraint Satisfaction Problem	3	0	0	3	CI
22GEE02	Total Quality Management	3	0	0	3	GE
22ITE29	Computer Security Audit and Assurance	3	0	0	3	NS
	Semester VIII					
	Elective VI					
22ITE30	Building Enterprise Applications	3	0	0	3	SD
22ITE31	Web Application Security	3	0	0	3	NS
22ITE32	Wireless Sensor Networks	3	0	0	3	NW
22ITE33	Realtime Programming for Embedded Systems	3	0	0	3	AP
22ITE34	Information Storage and Management	3	0	0	3	AP
22ITE35	Software Project Management	3	0	0	3	SD
	Total credits to be earned				**18**	

B.Tech - INFORMATION TECHNOLOGY CURRICULUM – R2022
(For the students admitted in the academic year 2023-24)

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
22CYT28	Chemistry for Information Technology	3	0	0	3	40	60	100	BS
22CSC12	Programming in C	3	0	2	4	50	50	100	PC
22ITC11	Scientific Computing	2	0	2	3	50	50	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**				

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
22PHT18	Physics for Information Technology	3	0	0	3	40	60	100	BS
22ITT21	Digital Logic Principles and Design	3	0	0	3	40	60	100	ES
22ITC22	Object Oriented Programming	3	0	2	4	50	50	100	PC
22TAM02	Tamils and Technology	1	0	0	1	100	0	100	HS
Practical / Employability Enhancement									
22GCL12	Foundation Laboratory – Electrical, IoT and Web	0	0	6	3	100	0	100	ES
22PHL18	Physics Laboratory for Information Technology	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					**23**				

*Alternate weeks

B.Tech - INFORMATION TECHNOLOGY CURRICULUM – R2022
(For the students admitted in the academic year 2023-24)

SEMESTER – III									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
22ITC32	Data Structures using Java	3	0	2	4	50	50	100	PC
22EIT35	Microprocessors and Embedded Systems	3	0	0	3	40	60	100	ES
22ITT32	Python Programming and Frameworks	3	0	0	3	100	0	100	PC
22ITT33	Computer Organization	3	1	0	4	40	60	100	PC
22ITT34	Information Theory and Coding	3	1	0	4	40	60	100	ES
22GET31	Universal Human Values	2	0	0	2	100	0	100	HS
Practical / Employability Enhancement									
22ITL32	Python Programming and Frameworks Laboratory	0	0	2	1	100	0	100	PC
22EIL33	Digital Logic and Microprocessors Laboratory	0	0	2	1	60	40	100	ES
Total Credits to be earned					**22**				

SEMESTER – IV									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
22MAT43	Discrete Mathematics	3	1	0	4	40	60	100	BS
22ITT41	Database Management Systems	3	0	0	3	40	60	100	PC
22ITT42	Web Technology	3	0	0	3	40	60	100	PC
22ITT31	Design and Analysis of Algorithms	3	0	0	3	40	60	100	PC
22ITT44	Operating Systems	3	1	0	4	40	60	100	PC
Practical / Employability Enhancement									
22ITL41	Database Management Systems Laboratory	0	0	2	1	60	40	100	PC
22ITL42	Web Technology Laboratory	0	0	2	1	60	40	100	PC
22GEL41	Professional Skills Training - I	0	0	80	2	100	0	100	EC
22EGL31	Communication Skills Development Laboratory	0	0	2	1	60	40	100	HS
Total Credits to be earned					**22**				

B.Tech - INFORMATION TECHNOLOGY CURRICULUM – R2022
(For the students admitted in the academic year 2023-24)

SEMESTER–V									
Course Code	Course Title	Hours/Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
22ITT51	Computer Networks	3	0	0	3	40	60	100	PC
22ITT52	Machine Learning	3	0	0	3	40	60	100	PC
22ITC51	Software Engineering	3	0	2	4	50	50	100	PC
22ITC52	User Interface Design	3	0	2	4	50	50	100	PC
	Professional Elective I	3	0	0	3	40	60	100	PE
	Open Elective - I	3	1/0	0/2	4	40/50	60/50	100	OE
Practical/Employability Enhancement									
22ITL51	Networks Laboratory	0	0	2	1	60	40	100	PC
22ITL52	Machine Learning Laboratory	0	0	2	1	60	40	100	PC
22GEL51	Professional Skills Training II	0	0	80	2	100	0	100	EC
Total Credits to be earned					**25**				

SEMESTER–VI									
Course Code	Course Title	Hours/Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
22ITT61	Devops	3	0	0	3	40	60	100	PC
22ITT62	Mobile Communication	3	0	0	3	40	60	100	ES
	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									
22ITL61	Cloud Computing Laboratory	0	0	2	1	60	40	100	PC
22ITL62	Internet of Things Laboratory	0	0	2	1	60	40	100	ES
22ITP62	Project Work I	0	0	10	5	100	0	100	EC
22MNT31	Environmental Science	2	0	0	0	100	0	100	MC
22GEP61	Comprehensive Test and Viva	---	---	---	2	100	0	100	EC
Total Credits to be earned					**22**				

B.Tech - INFORMATION TECHNOLOGY 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									
22GET71	Engineering Economics and Management	3	0	0	3	40	60	100	HS
22ITT71	Blockchain Technology	3	1	0	4	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									
22ITP72	Project Work II Phase I	0	0	12	6	50	50	100	EC
Total Credits to be earned					**22**				

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									
22ITP81	Project Work II Phase II	0	0	8	4	50	50	100	EC
Total Credits to be earned					**10**				

Total Credits: 168

B.Tech - INFORMATION TECHNOLOGY CURRICULUM – R2022
(For the students admitted in the academic year 2023-24)

LIST OF PROFESSIONAL ELECTIVE COURSES

Course Code	Course Name	L	T	P	C	Domain/Stream
	Semester V					
	Elective I					
22ITE01	Computer Graphics	3	0	0	3	AP
22ITE02	Search Methods for Problem Solving	3	0	0	3	CI
22ITE03	Game Design and Development	3	0	0	3	NW
22ITE04	Big Data Analytics	3	0	0	3	CI
22ITE05	Information Security Principles	3	0	0	3	GE
22ITE06	Algorithmic Thinking in Bioinformatics	3	0	0	3	CI
22ITE07	Design Thinking	3	0	0	3	GE
22ITE08	Enterprise Application Development using Java	2	0	2	3	AP
	Semester VI					
	Elective II					
22ITE09	3D Modelling and Mixed Reality Applications	3	0	0	3	AP
22ITE10	Knowledge Representation	3	0	0	3	CI
22ITE11	5G Wireless Networks	3	0	0	3	NW
22ITE12	Cryptography and Network Security	3	0	0	3	NS
22ITE13	Deep Learning	3	0	0	3	CI
22ITE14	Coding and Security	3	0	0	3	AP
	Semester VII					
	Elective III					
22ITE15	Digital Image Processing for Computer Vision	3	0	0	3	AP
22ITE16	Software Testing	3	0	0	3	SD
22ITE17	Native Mobile Application Development	3	0	0	3	SD
22ITE18	Software Defined Networks	3	0	0	3	NW
22ITE19	Video Analytics	3	0	0	3	CI
22ITE20	Contemporary Cryptography	3	0	0	3	NS
22GEE01	Fundamentals of Research	3	0	0	3	GE
	Elective IV					
22ITE21	Ethical Hacking	3	0	0	3	NS
22ITE22	Natural Language Processing	3	0	0	3	CI
22ITE23	Social Network Analysis	3	0	0	3	CI
22ITE24	Mobile and Wireless Security	3	0	0	3	NS
22ITE25	Cyber Forensics	3	0	0	3	NS
22ITE26	Multicore Architecture	3	0	0	3	AP
22ITE27	Business Intelligence and its Applications	3	0	0	3	CI

22ITE28	Constraint Satisfaction Problem	3	0	0	3	CI
22GEE02	Total Quality Management	3	0	0	3	GE
22ITE29	Computer Security Audit and Assurance	3	0	0	3	NS
	Semester VIII					
	Elective V					
22ITE30	Building Enterprise Applications	3	0	0	3	SD
22ITE31	Web Application Security	3	0	0	3	NS
22ITE32	Wireless Sensor Networks	3	0	0	3	NW
22ITE33	Realtime Programming for Embedded Systems	3	0	0	3	AP
22ITE34	Information Storage and Management	3	0	0	3	AP
22ITE35	Software Project Management	3	0	0	3	SD
	Total credits to be earned				**15**	

B.Tech - INFORMATION TECHNOLOGY CURRICULUM – R2022

OPEN ELECTIVE COURSES OFFERED TO OTHER DEPARTMENTS (OE) (Offered by Department of Information Technology)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	22ITO01	Artificial Intelligence	3	1	0	4	V
2.	22ITX01	Next Generation Databases	3	0	2	4	V
3.	22GEX02	NCC Studies (Air Wing) - 1	3	1	0	4	V
4.	22ITX02	Advanced Java Programming	3	0	2	4	VI
5.	22ITO02	Internet of Things	3	1	0	4	VI
6.	22ITO03	Fundamentals of Software Development	3	1	0	4	VI
7.	22ITO04	Mobile Application Development	3	1	0	4	VI
8.	22ITO05	Fundamentals of Cloud Computing	3	0	0	3	VII
9.	22ITO06	Introduction to Ethical Hacking	3	0	0	3	VII
10.	22ITO07	Business Continuity Planning	3	0	0	3	VIII
Total Credits to be earned						**14**	

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.	22CDO01	Fundamentals of User Experience Design	3	1	0	4	CSD
24.	22ADO01	Data Warehousing and Data Mining	3	1	0	4	AIDS
25.	22ALO01	Business Intelligence	3	1	0	4	AIML
26.	22CHO01	Industrial Enzymology	3	1	0	4	CHEM
27.	22CHO02	Waste to Energy Conversion	3	1	0	4	CHEM
28.	22CHO03	Applied Nanotechnology	3	1	0	4	CHEM
29.	22FTX01	Baking Technology	3	0	2	4	FT
30.	22FTO01	Food Processing Technology	3	1	0	4	FT
31.	22MAO01	Mathematical Foundations for Machine Learning	3	1	0	4	MATHS
32.	22MAO02	Numerical Computing	3	1	0	4	MATHS
33.	22MAO03	Stochastic Processes and Queuing Theory	3	1	0	4	MATHS
34.	22MAO04	Statistics for Engineers	3	1	0	4	MATHS
35.	22PHO01	Thin Film Technology	3	1	0	4	PHYSICS
36.	22PHO02	High Energy Storage Devices	3	1	0	4	PHYSICS
37.	22PHO03	Structural and Optical Characterization of Materials	3	1	0	4	PHYSICS
38.	22CYO01	Instrumental Methods of Analysis	3	1	0	4	CHEMISTRY
39.	22CYO02	Chemistry Concepts for Competitive Examinations	3	1	0	4	CHEMISTRY
40.	22CYO03	Organic Chemistry for Industry	3	1	0	4	CHEMISTRY

		SEMESTER VI					
41.	22CEO01	Disaster Management	3	1	0	4	CIVIL
42.	22MEX02	Design of Experiments	3	0	2	4	MECH
43.	22MTO02	Robotics	3	1	0	4	MTS
44.	22MTO03	3D Printing and Design	3	1	0	4	MTS
45.	22AUO01	Automotive Electronics	3	1	0	4	ECE
46.	22ECX03	PCB Design and Fabrication	3	0	2	4	ECE
47.	22EEO07	Energy Conservation and Management	3	1	0	4	EEE
48.	22EEO08	Microprocessors and Microcontrollers Interfacing	3	1	0	4	EEE
49.	22EEO09	Electrical Safety	3	1	0	4	EEE
50.	22EEO10	VLSI System Design	3	1	0	4	EEE
51.	22EEO11	Automation for Industrial Applications	3	1	0	4	EEE
52.	22EIO04	PLC Programming with High Level Languages	3	1	0	4	EIE
53.	22EIO05	Virtual Instrumentation	3	1	0	4	EIE
54.	22CSX04	Foundations of Machine Learning	3	0	2	4	CSE
55.	22CSX05	Web Engineering	3	0	2	4	CSE
56.	22CDX01	Fundamentals of User Interactive Design	3	0	2	4	CSD
57.	22ADX01	Data Visualization	3	0	2	4	AIDS
58.	22ALX01	Data Exploration and Visualization Techniques	3	0	2	4	AIML
59.	22CHO04	Air Pollution Monitoring and Control	3	1	0	4	CHEM
60.	22CHO05	Paints and Coatings	3	1	0	4	CHEM
61.	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
62.	22MAO05	Graph Theory and its Applications	3	1	0	4	MATHS
63.	22MAX01	Data Analytics using R Programming	3	0	2	4	MATHS
64.	22MAO06	Operations Research	3	1	0	4	MATHS
65.	22MAO07	Number Theory and Cryptography	3	1	0	4	MATHS
66.	22PHO04	Synthesis, Characterization and Biological Applications of Nanomaterials	3	1	0	4	PHYSICS

67.	22PHO05	Techniques of Crystal Growth	3	1	0	4	PHYSICS
68.	22CYO04	Corrosion Science and Engineering	3	1	0	4	CHEMISTRY
69.	22CYO05	Chemistry of Cosmetics in Daily Life	3	1	0	4	CHEMISTRY
70.	22CYO06	Nanocomposite Materials	3	1	0	4	CHEMISTRY
		SEMESTER VII					
71.	22CEO02	Introduction to Smart Cities	3	0	0	3	CIVIL
72.	22CEO03	Environmental Health and Safety	3	0	0	3	CIVIL
73.	22MEO01	Fundamentals of Ergonomics	3	0	0	3	MECH
74.	22MEO02	Principles of Management and Industrial Psychology	3	0	0	3	MECH
75.	22MEO03	Waste Heat Recovery System and Storage	3	0	0	3	MECH
76.	22MTO04	Drone System Technology	3	0	0	3	MTS
77.	22AUO02	Vehicle Maintenance	3	0	0	3	AUTO
78.	22ECO01	Wearable Devices	3	0	0	3	ECE
79.	22ECX04	Electronic Hardware and Troubleshooting	2	0	2	3	ECE
80.	22EEO12	Electric Vehicle	3	0	0	3	EEE
81.	22EEO13	E-Waste Management	3	0	0	3	EEE
82.	22EEO14	Embedded System Design	3	0	0	3	EEE
83.	22EEO15	Energy Storage Systems and Controllers	3	0	0	3	EEE
84.	22EEO16	AI Techniques for Engineering Applications	3	0	0	3	EEE
85.	22EIO06	Introduction to Distributed Control Systems	3	0	0	3	EIE
86.	22EIO07	Instrumentation in Aircraft Navigation and Control	3	0	0	3	EIE
87.	22EIO08	Industry 4.0 with Industrial IoT	3	0	0	3	EIE
88.	22EIO09	Industrial Data Communication	3	0	0	3	EIE
89.	22EIO10	Wireless Instrumentation	3	0	0	3	EIE
90.	22EIO11	Instrumentation Techniques in Agriculture	3	0	0	3	EIE
91.	22CSO03	Nature Inspired optimization techniques	3	0	0	3	CSE
92.	22CDO02	Introduction to Mobile Game Design	3	0	0	3	CSD
93.	22CDO03	Introduction to Graphics Design	3	0	0	3	CSD

94.	22ADO02	Neural Networks and Deep Learning	3	0	0	3	AIDS
95.	22ALO02	Industrial Machine Learning	3	0	0	3	AIML
96.	22CHO07	Hydrogen Energy	3	0	0	3	CHEM
97.	22CHO08	Rubber Technology	3	0	0	3	CHEM
98.	22FTO02	Principles of Food safety	3	0	0	3	FT
99.	22FTO03	Fundamentals of Food Packaging and Storage	3	0	0	3	FT
100.	22MAO08	Non-Linear Optimization	3	0	0	3	MATHS
101.	22MAO09	Optimization for Engineers	3	0	0	3	MATHS
102.	22CYO07	Waste and Hazardous Waste Management	3	0	0	3	CHEMISTRY
103.	22CYO08	Chemistry in Every day Life	3	0	0	3	CHEMISTRY
		SEMESTER VIII					
104.	22CEO04	Infrastructure Planning and Management	3	0	0	3	CIVIL
105.	22CEO05	Environmental Laws and Policy	3	0	0	3	CIVIL
106.	22MEO04	Safety Measures for Engineers	3	0	0	3	MECH
107.	22MEO05	Energy Conservation in Thermal Equipments	3	0	0	3	MECH
108.	22MEO06	Climate Change and New Energy Technology	3	0	0	3	MECH
109.	22MTO05	Micro and Nano Electromechanical Systems	3	0	0	3	MTS
110.	22AUO03	Public Transport Management	3	0	0	3	ECE
111.	22AUO04	Autonomous Vehicles	3	0	0	3	ECE
112.	22ECO02	Optical Engineering	3	0	0	3	EEE
113.	22EEO17	Smart Grid Technologies	3	0	0	3	EEE
114.	22EEO18	Biomass Energy Systems	3	0	0	3	EEE
115.	22EIO12	Environmental Sensors	3	0	0	3	EIE
116.	22EIO13	Pollution Control and Management	3	0	0	3	EIE
117.	22CSO04	Machine Translation	3	0	0	3	CSE
118.	22CSO05	Fundamentals of Blockchain	3	0	0	3	CSE
119.	22CDX02	Virtual Reality and Augmented Reality	3	0	0	3	CSD
120.	22ADO03	Business Analytics	3	0	0	3	AIDS
121.	22ALO03	Machine Learning for Smart Cities	3	0	0	3	AIML
122.	22CHO09	Industrial Accident Prevention and Management	3	0	0	3	CHEM
123.	22CHO10	Electrochemical Engineering	3	0	0	3	CHEM

124.	22CHO11	Smart and Functional Materials	3	0	0	3	CHEM
125.	22FTO04	Food Ingredients	3	0	0	3	FT
126.	22FTO05	Food and Nutrition	3	0	0	3	FT
127.	22CYO09	Chemistry of Nutrition for Women Health	3	0	0	3	CHEMISTRY

GENERAL OPEN ELECTIVES
(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

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

22PHT18 – PHYSICS FOR INFORMATION TECHNOLOGY							
Programme & Branch	**B.Tech- Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1 / 2**	**BS**	**3**	**0**	**0**	**3**

Preamble	This course aims to impart the knowledge on oscillations & waves, lasers, fiber optics, conductors, semiconductors and smart materials. It also describes the applications of aforementioned topics in information technology.	
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	**Conducting Materials:**	**9**
Conductors – Classical free electron theory of metals – Electrical conductivity – Thermal conductivity – Wiedemann-Franz law – Lorentz number – Draw backs of classical free electron theory – Quantum free electron theory (qualitative) – Fermi distribution function – Effect of temperature on Fermi function – Density of energy states – Carrier concentration in metals.		
Unit – III	**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 – IV	**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 – 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. Hitendra K. Malik and A.K. Singh, "Engineering Physics", 2nd Edition McGraw-Hill Education , New Delhi, 2018.

REFERENCES:

1. Charles Kittel, "Introduction to Solid State Physics", 8th Edition, John Wiley &Sons,New Jersey, 2004.
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.

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 classical and quantum free electron theory of metals to compute their electrical and thermal conductivities and to comprehend the effect of temperature on Fermi function and to derive the expressions for carrier concentration in metals using density of states.	Applying (K3)
CO3	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)
CO4	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)
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		2	3	2
CO2	3	2	2						2	2		2	3	2
CO3	3	2	2						2	2		2	3	2
CO4	3	2	2						2	2		2	3	2
CO5	3	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	15	40	45				100
CAT2	15	40	45				100
CAT3	20	50	30				100
ESE	10	40	50				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
ESE	10	30	60				100

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

22ITC11 - SCIENTIFIC COMPUTING							
Programme& Branch	**BTech – Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1**	**ES**	**2**	**0**	**2**	**3**
Preamble	This course provides the basic knowledge about the components of computer, software classifications, problem solving techniques, web design concepts and Git.						
Unit - I	**Introduction to Computers and Organization**						**6**
Introduction- Definition- Characteristics of computer- Block Diagram of a computer- Classification Of Computers- Applications of Computer- Capabilities- and limitations of computer. Input Units- Output Units- Storage devices- Primary storage- and secondary storage.							
Unit - II	**Number Systems and Software**						**6**
Number Systems and its conversions- Software and it's needs-Operating System- Utility Programs- Programming Language: Machine Language- Assembly Language- High-Level Language their advantages & disadvantages. Application S/W and its types: Word Processing- Spread Sheets and Presentation.							
Unit - III	**Problem Solving Technique**						**6**
Algorithms - Flowcharts – Pseudo codes – Structuring the logic: Sequential- selection and repetitive structure. Case Study on Problem Solving in sequential and selection and repetitive. Algorithm- Flowchart and Pseudo code for the problems related to sequential and selection and repetitive structures							
Unit - IV	**Web Designing**						**6**
Web Basics – Introduction to HTML 5 – Headings – Linking – Images – Special Characters and Horizontal rules – List – Tables – Forms – Internal Linking – meta elements. Introduction to Cascading Style Sheets (CSS) – Inline styles – Embedded style sheets – conflicting styles – linking external style sheets.							
Unit - V	**Git**						**6**
Introduction – installing Git – Installing Git on Windows – Installing the Cygwin Git package – Installing standalone Git – Git Command Line – Basic Git Concepts – Repositories – Object types – Index – Object Store Pictures – Git Concepts at Work. File management and the Index.							

LIST OF EXPERIMENTS / EXERCISES:

1.	Study of various computer components
2.	Installation of Operating system
3.	Write an algorithm, pseudocode and flowchart for solving sequential and selection problems using raptor
4.	Write an algorithm- pseudocode and flowchart for solving repetitive problems using raptor
5.	Design a Web Page using basic HTML Tags
6.	Design an Web Page to get and validate the data from the users
7.	Develop an web page and apply different stye sheet on the web page
8.	Create a repo and deploy the web page using gitup
9.	Managing source code with multiple branches
10.	Create a scenario for merge conflicts and resolve it using github

Lecture:30, Practical:30, Total:60

TEXT BOOK:

1.	Anita Goel- Computer Fundamentals, First Edition, Pearson Education India,2010 (Unit I,II,III)
2.	Paul Deitel,HarveyDeitel, Abbey Deitel,"Internet & World Wide Web- How to Program", 5th Edition, Pearson Education, 2019 (Unit IV)
3.	Jon Loeliger and Matthew Mccullough- Version control with Git-Second Edition-Shroff Publishers& Distributors, 2012 (Unit V)

REFERENCES/ MANUAL / SOFTWARE:

1.	Dromey R.G.- "How to Solve it by Computer"- Pearson Education- 2009.
2.	Balagurusamy E.- "Fundamentals of Computing and Programming"- Tata McGrawHill Education Pvt. Ltd.- 2017

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	outline the Computer components, working principles and its applications	Understanding (K2)
CO2	explore Number System and its conversions, Software classifications	Understanding (K2)
CO3	express the solution for structuring logic in terms of algorithm- flowchart and pseudo code	Applying (K3)
CO4	design a simple webpage and validate the forms using HTML	Applying (K3)
CO5	create a repository and manage the repository file functions using Git	Applying (K3)
CO6	solve the real-world problems using raptor	Applying (K3), Precision (S3)
CO7	design a simple webpage using HTML	Applying (K3), Precision (S3)
CO8	perform file operations in Git	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
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
CO6	3	2	1	1									3	2
CO7	3	2	1	1									3	2
CO8	3	2	1	1									3	2

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

ASSESSMENT PATTERN - THEORY

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

22PHL18 - PHYSICS LABORATORY FOR INFORMATION TECHNOLOGY

Programme & Branch	B.Tech - Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1 / 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, wavelength of laser, particle size, acceptance angle and numerical aperture of an optical fiber, specific resistance, band gap, Hall coefficient, thickness of thin wire and knowledge on the working of LCR circuit, p-n junction diode and 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 the given metallic wire using torsional pendulum / Studying the variation of current and voltage in a series LCR circuit.
2.	Determination of the frequency of alternating current using electrically vibrating tuning fork (Melde's apparatus).
3.	(i) Determination of the wavelength of semiconductor laser. (ii) Determination of the particle size of the given powder using laser.
4.	Determination of the acceptance angle and the numerical aperture of the given optical fiber.
5.	Determination of the specific resistance of the given metallic wire using Carey-Foster's bridge.
6.	Determination of the band gap of the given semiconducting material using post-office box.
7.	Observation of the I-V characteristics of a p-n junction diode / Determination of Hall coefficient using Hall effect arrangement.
8.	Observation of the I-V characteristics of a uni junction transistor.
9.	Determination of the thickness of a thin film using 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 or the variation of current and voltage in a series LCR circuit, the frequency of an alternating current, the wavelength of a semiconductor laser and the particle size of a powder material.	Applying (K3), Precision (S3)
CO2	determine the acceptance angle and numerical aperture of an optical fiber and the specific resistivity of a metallic wire.	Applying (K3), Precision (S3)
CO3	determine the band gap of a semiconductor, the I-V characteristics of a p-n diode or the Hall coefficient of a material, the I-V characteristics of a UJT, the thickness of a thin film and develop a coding / project / 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	2
CO2	3	2	2	3					2	2		2	3	2
CO3	3	2	2	3					2	2		2	3	2

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

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)

(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

22CYT28 – CHEMISTRY FOR INFORMATION TECHNOLOGY							
Programme & Branch	**B.Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**2 / 1****	**BS**	**3**	**0**	**0**	**3**
Preamble	This course explores the basic concepts of electrochemistry, electrochemical storage devices, organic electronic materials, insulating materials and e-waste management. It also ensures to impart the applicability of these fields for IT students.						
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	**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 – III	**ORGANIC ELECTRONIC MATERIALS**						**9**
Introduction – conducting polymers – p-type and n-type organic semiconducting materials – advantages over inorganic semiconducting materials – organic dielectric materials – processing and fabrication – spin coating, evaporation, sputtering, electrospinning, drop casting, templating – organic light emitting diodes – working, types and applications – comparison of LCD vs LED –organic field-effect transistors and organic solar cells- working, types and applications.							
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, IV.
2. Palanisamy P.N., Manikandan P., Geetha A., Manjula Rani K., Kowshalya V.N., "Environmental Science", Pearson Education, New Delhi, Revised Edition 2019, for Unit- II, III ,V.

REFERENCES:

1. S. S. Dara, "A Text book of Engineering Chemistry", S. Chand & Co Ltd., New Delhi, 20th B.TECH. (BCL) Page 16 Edition, 2013.
2. Palanna O., "Engineering Chemistry", McGraw Hill Education, New Delhi, 2018.

**** for 2022 batch 2nd sem for IT, for 2023 batch 1st sem for IT**

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	use the concepts of batteries, fuel cells and their applications in various fields.	Applying (K3)
CO3	utilize the organic electronic materials for various applications	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)

22ITC21 - DATA STRUCTURES							
Programme& Branch	**B.Tech. – Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Programming in C**	**2**	**PC**	**3**	**0**	**2**	**4**
Preamble	This course helps the students to learn the basic concepts of linear data structures, non-linear data structures and their applications						
Unit – I	**Data structures and Linked List:**						**9**
Introduction to Data Structures – Classification – Dynamic memory allocation- Self-referential structures- Introduction to Linked lists - Linked lists vs Arrays – Singly linked list-Doubly Linked list-Circular Linked list-Polynomial manipulations.							
Unit – II	**Stack and Queue:**						**9**
Introduction – Stack – Implementation of stack using array and linked list – Application of stack –Balanced Parentheses-Infix to Postfix expression conversion, Postfix expression evaluation. Queue – Implementation of Queue using array and linked list– Circular queue-Applications of queue-reversing the queue using stack.							
Unit – III	**Sorting and Hashing:**						**9**
Sorting: Internal sorting: Bubble sort – Shell sort – Bucket sort – External sorting: Multiway Merge – Polyphase Merge – Replacement Selection. Hashing: Hash Functions – Separate Chaining – Open Addressing: Linear Probing – Quadratic Probing – Double Hashing – Rehashing – Extendible Hashing.							
Unit – IV	**Trees:**						**9**
Preliminaries: Implementation of trees – Tree Traversals with an Application – Binary trees: Implementation – Expression trees – The Search Tree ADT– Binary Search Trees: Construction – Searching – Insertion – Deletion – Find Min – Find Max– AVL trees: Rotation – Insertion – Deletion.							
Unit – V	**Graphs:**						**9**
Definitions – Representation of Graphs – Types of Graph – Depth-first traversal – Breadth-first traversal – Topological Sort – Applications of DFS: Bi-connectivity – Euler circuits – Finding Strongly Connected Components – Applications of BFS: Bipartite graph – Graph Coloring.							

LIST OF EXPERIMENTS / EXERCISES:	
1.	Program to implement singly linked list
2.	Program to implement Stack and Queue using array and linked list
3.	Program to implement Infix to Postfix conversion using stack
4.	Program to evaluate postfix evaluation using stack
5.	Program to implement Reversing the queue using stack
6.	Program to implement shell sort
7.	Program to implement double hashing
8.	Program to implement binary search tree and its operations
9.	Program to implement BFS and DFS
10.	Program to implement topological sort
	Lecture:45, Practical:30, Total:75
TEXT BOOK:	
1.	Weiss M. A., “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, London, 2016.
REFERENCES/ MANUAL / SOFTWARE:	
1.	Cormen T. H., Leiserson C. E., Rivest R. L., & Stein C., "Introduction to Algorithms", 3rd Edition, MIT Press, USA, 2009.
2.	Horowitz E., Sahni S., "Fundamentals of Data Structures in C", 2nd Edition, Galgotia Publications, New Delhi, 2008.

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

CO1	describe the different operations on linked list	Applying (K3)
CO2	manipulate the operations on stacks and queue	Applying (K3)
CO3	demonstrate the concept of sorting and hashing techniques	Applying (K3)
CO4	build trees and perform its various operations	Applying (K3)
CO5	choose appropriate graph algorithm for solving problems	Applying (K3)
CO6	implement linear data structure for solving problems	Applying (K3), Precision (S3)
CO7	perform sorting and hashing operations	Applying (K3), Precision (S3)
CO8	implement various operations on non-linear data structures	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									3	2
CO2	3	2	1	1									3	2
CO3	3	2	1	1									3	2
CO4	3	2	1										3	2
CO5	3	2	1	1									3	2
CO6	3	2	1	1									3	2
CO7	3	2	1	1									3	2
CO8	3	2	1	1									3	2

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

ASSESSMENT PATTERN - THEORY

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

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks

22ITC22 - OBJECT ORIENTED PROGRAMMING							
Programme& Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Problem Solving and Programming**	**2**	**PC**	**3**	**0**	**2**	**4**

Preamble	This course provides the concepts of object oriented programming with a comprehensive introduction to C++. It also covers Java programming and its basic packages including GUI programming.	
Unit – I	**Introduction to OOP and C++ :**	**9**
Object Oriented Programming - Features – Merits & Demerits- Applications – Difference –Structure of C++ - Data types – variables – constants – Input and Output statements- Decision control and looping statements-Functions-Arrays-Classes and Objects-Memory allocation - Array of objects – Constructors - Destructors		
Unit – II	**Introduction to Java:**	**9**
Software Development and object-oriented programming paradigms - Overview – Structure of Java - Data Types - Variables – control statements - Arrays –Classes – Fundamentals – Declaring Objects - Assigning Object Reference Variables - Methods –Constructors - this keyword - Overloading Methods - Access Control – Static – Inheritance – Basics – Super keyword - Multilevel Hierarchy - Method Overriding		
Unit – III	**Packages , Interfaces and Exception Handling:**	**9**
Abstract Classes - final with Inheritance. Packages - Access Protection - Importing Packages – Interfaces - Exception Handling basics – Multiple catch Clauses- Nested try Statements – Java's Built-in Exceptions – User defined Exception		
Unit – IV	**Multithreading and I/O :**	**9**
Java Thread Model - Creating a Thread –Creating Multiple Threads – Synchronization – Interthread Communication. Enumerations – Type Wrappers - Auto Boxing. I/O Basics - Reading and Writing Console I/O – PrintWriter Class - Reading and Writing Files.		
Unit – V	**Strings and Event Handling:**	**9**
String Class – operations – String Buffer Class. Event Handling: Event Handling – Mechanisms -- Event Classes -ActionEvent - Sources of Events - Event Listener Interfaces – Action Listener. AWT Classes - Window Fundamentals - Frame Windows - AWT Controls - Layout Managers.		

LIST OF EXPERIMENTS / EXERCISES:

1.	Develop simple C++ programs using control statements
2.	Develop a simple C++ application using class and object
3.	Develop simple Java programs using control statements and arrays
4.	Demonstrate inheritance & polymorphism using C++ and Java programs
5.	Develop Java applications using interfaces and packages
6.	Demonstrate exception handling in Java
7.	Develop multithreaded applications in Java
8.	Develop programs in Java using java.io packages
9.	Demonstrate string manipulation in Java
10.	Develop applications in Java using collections classes
11.	Design a GUI based simple application using AWT classes

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	ReemaThareja, "Object Oriented Programming with C++",Third Edition, Oxford University Press,New Delhi,2018 (UNIT 1)
2.	Herbert Schildt, "Java: The Complete Reference", 12th Edition, McGraw Hill Education, New Delhi, 2021.(UNIT 2 to 5)

REFERENCES/ MANUAL / SOFTWARE:

1.	BuyyaRajkumar, ThamaraiSelvi S. and Xingchen Chu, "Object Oriented Programming with Java Essentials and Applications", 1st Edition, Tata McGraw Hill, New Delhi, 2009.
2.	Deitel Paul and Deitel Harvey, "Java How to Program", 11th Edition, Pearson Education, New Delhi, 2018.
3.	Cay S. Horstmann, "Core Java: Volume I Fundamentals", 11th Edition, Addison Wesley, New Delhi, 2019.

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 using C++	Applying (K3), Precision (S3)
CO2	develop simple applications using basic Java constructs	Applying (K3), Precision (S3)
CO3	build applications making use of packages, interfaces and exception handling in Java	Applying (K3), Precision (S3)
CO4	make use of multithreading and I/O streams	Applying (K3), Precision (S3)
CO5	develop simple event-based GUI applications in Java using AWT classes and controls	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									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

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	10	30	60				100
CAT3							
ESE	10	30	60				100

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 100 marks

22ITT21 -DIGITAL LOGIC PRINCIPLES AND DESIGN							
Programme& Branch	**B.Tech. & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**2**	**ES**	**3**	**0**	**0**	**3**

Preamble	This course enables the students to understand the basic principles of number system, Boolean algebra, combinational and sequential logic circuits.	
Unit - I	**Number Systems and Boolean Algebra:**	**9**
Number Systems - 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 – BCD Adder – Code Converters - 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		
Unit - V	**Register, Counter and Programmable Logic:**	**9**
Shift Registers: SISO– SIPO– PISO–PIPO–Bidirectional Shift register–Universal Shift register– Synchronous Counters: Binary Counter – up-down Binary Counter – BCD Counter – modulo-N Counter – Ring Counter – Johnson Counter – Programmable Logic devices: PROM – PLA – PAL.		
		Total:45

TEXT BOOK:

1	Morris Mano M., MichealD.Ciletti,"Digital Design: With an Introduction to the Verilog HDL,VHDL, and System Verilog", 6th Edition, Pearson Education, Noida, 2020.

REFERENCES:

1	Charles H. Roth, "Fundamentals of Logic Design", 6th Edition, Thomson Learning, UK, 2013.
2	Thomas L. Floyd, "Digital Fundamentals", 10 Edition, Pearson Education, New Delhi , 2011.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	summarize the different number systems and their conversion and boolean algebra	Applying (K3)
CO2	interpret boolean expression using map and tabulation technique and realize it using logic gates	Applying (K3)
CO3	design combinational logic circuits	Applying (K3)
CO4	design sequential logic circuits	Applying (K3)
CO5	implement digital systems using registers, counters and programmable logic 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	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

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	30	60				100
CAT3	10	40	50				100
ESE	10	40	50				100

* ±3% may be varied, CAT1, 2, 3 – 50 marks, ESE – 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)

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

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**	**2**	**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

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 – கணினித்தமிழ் 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 ENGINEERING LABORATORY I							
(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 ENGINEERING LABORATORY II							
(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

22ITT31 - DESIGN AND ANALYSIS OF ALGORITHMS							
Programme& Branch	**B.Tech. & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Data Structures, Problem Solving and Programming**	**3 / 4**	**PC**	**3**	**0**	**0**	**3**
Preamble	This course imparts a formal introduction to various algorithm design techniques, methods for analyzing the performance of algorithms and improving their efficiency.						
Unit – I	**Introduction**						**9**
Notion of an 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**						**9**
Selection and Bubble Sort, Sequential search and String Matching - closest pair and convex hull problem- Divide and Conquer methodology: Merge sort - Quick sort - Binary search - Binary tree traversals and related properties - Multiplication of large integers and Strassen's Matrix Multiplication - closest pair and convex hull problem.							
Unit – III	**Decrease and Conquer**						**9**
Insertion sort -Topological Sorting - Fake coin problem - Computing a Median and the Selection Problem - Transform and conquer: Presorting - Balanced search trees -AVL trees -2-3 Trees- Heaps and Heap sort.							
Unit – IV	**Dynamic Programming**						**9**
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.							
Unit – V	**Backtracking**						**9**
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.							
							Total: 45

TEXT BOOK:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, New Delhi, 2017

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Eastern Economy Edition, PHI, New Delhi, 2010.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, New Delhi, 2005.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	examine asymptotic notation and find time complexity of algorithms	Analyzing (K4)
CO2	apply brute force and divide-and-conquer techniques to various problems and identify their efficiencies	Applying (K3)
CO3	utilize decrease and conquer and transform & 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	3	2	2		3	3	3	3	3	3	1	3	3
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	20	40	40				100
CAT2	20	30	50				100
CAT3	20	30	50				100
ESE	10	40	50				100

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

22ITT32 - PYTHON PROGRAMMING AND FRAMEWORKS							
Programme& Branch	**B.Tech. & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**3**	**PC**	**3**	**0**	**0**	**3**

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		
		Total:45

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, 2017, (for Units IV & V)

REFERENCES:

1. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press, 2013.
2. https://www.geeksforgeeks.org/difference-between-association-and-aggregation/
3. https://www.i2tutorials.com/crud-operations-with-mysql-database-using-python/

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	develop simple applications using python - functions, string, data structures	Applying (K3)
CO2	build Python applications making use of List, Dictionaries, Tuples and Sets	Applying (K3)
CO3	apply Object Oriented Programming concepts and CRUD operations in Python applications	Applying (K3)
CO4	make use of NumPy Arrays in Python applications	Applying (K3)
CO5	utilize Pandas and Matplotlib for developing advance applications in Python	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	20	30	50				100
CAT2	10	20	70				100
CAT3	10	20	70				100
ESE	10	40	50				100

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

22ITT33 - COMPUTER ORGANIZATION							
Programme& Branch	**B.Tech. & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**3**	**PC**	**3**	**1**	**0**	**4**
Preamble	This course deals with the basics of computer and its functional units. It also covers the interfacing with memory and I/O devices. Advanced topics like pipelining and computer performance are also covered.						
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	**Basic Processing Unit and Pipelining:**						**9+3**
Fundamental Concepts–Instruction Execution –Hardware Components–Instruction Fetch and Execution Steps – Control Signals - Hardwired control – CISC Style Processors. 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: USB.							
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, New York, 2017.						
REFERENCES:							
1.	Patterson David, A. and Hennessy John L., “Computer Organization and Design: The Hardware / Software Interface”, 6th edition, Harcourt Asia, Morgan Kaufmann, Singapore, 2021.						
2.	Stallings William, “Computer Organization and Architecture: Designing for Performance”, 10th edition, Pearson Education, New Delhi, 2015.						

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	describe the basic structure, arithmetic and memory operations of a digital computer and illustrate the addressing modes for set of instructions	Applying (K3)
CO2	describe and apply algorithms for performing different arithmetic operations.	Applying (K3)
CO3	make use of the data path in a processor to write the sequence of steps to fetch and execute a given instruction and apply the concepts of pipelining	Applying (K3)
CO4	distinguish between different types of memory and apply the mapping functions between different levels of memory	Applying (K3)
CO5	illustrate various types of interrupts in I/O transfer and the role of different types of bus in I/O 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	1	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	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)

22ITT34 - INFORMATION THEORY AND CODING							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**3**	**ES**	**3**	**1**	**0**	**4**

Preamble	This course aims at introducing information theory and the practical aspects of various data compression techniques and error-control coding.	
Unit – I	**Information Entropy Fundamentals:**	**9+3**
Uncertainty, Information and Entropy – Source coding Theorem – Data Compaction – Discrete Memoryless channels – Mutual Information - Channel Capacity – Channel Coding Theorem.		
Unit – II	**Error Control Coding:**	**9+3**
Discrete-Memory less Channels**-** Linear Block codes- Syndrome - Minimum Distance Considerations – Syndrome Decoding - Cyclic codes – Generator Polynomial – Parity Check Polynomial – Generator and Parity-Check Matrices -Encoder for Cyclic codes – Calculation of the Syndrome – Convolutional Codes: Code Tree, Trellis and State Diagram.		
Unit – III	**Text and Image Compression:**	**9+3**
Compression Principles – Text compression: Static Huffman Coding - Dynamic Huffman coding – Arithmetic coding – LZW coding - Image Compression: Graphics Interchange format – Tagged Image File Format – Digitized documents – Digitized Pictures - JPEG Standards.		
Unit – IV	**Audio Compression:**	**9+3**
Audio Compression: Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive predictive coding –Linear Predictive coding – Code-excited LPC – Perceptual coding- MPEG audio coders – Dolby audio coders.		
Unit – V	**Video Compression:**	**9+3**
Principles: Frame types-Motion estimation and compensation-Implementation issues – H.261- H.263- MPEG:MPEG-1 - MPEG-2 - MPEG-3 - MPEG-4 video standards.		
		Lecture: 45,Tutorial:15, Total: 60

TEXT BOOK:

1.	Simon Haykin, "Communication Systems", 5th Edition, John Wiley and Sons, New York, 2017, for Units I, II.
2.	Fred Halsall, "Multimedia Communications, Applications, Networks, Protocols and Standards", 4th Edition, Pearson Education, New Delhi, 2009, for Units III, IV, V.

REFERENCES:

1.	Ranjan Bose, "Information Theory, Coding and Cryptography", 3rd Edition, Tata McGraw-Hill, India, 2017.
2.	Ze-Nian Li,Mark S. Drew, Jiangchuan Liu, "Fundamentals of Multimedia", 2nd Edition, Springer, CBS Publishers and Distributors Pvt Ltd, New Delhi, 2014.
3.	Mark Nelson and Jean-loup Gailly, "Data Compression Book", 2nd Edition, BPB Publication, New Delhi, 2004.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	illustrate source coding theorem and entropy to quantify information	Applying (K3)
CO2	outline various error control coding and apply to given problem	Applying (K3)
CO3	make use of different compression standards for image and text compression	Applying (K3)
CO4	applyvarious audio compression coding standards in different applications	Applying (K3)
CO5	use the different video compression standards in different 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	1	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	30	50	20				100
CAT2	30	40	30				100
CAT3	30	50	20				100
ESE	20	45	35				100

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

22EIT35 - MICROPROCESSORS AND EMBEDDED SYSTEMS							
Programme& Branch	**B.Tech. & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Digital Logic Principles and Design**	**3**	**ES**	**3**	**0**	**0**	**3**
Preamble	This course gives an introduction to 8086/8088 microprocessor architecture and programming. It also deals with 8051 microcontroller architecture and programming.						
Unit – I	**8086 Microprocessor:**						**9**
Architecture of 8086 – The execution unit – Bus interface unit- Addressing modes – Instruction set of 8086: Data transfer instructions – Branch Instructions -Logical instructions - Arithmetic instructions – Shift and rotate instructions - Simple Assembly Language Programs of 8086							
Unit – II	**8051 Microcontroller:**						**9**
Introduction to 8051 Microcontroller- Architecture- Memory Organization- Special function registers – Program Counter – PSW register – Stack - Instruction set - Addressing modes							
Unit – III	**8051 Programming:**						**9**
I/O Ports – Timer / Counter (Mode 1) – Serial Data Communication - Interrupt programming – Programming in Embedded C: I/O port programming- Timer programming-Counter programming-Serial port programming-Interrupt programming							
Unit – IV	**8051 Interfacing with Peripherals:**						**9**
LED - Seven segment display – Switch interfacing – LCD - A/D and D/A converters- LM35 sensor - Stepper motor - Matrix keypad							
Unit – V	**Applications of Microcontrollers (Block Diagram Approach):**						**9**
Smart Card reader, Automated Meter Reading System, Washing machine, Speedometer, Healthcare monitoring systems, 3D Printers, Smart Home automation system.							
							Total:45
TEXT BOOK:							
1.	Muhammed Ali mazidi, Janice GillipieMazidi, RolinMcKinlay, Lyla B. Das, “Microprocessors and Microcontrollers”, Pearson Education, New Delhi, 2020.						
REFERENCES:							
1.	Soumitra Kumar Mandal, “Microprocessors and Microcontrollers Architecture, Programming and Interfacing Using 8085, 8086 and 8051”, 1st Edition, Tata McGraw Hill, New Delhi, 2011						
2.	Patel, “The 8051 Microcontroller Based Embedded Systems”, 1st Edition, Tata McGraw Hill Publishing Company, New Delhi, 2014.						

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	describe the internal blocks and register organization of 8086 microprocessor architecture.	Applying (K3)
CO2	describe the internal blocks of 8051 microcontroller Architecture	Applying (K3)
CO3	write embedded c programs for 8051 features programming	Applying (K3)
CO4	apply programming skills to interface peripheral devices.	Applying (K3)
CO5	interpret the applications of microcontroller	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		3	3	3	2	2	3		3	2
CO2	3	3	2	2		3	3	3	2	2	3		3	2
CO3	3	2	2	2		3	3	3	2	2	3		3	2
CO4	3	2	2	2		3	3	3	2	2	3		3	2
CO5	3	2	2	2		3	3	3	2	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	20	40	40				100
CAT2	20	30	50				100
CAT3	20	30	50				100
ESE	10	40	50				100

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

22GET31- 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**	**HS**	**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		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	25	75					100
CAT2	25	75					100
ESE	NA						100

* ±3% may be varied (CAT 1 & 2 – 50 marks & ESE – 100 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**	**3 / 2**	**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),https://www.tamildigitallibrary.in/book-search.php?tag=%E0%AE%9A%E0%AF%86%E0%AE%A9%E0%AF%8D%E0%AE%A9%E0%AF%88 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**	**3 / 2**	**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)**

22ITL31 - DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY

Programme& Branch	B.Tech. & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Data Structures	**3**	**PC**	**0**	**0**	**2**	**1**

Preamble	This course investigates the various algorithm design techniques and methods for designing and analyzing algorithms.

LIST OF EXPERIMENTS / EXERCISES:

1.	Find the order of growth of the given problems. Identify the basic operation and count the number of times the basic operation is executed
2.	Implement the Quick sort algorithm and analyze with respect to space and time
3.	Implement the Merge sort algorithm and analyze with respect to space and time
4.	Implement binary search and analyze with respect to space and time
5.	Using Decrease and conquer technique, compute the kth smallest element in the list of 'n' numbers. Also, find the time complexity
6.	Write the heap sort algorithm to sort 'n' numbers using transform and conquer
7.	Compare top down and bottom-up approaches of solving the Knapsack problem using Dynamic Programming
8.	Construct the Huffman code for the given data. Also perform encoding and decoding (use Greedy technique).
9.	Apply backtracking to solve the given instance of subset sum problem
10.	Solve the travelling salesman problem of the given graph using branch and bound technique

Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	C/JAVA/Python
2.	Laboratory Manual

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	analyze the Space and Time efficiency of various algorithms	Analyzing (K4) Precision (S3)
CO2	estimate the performance of various algorithm design techniques	Evaluating (K5) Precision (S3)
CO3	choose appropriate design strategies for solving a given problem	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	2	2	1	3	3	3	3	3	3	1	3	3
CO2	3	3	3	3	2	3	3	3	3	3	3	2	3	3
CO3	3	2	1	1		3	3	3	2	2	3		3	2

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

22ITL32 - PYTHON PROGRAMMING AND FRAMEWORKS LABORATORY								
Programme& Branch	**B.Tech. & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**3**	**PC**	**0**	**0**	**2**	**1**

Preamble	This course provides hands-on exposure to develop applications using the features of Python. It also focuses on programming with databases

LIST OF EXPERIMENTS / EXERCISES:

1.	Implement linear search and binary search
2.	Implement Quick Sort and Merge Sort
3.	Find the most frequent words from a given text file and copy the same into another file
4.	Explore string manipulation functions (word play)
5.	Program using user-defined functions with different types of argument passing methods
6.	Demonstrate tuple, list, set and dictionary operations
7.	Program to illustrate the concept of constructors
8.	Program to implement different types of inheritance, Aggregation and Association
9.	Develop an application to illustrate CRUD operations using python and MySQL
10.	Program to demonstrate the usage of exception handling
11.	Perform data manipulation using NumPy
12.	Demonstrate Data Visualization using Pandas and Matplotlib

Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Software :Python, Anaconda, Jupyter Notebook

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	build, test and debug simple Python programs using control structures and functions	Creating (K6), Precision (S3)
CO2	develop applications using Object Oriented Programming concepts in Python and establish database connection	Applying (K3), Precision (S3)
CO3	demonstrate data manipulation and data visualization using Numpy, Pandas and 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	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2

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

22EIL33 - DIGITAL LOGIC AND MICROPROCESSORS LABORATORY

Programme& Branch	B.Tech. & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	3	ES	0	0	2	1

Preamble	This course provides practical exposure in implementing various digital circuits. It also deals with assembly language programming and interfacing with 8086

LIST OF EXPERIMENTS / EXERCISES:

1.	Simplify and Implement Simple Combinational Circuits
2.	Simplify and Implement Adder and Subtractor
3.	Simplify and Implement Decoder and Encoder
4.	Simplify and Implement Code converters
5.	Simplify and Implement Multiplexer and Demultiplexer
6.	Design counters and shift Registers
7.	Write simple programs using 8086 (Addition, subtraction, multiplication and division)
8.	Write simple programs using 8086 (Maximum and Minimum in a given list)
9.	Write simple programs using 8086 (Ascending/Descending ordering of a list)
10.	Perform the following Interfaces: i) Generate a square wave and rectangular wave by interfacing timer with 8051, ii) Generate rolling display by interfacing 8279 with 8051

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	design and implement combinational logic circuits	Applying (K3), Precision (S3)
CO2	examine sequential logic circuits using flip-flops	Analyzing (K4), Precision (S3)
CO3	develop assembly language programs for simple applications and interface peripherals with 16 bit microprocessor	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		3	3	3	2	2	3		3	2
CO2	3	3	2	2	1	3	3	3	3	3	3	1	3	3
CO3	3	2	1	1		3	3	3	2	2	3		3	2

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

22ITC32 - DATA STRUCTURES USING JAVA							
Programme & Branch	**B.Tech. – Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Object Oriented Programming**	**3**	**PC**	**3**	**0**	**2**	**4**

Preamble	This course helps the students to learn the basic concepts of linear data structures, non-linear data structures and their applications	
Unit – I	**Data structures and Linked List**	**9**
Overview of Data Structures – Java for C++ Programmers- The Basics of Arrays in Java - Linked lists: Links – A Simple linked list- Finding and deleting specified Links - Doubly Linked lists – Recursion: Factorial - A Recursive Binary Search – The Towers of Hanoi.		
Unit – II	**Stack and Queue**	**9**
Introduction – Stack: Implementation of stack – Stack Example: Reversing a Word – Delimiter Matching. Queue: Implementation of Queue – Circular queue – Dequeue – Parsing Arithmetic Expressions: Postfix Notation – Translating Infix to Postfix – Evaluating Postfix Expressions.		
Unit – III	**Sorting and Hashing**	**9**
Simple Sorting: Bubble sort – Selection sort – Insertion Sort – Sorting objects – Advanced Sorting – Shell sort – Quick sort – Introduction to Hashing: Open Addressing - Linear Probing – Quadratic Probing – Double Hashing - Separate Chaining - Hash Functions.		
Unit – IV	**Trees**	**9**
Binary trees – Tree terminology – Binary Search Tree: Finding a node – Inserting a node - Tree Traversals – Finding Maximum and Minimum values - Deleting a node – Red-Black Trees: Rotations – Inserting a New Node – Deletion – Red-Black Tree Implementation.		
Unit – V	**Graphs**	**9**
Introduction to Graphs - Depth-First Search – Breadth-First Search – Minimum Spanning Tree - Topological Sorting with Directed Graphs – Connectivity in Directed Graphs – Shortest Path Problem – Dijikstra's Algorithm – All Pair Shortest path Algorithm.		

LIST OF EXPERIMENTS / EXERCISES:

1.	Program to implement singly linked list
2.	Program to implement Doubly linked list
3.	Program to implement Stack and Queue
4.	Program to evaluate postfix evaluation using stack
5.	Program to implement Reversing a word using stack
6.	Program to implement shell sort
7.	Program to implement double hashing
8.	Program to implement binary search tree and its operations
9.	Program to implement BFS and DFS
10.	Program to implement topological sort

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Robert Lafore., "Data Structures and Algorithms in JAVA", 2nd Edition, Pearson Education, London, 2018.

REFERENCES/ MANUAL / SOFTWARE:

1.	Cormen T. H., Leiserson C. E., Rivest R. L., & Stein C., "Introduction to Algorithms", 3rd Edition, MIT Press, USA, 2009.
2.	Horowitz E., Sahni S., "Fundamentals of Data Structures in C", 2nd Edition, Galgotia Publications, New Delhi, 2008.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	describe the different operations on linked list	Applying (K3)
CO2	manipulate the operations on stacks and queue	Applying (K3)
CO3	demonstrate the concept of sorting and hashing techniques	Applying (K3)
CO4	build trees and perform its various operations	Applying (K3)
CO5	choose appropriate graph algorithm for solving 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	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

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	30	60				100

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

22MAT43 - DISCRETE MATHEMATICS							
(Common to Computer Science and Engineering, Computer Science and Design & Information Technology branches)							
Programme & Branch	**BE - Computer Science and Engineering, Computer Science and Design & BTech - Information Technology branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**4**	**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)

22ITT41 - DATABASE MANAGEMENT SYSTEMS							
Programme& Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**4**	**PC**	**3**	**0**	**0**	**3**
Preamble	This course provides the fundamentals of database concepts, SQL queries and transactions. It also deals with various concurrency control techniques for transactions.						
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 Operations- Relational Algebra.							
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 - Intermediate SQL: Joins – views– Index – Integrity Constraints– SQL data types and schemas – Authorization.							
Unit – III	**Relational Database Design:**						**9**
Features of good relational designs- Functional dependency theory - Decomposition using functional dependencies–Algorithms for decomposition. Normal Forms: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF–Data Storage: RAID – Tertiary storage - File Organization – Organization of Records in Files – Data dictionary storage.							
Unit – IV	**Indexing, Hashing and Transactions:**						**9**
Ordered indices– B trees - B+ Tree index files–Multiple key access - Static and Dynamic Hashing – Bitmap indices. Overview of Query Processing- Transaction concept–Transaction model–Storage structure–Transaction atomicity and durability – Isolation – Serializability.							
Unit – V	**Concurrency Control and Recovery System:**						**9**
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							
							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.	Elmasri, Ramez 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	outline the features, architecture and applications of database system	Applying (K3)
CO2	design an ER model and use relational database with SQL statements	Applying (K3)
CO3	design relational database using normalization methods	Applying (K3)
CO4	apply indexing and hashing techniques in relational database, and perform transaction processing	Applying (K3)
CO5	apply the concepts of concurrency control and recovery in a relational database	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	10	20	70				100
CAT2	10	20	70				100
CAT3	10	20	70				100
ESE	10	30	60				100

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

22ITT42 - WEB TECHNOLOGY

Programme& Branch	B.Tech & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Object Oriented Programming	4	PC	3	0	0	3

Preamble	This course provides an introduction to HTML, CSS and Bootstrap. It also deals with Client-side JS and ServerSide JS Framework.	
Unit – I	**UI Design:**	**9**
HTML5: Introduction– Basic tags – HTML Forms Element– Page Structured Elements– Media Tags –Cascading Style Sheet. Responsive Web Design: Introduction - Bootstrap - Grid basics – Tables –Images - Button - list - Drop down - Navs - Nav Bar - Forms-Input – Input Groups – Modal.		
Unit – II	**JavaScript ES6:**	**9**
Introduction – Variables – Operators - Control structures -Functions - Scope - Objects - Array, Date - Math – RegExp – HTML DOM – Collections - Event Handling – JSON parsing.		
Unit – III	**Server-side JS Framework:**	**9**
Node JS: Introduction – Architecture – Features- Creating Web Servers with HTTP -Request - Response – Event Handling - GET and POST Methods –File Upload - Connect to NoSQL Database using Node JS – Implementation of CRUD operations.		
Unit – IV	**TypeScript and Angular:**	**9**
TypeScript: Introduction – Features – Variables – Data types – Enum – Array – Tuples – Functions – OOP concepts – Interfaces. Angular : Introduction - Needs - Evolution – Features – Architecture - Setup and Configuration – Components and Modules –Templates - Controllers – Scope – Directives – Data Binding.		
Unit – V	**AngularJS Framework:**	**9**
Pipes/Filters -DOM – Events - Routing - Services – HTTP – Ajax– Template Driven Forms - Reactive Forms – Form Validation – Basic Animations.		
		Total:45

TEXT BOOK:

1.	Infosys campus connect material shared by Infosys

REFERENCES:

1.	Paul Deitel, Harvey M.Deitel and Abbey Deitel, “Internet and World Wide Web - How To Program”, 5th Edition, Prentice Hall,2011.
2.	https://www.javatpoint.com

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	design static web pages using HTML, CSS and Bootstrap.	Applying (K3)
CO2	develop interactive and dynamic web pages using basics constructs of Javascript ES6	Applying (K3)
CO3	develop a web application using node JS with database connectivity	Applying (K3)
CO4	apply the features of Typescript and Angular to develop web applications.	Applying (K3)
CO5	demonstrate full stack web development using Typescript, Angular and Node JS	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	20	20	60				100
CAT2	20	20	60				100
CAT3	20	20	60				100
ESE	20	20	60				100

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

22ITT43 - FORMAL LANGUAGES AND AUTOMATA THEORY							
Programme& Branch	**B.Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**

Prerequisites	**Nil**	**4**	**PC**	**3**	**0**	**0**	**3**
Preamble	This course deals with models of computation, along with their types in the context of formal languages and their recognizers. It familiarizes students with the foundations and principles of theoretical computer science. This can be applied in the design of compilers, network protocols and pattern recognition system.						
Unit – I	**Automata:**						**9**
Introduction to Formal Proof - Additional Forms of Proof - Inductive Proofs - Deterministic Finite Automata - Non-deteministic Finite Automata - Application: Text Search - Finite Automata with Epsilon Transitions							
Unit – II	**Regular Expressions and Languages:**						**9**
Regular Expressions - Finite Automata and Regular Expressions - Applications of Regular Expressions - Algebraic Law for Regular Expressions - Proving Language Not to Be Regular -Closure Properties of Regular Expressions: Closure Properties of Regular Expressions: Closure of Regular Languages under Boolean Operations – Reversal - Equivalence and Minimization of Automata							
Unit – III	**Context -Free Grammars and Languages:**						**9**
Context - Free Grammars-Parse Trees - Application of Context-Free Grammars - Ambiguity in Grammars and Languages							
Unit – IV	**Pushdown Automata:**						**9**
Definition of Pushdown Automata - The Languages of PDA - Equivalence of PDA's and CFG's - Deterministic Pushdown Automata - Normal Forms of Context Free Grammars - The pumping Lemma for Context Free Languages							
Unit – V	**Turing Machine:**						**9**
Problems that Computers cannot Solve - The Turing Machine - Programming Techniques for Turing Machines - Extensions to the Basic Turing Machine - Restricted Turing Machines - A language that is not Recursively Enumerable - An Undecidable Problem that is RE - Undecidable Problems About Turing Machine – Post's Correspondence Problem							
							Total:45
TEXT BOOK:							
1.	Hopcroft J.E., Motwani R. and Ullman J.D., "Introduction to Automata Theory, Languages and Computations", 3rd Edition, Pearson Education, New Delhi, 2008.						
REFERENCES:							
1.	Kamala Krithivasan and Rama R, "Introduction to Formal Languages, Automata Theory and Computation", 1st Edition, Pearson Education, 2009.						
2.	Martin J., "Introduction to Languages and the Theory of Computation", 4thEdition, Tata McGraw-Hill, New Delhi, 2010.						

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	design DFA and NFA for the given language	Applying (K3)
CO2	apply regular expressions to identify regular languages and its study closure properties.	Applying (K3)
CO3	specify context free languages using context free grammars and study its properties.	Applying (K3)
CO4	develop pushdown automata for recognizing context free languages	Applying (K3)
CO5	construct Turing machines and study the properties of 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	1	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	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)

22ITT44 - OPERATING SYSTEMS							
Programme& Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**

Prerequisites	**Nil**	**4**	**PC**	**3**	**1**	**0**	**4**

Preamble	This course describes about operating system abstractions, mechanisms and their implementations such as process management, synchronization, scheduling, deadlock and file systems.
Unit – I	**Operating Systems Overview** **9+3**
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+3**
Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication – IPC in Shared Memory and Message Passing Systems. Threads: Overview - Multicore Programming - Multithreading Models. CPU Scheduling: Scheduling Criteria – Scheduling Algorithms.	
Unit – III	**Process Synchronization** **9+3**
Critical Section Problem – 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+3**
Main Memory – Background – Contiguous Memory Allocation – Paging – Segmentation – Structure of the page table – Swapping. Virtual Memory: Background – Demand Paging – Page Replacement – thrashing.	
Unit – V	**Storage Management** **9+3**
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 – Case study: Linux System.	
Lecture:45, Tutorial :15, Total:60	

TEXT BOOK:

1. Silberschatz A, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley & Sons Inc.,2018.

REFERENCES:

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, New Delhi, 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify operating system structure, services and system calls	Applying (K3)
CO2	demonstrate various process scheduling algorithms and describe multithreading models	Applying (K3)
CO3	apply different methods for process synchronization and for handling deadlocks .	Applying (K3)
CO4	illustrate memory management strategies and demonstrate various page replacement	Applying (K3)
CO5	summarize the features of file systems and apply various disk scheduling 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	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	20	50	30				100
CAT2	20	50	30				100
CAT3	20	50	30				100
ESE	10	60	30				100

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

22ITL41 - DATABASE MANAGEMENT SYSTEMS LABORATORY

Programme& Branch	B.Tech. & Information Technology	Sem.	Category	L	T	P	Credit

Prerequisites	Nil	4	PC	0	0	2	1

Preamble	This course provides hands-on experience in databases and its operations using SQL and other high level languages

LIST OF EXPERIMENTS / EXERCISES:

1.	Data definition language, commands, integrity constraints
2.	Data manipulation language, Data control language commands and TCL commands
3.	Nested queries
4.	Join operations
5.	Views and index
6.	PL/SQL statements
7.	Cursors
8.	Triggers
9.	Procedures and Functions
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

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	develop SQL and PL/SQL commands to create and manipulate databases	Applying (K3), Precision (S3)
CO2	execute and examine queries using concepts of embedded query languages	Analyzing (K4), Precision (S3)
CO3	apply database concepts to solve 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	1	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1	1	3	3	3	3	3	3	1	3	3
CO3	3	2	1	1		3	3	3	2	2	3		3	2

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

22ITL42 - WEB TECHNOLOGY LABORATORY

Programme& Branch	B.Tech & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Object Oriented Programming	4	PC	0	0	2	1

Preamble	This course provides hands-on experience in databases and its operations using SQL and other high level languages

LIST OF EXPERIMENTS / EXERCISES:	
1.	Design a web page using HTML tags and host it in github repository.
2.	Design a responsive website using Bootstrap.
3.	Design a registration form and perform form validation using JavaScript.
4.	Design an webpage to create simple interactive Bill calculator using DOM.
5.	Develop simple login page by performing event handling using GET and POST methods in Node JS.
6.	Design a webpage to maintain personal information using CRUD operations in MongoDB.
7.	Design a web application using components, modules and router in Angular.
8.	Develop a web application using Angular http services.
9.	Design a reactive form to maintain personal information and perform validation using Angular.
10.	Develop and deploy eCart management system using Angular.
	Total:30

REFERENCES/ MANUAL /SOFTWARE:	
1.	Visual Studio code/ GEdit, Node JS+NPM, MongoDB
2.	Angular, Github

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	develop interactive web pages using HTML, CSS, JavaScript and Bootstrap.	Applying (K3), Precision (S3)
CO2	develop a web application to maintain information in a database using server-side scripting.	Applying (K3), Precision (S3)
CO3	apply the concepts of Angular to design full-fledged web applications.	Creating (K6), 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		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1	3	3	3	3	3	3	3	3	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 upgradation-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	**Written Communication & Verbal Aptitude**	**30**
Writing Skills: Writing strategies and formats Importance of Résumés Writing a Cover letter -Responding to Job Advertisements Professional e-mail Writing Responding to e-mails and business letters Technical Report writing Interpretation of Technical Data (Transcoding) Writing One-page Essays. Verbal Aptitude Synonyms Antonyms Homonyms One word substitution Idioms and Phrases Paired words Analogies Spelling test Cloze test using suitable verb forms using appropriate articles and prepositions; Spotting Errors Sentence Correction and Formation Grammar Based questions (Transformation : Active-Passive & Direct-Indirect); Rearranging Jumbled Sentences & Jumbled paragraphs, Identifying Facts, Inferences and Judgements statements		
		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.	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 communication skills effectively to understand and deliver information in various written discourses grammatically with accuracy	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
ESE	NA						100

* ±3% may be varied (CAT 1,2,3 - 50 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

22ITT51 - COMPUTER NETWORKS							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**

Prerequisites	Nil	5	PC	3	0	0	3

Preamble	This course deals with the fundamental concepts of computer networks. It presents bottom up approach of different layers along with their concepts, functions and protocols.	
Unit - I	**Network Models and Physical Layer**	**9**
Data Communications – Networks – Networks Types. Network Models: TCP/IP Protocol suite - The OSI Model. Digital-to-digital conversion: Line coding – Line Coding Schemes – Transmission Modes – Transmission media: Guided – Unguided media.		
Unit - II	**Data Link Layer**	**9**
Introduction – Link Layer Addressing – Error Detection and Correction: Introduction – Block Coding – CRC – Checksum– Framing – HDLC - Point-to-point protocol. Media Access Control: Random Access – Channelization - Wired LAN: Standard Ethernet – Connecting Devices – Virtual LANs.		
Unit - III	**Network Layer**	**9**
Network Layer Services- Network layer performance - IPV4 addresses – Internet Protocol (IP) - ICMPv4. Unicast Routing Algorithms: Distance Vector and Link-state routing unicast – Routing Protocols: RIP and OSPF - IPV6 addressing- IPV6 protocol.		
Unit - IV	**Transport Layer**	**9**
Introduction – Transport layer protocols: Simple – Stop-and-wait - Go-back-N – Selective Repeat - Piggybacking – UDP – TCP. Quality of Service: Data Flow Characteristics – Flow control to improve QoS.		
Unit - V	**Application Layer**	**9**
World Wide Web and Hyper Text Transfer Protocol – File transfer protocol – Electronic Mail - Telnet – Secure shell – Domain name system – Network Management: Introduction – Simple Network Management Protocol.		
		Total:45

TEXT BOOK:

1.	Behrouz A. Forouzan, “Data Communications and Networking”, McGraw-Hill, 5th Edition, 2013.

REFERENCES:

1.	Kurose James F. and Ross Keith W., “Computer Networking: A Top-Down Approach”, 6th Edition, Pearson Education, New Delhi, 2017.
2.	Stallings, “Data and Computer Communications”, PHI, 10th Edition, New Delhi, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explore the basics of network models and physical layer	Applying (K3)
CO2	identify error detection and correction methods and protocols at data link layer	Applying (K3)
CO3	outline the different addressing schemes and apply various routing protocols at network layer	Applying (K3)
CO4	illustrate the different transport layer protocols and employ suitable flow control and QoS techniques	Applying (K3)
CO5	know various protocols and their working principles at application layer	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	20	50	30				100
CAT2	20	50	30				100
CAT3	20	50	30				100
ESE	10	60	30				100

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

22ITT52 - MACHINE LEARNING							
Programme & Branch	B. Tech & Information Technology	Sem.	Category	L	T	P	Credit

Prerequisites	Design and Analysis of Algorithms	5	PC	3	0	0	3

Preamble	This course provides an insight into different types of machine learning algorithms and their utility in various real-world problems	
Unit - I	**Introduction to Machine Learning**	**9**
Introduction – Definition - Types of Machine Learning - Applications - Tools in machine learning - Types of data - Exploring structure of data - Data Quality and Remediation - Data preprocessing.		
Unit - II	**Modeling and Evaluation**	**9**
Introduction to model – Model Selection: Predictive Model-Descriptive Model-Training a Supervised Learning Model - Model representation and Interpretation – Evaluating performance of Model – Improving performance of a Model. Feature Engineering: Introduction- Feature Transformation - Feature Subset Selection.		
Unit - III	**Supervised learning: Classification**	**9**
Introduction - examples- Classification Model- Classification learning -Classification algorithms: Naive Bayes - K-nearest Neighbour - Decision tree - Random forest model - Support Vector Machine. Evaluating performance of model - Regression: Examples – Regression algorithm: simple linear regression - Multiple linear regression - polynomial regression model - Logistic regression, Evaluating performance of a model.		
Unit - IV	**Neural Networks**	**9**
Introduction to biological and artificial neuron – Types of activation functions –Architecture of neural network: Single layered feed forward ANN - Multilayered feed forward ANN-competitive network-Recurrent Network -Learning process in ANN- Back Propagation-Deep Learning. Unsupervised Learning: Introduction –Applications – Clustering algorithms – Evaluating performance of model.		
Unit - V	**Other Types of Learning**	**9**
Reinforcement learning - Elements of Reinforce learning –Model based Learning – Temporal difference learning - representation Learning-Active learning –Instance based Learning – Association rule learning algorithm - Ensemble Learning Algorithm - Regularization Algorithm.		
		Total:45

TEXT BOOK:

1.	Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, “Machine Learning”, 1st edition, Pearson Education, 2019.

REFERENCES:

1.	Ethem Alpaydin, “Introduction to Machine Learning”, 3rd edition, Prentice Hall, 2015
2.	Tom M. Mitchell, “Machine Learning”, 1st edition, Tata McGraw-Hill Education, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	utilize data preprocessing and explore structure of data	Applying (K3)
CO2	Select models and apply feature engineering methods to choose suitable models	Applying (K3)
CO3	employ supervised learning methods to solve real world problems	Applying (K3)
CO4	Solve problems using neural networks and unsupervised learning	Applying (K3)
CO5	apply the concepts of reinforcement learning and other types of machine learning 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	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	20	50	30				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	10	40	50				100

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

22ITC51 - SOFTWARE ENGINEERING

Programme & Branch	B. Tech & Information Technology	Sem.	Category	L	T	P	Credit

Prerequisites	Nil	5	PC	3	0	2	4

Preamble	This course promotes the practice of software engineering concepts at a higher level of abstraction which is to be acquired by software engineers and developers. It also covers agile software engineering principles that are applicable to the analysis, design, development and testing of software systems.	
Unit - I	**Process Models**	**9**
Software process structure – Process models - Waterfall model, Incremental process models, Evolutionary process models, Specialized process models – Unified Process		
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		
Unit - III	**XP and Incremental Design**	**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 - Make Code and Design Decisions at the Last Responsible Moment - Incremental Design and the Holistic XP Practices		
Unit - IV	**Lean and Kanban**	**9**
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 - V	**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.		

LIST OF EXPERIMENTS / EXERCISES:

1.	Create a product back log with stories
2.	Determine Release plan to decide which stories can be accomplished in the release
3.	Write Sprint plan to determine which features can be accomplished in the first iteration, or sprint
4.	Manage your workload
5.	Use several predefined and user created queries to Track project progress
6.	Schedule the sprint review to allow team members to add their thought and review the discussion at the meeting
7.	Create a plan to shut down the first sprint and get ready to start the next one
8.	Identify use cases and develop business use case model (System use case diagram)
9.	Identify the conceptual classes (boundary, controller and entity classes) and develop a domain model with UML Class diagram.
10.	Develop user interface using Python and Database creation using MySQL and Perform unit and integration testing

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Roger S. Pressman, Bruce R. Maxim, "Software Engineering: A Practitioner's Approach", 8th Edition, McGraw-Hill Education, India, 2019. (Units 1 & 5)
2.	Andrew Stellman and Jennifer Greene, "Learning Agile: Understanding Scrum, XP, Lean and Kanban", 1st Edition, O'Reilly Media Inc,2015 (Units 2,3 &4)

REFERENCES/ MANUAL / SOFTWARE:

1.	Ali Bahrami, "Object Oriented Systems Development", 1st Edition, Tata McGraw-Hill, New Delhi, 2008.
2.	Infosys spring board contents provided by Infosys at https://infyspringboard.onwingspan.com/web/en/page/home

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify various software development models	Applying (K3), Precision (S3)
CO2	outline agile principles and apply Scrum for project development.	Applying (K3), Precision (S3)
CO3	use XP methods for modeling and design of a software system	Applying (K3), Precision (S3)
CO4	model applications using Lean and Kanban practices	Applying (K3), Precision (S3)
CO5	make use of various software testing techniques to test the software systems	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		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	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)

22ITC52 - USER INTERFACE DESIGN							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Web Technology**	**5**	**PC**	**3**	**0**	**2**	**4**

Preamble	This course provides knowledge on creating user interfaces using React javascript.	
Unit – I	**Introduction**	**9**
Basics of React - installation - Environment - ES6: Objects and Arrays Arrow Functions - Classes - Virtual DOM - React Elements - Introduction to JSX - Create element - Rendering element - Adding style to React elements - Dynamic element creation.		
Unit – II	**Component**	**9**
Creating components - Class component - Function component - constructor - Rendering a component - Composing components - Extracting components - Styling Component - Mobile responsive components.		
Unit – III	**Props and State**	**9**
Creating property - Validation - Creating state - Using state - Changing the state - Passing data - Props in constructor. React Lifecycle: Lifecycle of components - Mount - Unmount - Update		
Unit – IV	**React Events**	**9**
Event Handlers - Bind. React Form: Controlled component - Uncontrolled component - Working with lists and keys - Adding forms - Event handling - Conditional rendering - Submitting forms - Adding multiple fields - Validation		
Unit – V	**Router and Hooks**	**9**
Routing overview - Authentication - Basics - State hook - Effect hook - Rules of hook - Building hooks - Hooks API Reference - Redux		

LIST OF EXPERIMENTS / EXERCISES:

1.	Create a React based website for your client using components, elements and styles.
2.	Create a user profile page using props
3.	Create a calculator application that performs basic arithmetic operations using React's state management.
4.	Create a simple e-commerce website with minimum of three pages. Use React Router to implement routing between these pages.
5.	Build a simple counter application that increments or decrements a value based on user input.
6.	Create a form that allows users to add new items to a list. The form should include fields for the name, description and quantity of the item.
7.	Create a weather application that displays the weather forecast for a specific location.
8.	Build a CRUD application that allows users to add, view, edit and delete data from a database.
9.	Create a to-do list application using hooks.
10.	Build a user authentication system that allows users to sign up, log in, and log out.

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Wieruch, Robin, “The Road to Learn React: Your Journey to Master Plain Yet Pragmatic React. Js.”, Lean Publishing, Germany, 2017.

REFERENCES/ MANUAL / SOFTWARE:

1.	Banks, Alex, and Porcello, Eve, “Learning React: Functional Web Development with React and Redux”, O'Reilly Media, United States, 2017.
2.	https://reactjs.org
3.	Martin Sauter, "From GSM to LTE, An Introduction to Mobile Networks and Mobile Broadband", Wiley, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	develop a react applications using basic elements and styles	Applying (K3), Precision (S3)
CO2	apply the fundamental concepts of component in react	Applying (K3), Precision (S3)
CO3	demonstrate properties and state in react	Applying (K3), Precision (S3)
CO4	implement simple applications using react events	Applying (K3), Precision (S3)
CO5	illustrate the functionalities of React hooks and routing	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	3	3	3	3	2	2	3		3	2
CO2	3	2	1	1	3	3	3	3	2	2	3		3	2
CO3	3	2	1	1	3	3	3	3	2	2	3		3	2
CO4	3	2	1	1	3	3	3	3	2	2	3		3	2
CO5	3	2	1	1	3	3	3	3	2	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	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)

22ITL51 - NETWORKS LABORATORY

Programme & Branch	B.Tech. & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	PC	0	0	2	1

Preamble	This course provides an exposure to configure the routers, end devices and servers using packet Tracer. It also enables the students to configure routing protocols using tools like GNS3 and Packet Tracer.

LIST OF EXPERIMENTS / EXERCISES:

1.	Simulate the network topologies (Bus, Ring, Star and Mesh) using Cisco Packet Tracer
2.	Implement bit stuffing and byte stuffing using C program.
3.	Simulate and identify the difference in working operation of Hub and Switch using Cisco Packet Tracer
4.	Configure a Web server, DHCP server and a DNS server all together in a single simulation through which IP have to be allocated for the host through DHCP server, Conversion of Canonical Name to IP address to be done by DNS server and Access to the webpage has to give by web server using Cisco Packet Tracer.
5.	Simulate a network that performs Network address Translation to share a single public IP to the entire host connected in the network.
6.	Develop as chat application using TCP socket
7.	Create UDP based network application using socket programming
8.	Implement Go-Back-N and Selective repeat flow control protocols
9.	Transfer a file to a remote server, analyze the traces of the TCP segments sent and received and investigate the behaviours of TCP using Wireshark
10.	Capture packet traces by retrieving an HTML file and investigate the operations of Ethernet protocol and the ARP protocol using Wireshark

Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Cisco Packet Tracer /C, Java /Wireshark Tool

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	demonstrate and configure networking protocols using Cisco Packet Tracer	Applying (K3), Precision (S3)
CO2	implement the working mechanism using data link, network and transport layer protocols	Applying (K3), Precision (S3)
CO3	demonstrate the various layer protocols using simulator tool	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	3	3	3	3	2	2	3	2	3	2
CO2	3	2	1	1	3	3	3	3	2	2	3	2	3	2
CO3	3	2	1	1	3	3	3	3	2	2	3	2	3	2

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

22ITL52 - MACHINE LEARNING LABORATORY							
Programme & Branch	**B.Tech. & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Design and Analysis of Algorithms, Object oriented programming**	**5**	**PC**	**0**	**0**	**2**	**1**

Preamble	This course provides implementation of various machine learning algorithms for designing solutions for real life problems

LIST OF EXPERIMENTS / EXERCISES:

1.	Impute missing values in data inputs
2.	Use feature selection/extraction method to perform dimensionality reduction
3.	Demonstrate Naïve Bayes Classification
4.	Classify the input dataset using decision tree
5.	Perform classification using Support Vector Machines
6.	Perform multivariate classification and regression
7.	Develop a program to implement feed-forward neural networks
8.	Implement K-means clustering
9.	Develop a simple application to demonstrate reinforcement learning
10.	Assess machine learning algorithms using cross validation methods

Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Python/ R/ Java
2.	Jupyter Notebook/Eclipse

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	apply various learning methods to preprocess the dataset by data cleaning and dimensionality reduction	Applying (K3), Precision (S3)
CO2	use various supervised learning methods to perform classification	Applying (K3), Precision (S3)
CO3	demonstrate unsupervised learning and reinforcement learning methods	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	3	3	3	3	2	2	3	2	3	2
CO2	3	2	1	1	3	3	3	3	2	2	3	2	3	2
CO3	3	2	1	1	3	3	3	3	2	2	3	2	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. Logicalreasoning: 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				3	3		3		3	2		
CO2	3	2				3	3		3		3	2		
CO3		2				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	20	40	40				100
CAT2		50	50				100
CAT3		50	50				100
ESE	NA						

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

22ITT61 - DEVOPS

Programme & Branch	B. Tech & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Computer Networks & Operating System	6	PC	3	0	0	3

Preamble	This course covers the new paradigm of combined development and operations in SDLC. It covers concepts like virtualization, Containerization, Continuous integration and development and cluster / cloud integration.

Unit – I	**Introduction to DevOps, SDLC, Agile and Virtualization**	**9**

Definition of DevOps –The need for DevOps – Key concepts and principles of DevOps – Overview of SDLC – Phases of SDLC (Planning,Analysis,Design,Development,Testing,Deployment,Maintenance) – Overview of Agile methodology – Agile principles and values – Agile practices (Scrum, Kanban, Lean) – Role of DevOps in SDLC – Continuous Integration and Continuous Deployment (CI/CD) – Virtualization vs containerization –Overview of virtualization technologies (VMware,VirtualBox).

Setting up virtualization software (e.g., VirtualBox, VMware) and creating a virtual machine. Installing and configuring a Linux distribution on the virtual machine. Setting up a web application development environment with the LAMP stack (Linux, Apache, MySQL, PHP). Setting up version control with Git and creating a simple Git repository. Implementing Agile methodology with a team-based project using Scrum, Kanban or Lean methodologies.

Unit - II	**Containerization and Docker**	**9**

Overview of containerization - Introduction to Docker - Docker architecture and components - Docker images and containers - Docker CLI commands – Docker file for building custom images - Docker Compose for multi-container applications.

Installing and setting up Docker on a Linux machine. Building a Docker image using a Docker file. Running a Docker container and accessing its shell. Creating and running a multi-container application with Docker Compose. Deploying a Docker container to a remote server.

Unit - III	CI/CD with Jenkins Pipeline	**9**

Introduction to Jenkins - Understanding Continuous Integration and Continuous Delivery/Deployment - Jenkins architecture and components - Setting up Jenkins and Creating jobs - Jenkins Pipeline as code - Jenkins Master-Slave setup - Jenkins security and User Management - Integrating Jenkins with other DevOps tools.

Installing and setting up Jenkins on a Linux machine. Setting up a Jenkins pipeline job. Configuring the pipeline job to build and test a sample application from a Git Hub repository. Integrating the pipeline job with a Docker registry to store and deploy the Docker image. Adding notifications and alerts to the pipeline job using Slack or email.

Unit - IV	**Kubernetes**	**9**

Introduction to Kubernetes - Kubernetes architecture and components - Kubernetes cluster setup and configuration - Kubernetes objects (Pods, Services, Deployments, etc.) - Kubernetes CLI commands - Kubernetes Networking and Service Discovery - Scaling and self-healing with kubernetes. Creating and managing applications with Kubernetes.

Installing and setting up Kubernetes on a local machine or a cloud provider. Deploying a sample application to Kubernetes using Kubernetes CLI commands. Creating and managing Kubernetes objects (Pods, Services, Deployments, etc.). Scaling the application by creating replicas and load balancing with Kubernetes. Upgrading and rolling back the application with Kubernetes.

Unit - V	**Terraform, Prometheus, and Grafana**	**9**

Introduction to Infrastructure as Code (IaC) - Overview of Terraform - Terraform Configuration file - Terraform Providers and State Management - Terraform Modules and Variables - Provisioning Resources with Terraform - Overview of monitoring and alerting - Introduction to Prometheus and Grafana - Setting up Prometheus and Grafana - Creating and visualizing metrics with Prometheus and Grafana.

Installing and setting up Terraform on a Linux machine. Creating and managing infrastructure using Terraform. Creating and configuring a Prometheus server to monitor a sample application. Setting up alert rules and notifications with Prometheus and Alert manager. Creating and visualizing metrics with Grafana.

Total:45

TEXT BOOK:

1. Gene Kim, Patrick Debois, John Willis, and Jez Humble , "The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations", 2016.

REFERENCES:

1. Docker - https://www.docker.com/use-cases/devops
2. Kubernetes - https://kubernetes.io/docs/concepts/overview/what-is-kubernetes/
3. Amazon Web Services (AWS) DevOps - https://aws.amazon.com/devops/
4. Agile Alliance - https://www.agilealliance.org/
5. Cloud Native Computing Foundation - https://www.cncf.io/
6. The DevOps Enterprise Summit - https://events.itrevolution.com/us/
7. Continuous Delivery Foundation - https://cd.foundation/

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	Select and install a virtualization software and create a virtual machine for web application development using WAMP/LAMP.	Applying (K3)

CO2	Experiment with containerization by installing and setting up Docker and Docker Compose	Applying (K3)
CO3	Demonstrate Continuous Development (CD) / Continuous Integration (CI) using Jenkins integrated with other DevOps tools.	Applying (K3)
CO4	Make use of Kubernetes to build scalable applications on clusters to achieve load balancing.	Applying (K3)
CO5	Build and deploy cloud-based scalable solutions using Terraforms, Prometheus, and Grafana for effective monitoring and provisioning of resources	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	3	3	3	2	2	3		3	2
CO2	3	2	1	1	3	3	3	3	2	2	3		3	2
CO3	3	2	1	1	3	3	3	3	2	2	3		3	2
CO4	3	2	1	1	3	3	3	3	2	2	3		3	2
CO5	3	2	1	1	3	3	3	3	2	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	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)

22ITT62 - MOBILE COMMUNICATION							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Computer Networks**	**6**	**ES**	**3**	**0**	**0**	**3**
Preamble	Pre-requisites: Basic knowledge about data communication such as concepts of modulation, error correction code as well as networking concepts such as TCP/IP protocols.						
Unit - I	**Introduction to Wireless Communication**						**9**
Wireless transmission –Frequencies for radio transmission –Signals –Antennas –Signal Propagation –Multiplexing –Spread spectrum –cellular systems-MAC-Motivation –SDMA –FDMA –TDMA –CDMA							
Unit - II	**Telecommunication and Satellite systems**						**9**
Tele Communications –GSM: Mobile services -System architecture -Radio interface -Protocols -Localization and calling –Handover -Security -New data services–Satellite Systems –Basics –Routing -Localization-Handover.							
Unit – III	**Wireless LAN**						**9**
Wireless LAN -Infrared Vs Radio Transmission –Infrastructure Networks and Adhoc Networks -IEEE 802.11 –System architecture-Protocol architecture - HIPERLAN: HIPERLAN1 –Bluetooth-User scenarios-Architecture.							
Unit – IV	**Mobile Network and Transport Layer**						**9**
Mobile IP: Goals, assumptions and requirements – Entities and terminologies – IP packet delivery – Agent discovery – Registration – Tunneling and Encapsulation – Dynamic Host Configuration Protocol-Mobile ad-hoc Networks –Improvement on TCP for mobile and wireless network							
Unit – V	**Application Layer & IoT**						**9**
WAP-Architecture -Wireless application environment–Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT Communication Models - IoT Communication APIs – IoT enabling Technologies - Wireless Sensor Networks - Cloud Computing – Big data analytics – Communication Protocols - Embedded Systems – IoT Levels and Templates							
							Total:45

TEXT BOOK:

1.	Schiller J., “Mobile Communication”, 2nd Edition,Pearson Education, New Delhi, 2014 (For Units I,II,III,IV)
2.	ArshdeepBahga and Vijay Madisetti, "Internet of Things – A Hands-on Approach", 1st Edition, University Press, 2015. (For Units V)

REFERENCES:

1.	Raj Kamal, “Mobile Computing”, 3rd edition, Oxford University PressInc. New Delhi, 2019
2.	Asoke K Talukder,Hasan Ahmed,Roopa R Yavagal, “Mobile Computing Technology, applications and Service Creation”, 2nd Edition , McGraw Hill Education Private Ltd,2018
3.	Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", 1st Edition, CRC Press, 2012
4.	Jonathan Rodriguez, “Fundamentals of 5G Mobile Networks”, Wiley, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	summarize the fundamentals of wireless communication and determine the suitable medium access control techniques	Applying (K3)
CO2	elaborate the concepts and protocol architectures of GSM and satellite systems	Applying (K3))
CO3	illustrate the concepts of Wireless LAN and associated technologies	Applying (K3)
CO4	explore the routing protocols and TCP congestion control mechanisms in wireless network	Applying (K3)
CO5	use the WAP and IoT architecture, infrastructure and explore the constraints of Internet of Things	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	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)

22ITL61 - CLOUD COMPUTING LABORATORY							
Programme & Branch	**B.Tech. & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**

Prerequisites	Operating Systems, Computer Networks	6	PC	0	0	2	1

Preamble	This course enables the students to design, develop, and deploy cloud-based web applications.

LIST OF EXPERIMENTS / EXERCISES:

1.	Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
2.	Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3.	Install Google App Engine. Create hello world app and other web applications using python/java
4.	Use GAE launcher to launch web applications
5.	Create EC2-AWS S3 bucket based static web pages
6.	Create EC2-AWS- instance and migration
7.	Create EC2-AWS web application using Beanstalk
8.	Perform AWS load balancing and auto scaling
9.	Implement PaaS-Mobile sensor based IoT application hosted via PaaS environment
10.	Install Hadoop single node cluster and run simple applications like wordcount.

Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	VMware, Google App Engine
2.	C/Python/Java
3.	Hadoop

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	experiment with various virtualization tools such as Virtual Box and VMware workstation.	Applying (K3), Precision (S3)
CO2	develop EC2-AWS buckets, instances and web applications	Applying (K3), Precision (S3)
CO3	apply large data sets in a parallel environment.	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	3	3	3	3	2	2	3	2	3	2
CO2	3	2	1	1	3	3	3	3	2	2	3	2	3	2
CO3	3	2	1	1	3	3	3	3	2	2	3	2	3	2

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

22ITL62 - INTERNET OF THINGS LABORATORY							
Programme & Branch	**B.Tech. & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Computer Networks**	**6**	**ES**	**0**	**0**	**2**	**1**

Preamble	This course demonstrates the working of various communication technologies like GSM, ZigBee, and Arduino. Various environmental conditions like temperature, humidity etc. will be sensed and transmitted using these technologies and the values will be uploaded to cloud. This course also explores the development of simple real time applications using Raspberry Pi

LIST OF EXPERIMENTS / EXERCISES:	
1.	Experiments on GSM / GPRS Basic AT Commands, Voice calls / Voice communication, Phone Book, SMS
2.	Experiments using ZigBee Data communication between co-ordinator and device module
3.	Create simple security alarm system using Raspberry Pi / Arduino
4.	Web page integration with Raspberry Pi / NODEMCU
5.	Create your own smart light using Raspberry Pi / Arduino / NODEMCU
6.	Control and monitor the temperature of the elements using temperature sensor with NODEMCU
7.	Sensing and sending the sensor value via SMS / Gmail
8.	Control any electrical appliance via webpage using Raspberry pi/ Arduino / NODEMCU
9.	Push IoT sensor data for cloud storage and apply simple data analytics.
10.	Develop a mini-project using Raspberry pi/Arduino
	Total:30

REFERENCES/ MANUAL /SOFTWARE:	
1.	Windows/Linux
2.	Win X Talk, Python IDE, Thingspeak
3.	Raspberry pi , Arduino, NODEMCU, GSM Module and Sensors
4.	Python and C

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, WiFi, ZigBee	Applying (K3), Precision (S3)
CO2	develop simple experiments to sense, monitor and control smart objects via web application	Applying (K3), Precision (S3)
CO3	build IoT solutions for the societal 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	1	1	3	3	3	3	2	2	3	2	3	2
CO2	3	2	1	1	3	3	3	3	2	2	3	2	3	2
CO3	3	2	1	1	3	3	3	3	2	2	3	2	3	2

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

22ITP61 - PROJECT WORK I							
Programme & Branch	**B.Tech. & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**

Prerequisites	Programming Languages, Software Engineering	6	EC	0	0	8	4

Preamble	It provides practical exposure to the students and an opportunity to apply the IT mathematical 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 IT related solutions for an engineering problem	Applying (K3)
CO2	Analyze and review research literature related to the problem	Applying (K3)
CO3	Apply mathematical knowledge for design a solution for the problem	Applying (K3)
CO4	Implement IT enabled solutions	Applying (K3)
CO5	Communicate, demonstrate and document the work as a member and leader in a team	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	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

22ITP62 - PROJECT WORK I							
Programme & Branch	**B.Tech. & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Programming Languages, Software Engineering**	**6**	**EC**	**0**	**0**	**10**	**5**

Preamble	It provides practical exposure to the students and an opportunity to apply the IT mathematical 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 IT related solutions for an engineering problem	Applying (K3)
CO2	Analyze and review research literature related to the problem	Applying (K3)
CO3	Apply mathematical knowledge for design a solution for the problem	Applying (K3)
CO4	Implement IT enabled solutions	Applying (K3)
CO5	Communicate, demonstrate and document the work as a member and leader in a team	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	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

22MNT31 - ENVIRONMENTAL SCIENCE							
(Common to All Engineering and Technology Branches)							
Programme & Branch	**All BE/BTech Engineering & Technology branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**

Prerequisites	**Nil**	**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- Value 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	40	35				100
CAT2	25	40	35				100
ESE	NA						100

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

22GEP61 - COMPREHENSIVE TEST AND VIVA							
(Common to All Engineering and Technology Branches)							
Programme & Branch	**B.Tech. & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**All core Subjects of IT**	**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 Information Technology	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 Information Technology 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 IT 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	1	2	3	3	2	2	3	3	3	2
CO2	3	2	1	1	1	2	3	3	2	2	3	3	3	2
CO3	3	2	1	1	1	2	3	3	2	2	3	3	3	2
CO4	3	2	1	1	1	2	3	3	2	2	3	3	3	2
CO5	3	2	1	1	1	2	3	3	2	2	3	3	3	2

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

22GET71 - 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)

22ITP71 - PROJECT WORK II PHASE I							
Programme & Branch	**B. Tech & Information Technology**	**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 IT mathematical concepts to solve the real world problems. It also gives an 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 a new problem from the existing work	Applying (K3)
CO2	Analyse and review research literature related to the new problem identified	Applying (K3)
CO3	Choose appropriate design methodology for finding solution to the problem	Applying (K3)
CO4	Implement IT enabled solutions	Applying (K3)
CO5	Communicate, demonstrate and document the work as a member and leader in a team	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	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

22ITP72 - PROJECT WORK II PHASE I							
Programme & Branch	**B. Tech & Information Technology**	**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 IT mathematical concepts to solve the real world problems. It also gives an 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 a new problem from the existing work	Applying (K3)
CO2	Analyse and review research literature related to the new problem identified	Applying (K3)
CO3	Choose appropriate design methodology for finding solution to the problem	Applying (K3)
CO4	Implement IT enabled solutions	Applying (K3)
CO5	Communicate, demonstrate and document the work as a member and leader in a team	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	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

22ITT71 - BLOCKCHAIN TECHNOLOGY							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Cryptography and Network Security**	**7**	**PC**	**3**	**1**	**0**	**4**
Preamble	This course provides a comprehensive introduction to the theoretical and practical aspects of block chain technologies and its applications.						
Unit - I	**Blockchain 101**						**9+3**
Distributed systems - The history of block chain - Introduction to block chain – definitions - elements - Features - Applications of block chain technology - Tiers - Types of block chain - Consensus in block chain - CAP theorem - Benefits and limitations of block chain							
Unit - II	**Decentralization, Cryptography and Technical Foundations**						**9+3**
Decentralization using block chain – Methods – Routes - Block chain and full ecosystem decentralization -.Smart contract - Decentralized organization - 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	**Bitcoin**						**9+3**
Bitcoin – Transactions – Blockchain - Bitcoin payments - Alternative Coins - Theoretical foundations - Bitcoin limitations – Namecoin - Litecoin – Primecoin – Zcash - Smart Contracts							
Unit - IV	**Ethereum 101**						**9+3**
Introduction - Ethereum block chain - Elements of the Ethereum block chain - Precompiled contracts – Accounts – Block – Block header – Messages – Mining - Clients and wallets - The Ethereum network - Ethereum Development Environment							
Unit - V	**Hyperledger**						**9+3**
Projects – protocol - Hyperledger Fabric - Sawtooth lake – Corda - Blockchain-Outside of Currencies: Internet of Things							
							Lecture:45, Tutorial:15, Total:60
TEXT BOOK:							
1.	Imran Bashir, "Mastering Blockchain: Distributed ledgers, decentralization and smart contracts Explained", 2nd Edition, Packt Publishing, 2018.						
REFERENCES:							
1.	Brenn Hill, Samanyu Chopra, Paul Valencourt, "Blockchain Quick Reference: A guide to exploring decentralized blockchain application development", 1st Edition, Packt publishing, 2018.						
2.	Andreas Antonopoulos, "Mastering Bitcoin: Programming the open blockchain", 2nd Edition, O'Reilly Media, 2017.						

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	outline the history and different applications of block chain, and choose appropriate consensus in block chain	Applying (K3)
CO2	make use of practical aspect of cryptography in decentralization of block chain	Applying (K3)
CO3	use bitcoins, identify alternative coins and smart contracts for your application	Applying (K3)
CO4	construct a distributed application using Ethereum	Applying (K3)
CO5	develop 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	1	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	30	50	20				100
CAT2	30	50	20				100
CAT3	30	50	20				100
ESE	30	40	30				100

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

22ITP81 - PROJECT WORK II PHASE II							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**8**	**EC**	**0**	**0**	**8**	**4**

Preamble	It provides industry exposure to the students and an opportunity to analyze the problems, identify the appropriate design methodology for solving the problems. It also gives an 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 IT related solutions for an engineering problem	Applying (K3)
CO2	Analyze and review existing system	Applying (K3)
CO3	Choose appropriate design methodology for the problem	Applying (K3)
CO4	Implement IT enabled solutions	Applying (K3)
CO5	Communicate, demonstrate and document the work as a member and leader in a team	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	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

22ITE01 - COMPUTER GRAPHICS							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Mathematics I**	**5**	**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**	**9**
Introduction - Graphics applications -Graphics systems – Output Primitives: Line, Circle and Ellipse drawing algorithms – Attributes of Output Primitives		
Unit - II	**2D Transformations**	**9**
Two Dimensional Geometric Transformations – Basic Transformation – Matrix Representation and Homogeneous Coordinate – Composite Transformation – Other Transformation - Two Dimensional Clipping and Viewing		
Unit - III	**3D Transformations**	**9**
Concepts - Three dimensional object representations: Polygon Surfaces - Curved Lines and Surfaces - Quadratic Surfaces - Spline Representations - Visualization of Datasets		
Unit - IV	**3D Modeling**	**9**
Three Dimensional Geometric and Modeling Transformations – Three Dimensional Viewing – Viewing Pipeline – Viewing Coordinates – Projection – Parallel Projection – Perspective Projection		
Unit - V	**Color Models and Computer Animations**	**9**
Properties of Light – Standard Primaries – XYZ Color Model – RGB – YIQ – CMY – HSV – Conversion between HSV and RGB 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. 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	brief 2D objects by applying transformation, clipping, and viewing operations	Applying (K3)
CO3	apply 3D concepts and 3D object representations	Applying (K3)
CO4	experiment with 3D transformations, viewing, projection and volume	Applying (K3)
CO5	make use of color models and computer animations	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	20	50	30				100
CAT2	20	55	25				100
CAT3	20	55	25				100
ESE	20	35	45				100

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

22ITE02 - SEARCH METHODS FOR PROBLEM SOLVING

Programme & Branch	B. Tech & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Artificial Intelligence	**5**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course provides basic knowledge about different kinds of search methods for solving real world problems.	
Unit- I	**Solving problems by Searching**	**9**
Problem - Solving agents - Example problems - Search Algorithms - Uninformed Search Strategies - Breadth First Search – uniform - cost search – Depth - first search – Depth - limited search - Iterative deepening depth - first search - bidirectional search.		
Unit- II	**Heuristic Search Strategies**	**9**
Greedy best - first search - A* search - Optimality of A* - Memory - bounded heuristic search - learning to search better - Heuristic Functions.		
Unit- III	**Searching and Optimization problems**	**9**
Local Search and Optimization Problems - Local Search in Continuous Spaces - Search with Nondeterministic Actions - Search in Partially Observable Environments.		
Unit- IV	**Adversarial Search and Games**	**9**
Game Theory - Optimal Decisions in Games - Heuristic Alpha – Beta Tree Search - Stochastic Game - Partially Observable Game		
Unit- V	**Constraint Satisfaction Problems**	**9**
Defining Constraint Satisfaction Problems - Constraint Propagation: Inference in CSPs - Backtracking Search for CSPs - Local Search for CSPs - The Structure of Problems.		

Total:45

TEXT BOOK:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach", 4th Edition, Pearson Education Press, 2022.

REFERENCES:

1. George F. Luger, “Artificial Intelligence", 1st Edition, Pearson Education, 2001.
2. George F. Luger, “Structures and strategies for complex problem solving”, 6th Edition, Pearson, 2021.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain search strategies and solve problems by applying a suitable search method	Applying(K3)
CO2	apply heuristic search techniques	Applying(K3)
CO3	model search strategies as optimization problems	Applying(K3)
CO4	make use of game theory to solve adversarial problems	Applying(K3)
CO5	solve problems using constraint satisfaction formulation	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	10	60	30				100
CAT2	10	60	30				100
CAT3	20	50	30				100
ESE	15	45	40				100

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

22ITE03 - GAME DESIGN AND DEVELOPMENT							
Programme & Branch	**B.Tech. & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Computer Networks**	**5**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course focuses to design and develop a simple game application using unity tool.	
Unit - I	**Unity Basics & 2D Games**	**9**
The Basics of Game Development : Introduction - Installing Unity – GameObjects - Creating and Destroying GameObjects - Unity Components - Adding Components – Interface – Develop a First Unity Project - Introduction to Unity 2D – Sprites – create – Modes – Modify - Creating GameObject and Adding Components - 2D Sprite Sheet - Transforms and Object Parenting - Internal Assets		
Unit – II	**Programming C# in Unity**	**9**
The Default C# Script In Unity – Variables - Data Types - Operators - Functions - If And Switch - Loops - Classes And Methods – Scope and Access Modifiers Collisions - Prefabs and instantiation – GameObject Destruction – Simple application		
Unit – III	**2D Graphics with GIMP and Unity**	**9**
2D Graphics with GIMP and Unity - Introduction To Gimp - Bouncing Donuts Design - Creating A Wooden Plank In Gimp - Three Planks And A Donut In Unity - 2d Graphics With Blender And Unity - Introduction To Blender - Creating The Donut Box In Blender - Exporting From Blender To Unity -Bouncing Donuts Prototype: First Gameplay!		
Unit – IV	**The Unity Interface , Sound & music effects**	**9**
The Unity Interface - The Unity Editor - The Scene View - The Hierarchy Window - The Project Window - The Inspector Window - Rendering: Materials And Shaders - Lights - Collision: Donut Vs. Sphere-Cameras - Sound Effects with Audacity - Music with MuseScore		
Unit – V	**2D Tools in Unity**	**9**
Sprites - Tiles - 2d Sprite Sheet Animation - Designing a 2D Game – Menu - Animating the Player Character – Testing and release		
		Total:45

TEXT BOOK:

1. https://learn.unity.com / https://www.javatpoint.com (for Units 1 & 2)
2. Franz Lanzinger,“2D Game Development with Unity”, CRC Press,1st Edition,2021 (for Units 3,4 & 5)

REFERENCES:

1. Nicolas Alejandro Borromeo ,”Hands-On Unity 2022 Game Development: Learn to use the latest Unity 2022 features to create your first video game in the simplest way possible”, 3rd Edition , Packt Publishing ,2022.
2. Paris Buttfield-Addison , Jon Manning , Tim Nugent ,”Unity Game Development Cookbook: Essentials for Every Game“, 1st Edition, O'Reilly Media, 2019.
3. Joe Hocking , “Unity in Action, Third Edition: Multiplatform game development in C# “, 3rd Edition, Manning, 2022.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Summarize the concepts of unity platform tools	Applying (K3)
CO2	Apply the game programming concepts of C# in Unity	Applying (K3)
CO3	Design and develop a simple 2D Graphics with GIMP	Applying (K3)
CO4	Develop a 2D Graphics with sound and music effects	Applying (K3)
CO5	Create a simple animation game application using 2D unity tools	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	20	80					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)

22ITE04 - BIG DATA ANALYTICS							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Database Management Systems**	**5**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course provides basic knowledge about Big data, its framework, storage in databases and Stream processing with SPARK and KAFKA.	
Unit - I	**Big Data**	**9**
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**	**9**
Introduction – RDBMS Vs Hadoop – 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.		
Unit - III	**MongoDB AND Cassandra**	**9**
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**	**9**
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**	**9**
Stream processing with SPARK: Introduction – SPARK architecture- SPARK Eco system – SPARK for Big Data Processing – SPARK applications – Apache KAFKA – KAFKA Architecture – Use cases.		
		Total:45

TEXT BOOK:

1.	Seema Acharya and Subhashini Chellappan, "Big Data and Analytics", 2nd Edition, Wiley, 2019. (For Units I, II, III, IV)
2.	Dr.Anil Maheshwari, “Big Data”, 1st Edition, McGraw Hill Education, New Delhi, 2017 (For Unit V)

REFERENCES:

1.	EMC Education Services, "Data science and Big data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", 1st Edition, John Wiley and Sons, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the concepts and characteristics of big data	Applying (K3)
CO2	make use of MapReduce programs in Hadoop framework	Applying (K3)
CO3	utilize MongoDB and Cassandra to solve real world problems	Applying (K3)
CO4	develop solutions for big data problems using Hive and Pig	Applying (K3)
CO5	identify the need for stream processing and apply Spark and Kafka architectures.	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	10	50	40				100
CAT2	10	30	60				100
CAT3	10	50	40				100
ESE	10	40	50				100

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

22ITE05 - INFORMATION SECURITY PRINCIPLES							
Programme& Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	Nil	**5**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course describes the explosive growth of security in computer systems and their interconnections via networks that have increased the dependence of both organizations and individuals on the information stored and communicated using cryptographic systems.	
Unit – I	**Elementary Number Theory**	**9**
Divisibility and the Euclidean algorithm- Linear Diophantine equations – Congruences: Definitions and properties– linear congruences and Quadratic congruences- residue classes- Euler's phi function – Fermat'sLittle Theorem – Chinese Remainder Theorem – Exponentiation and Discrete logarithm- Quadraticresidues – Legendre symbol – Jacobi symbol – Algebraic structures: groups, rings, fields, GF(p)fields,GF(2^n)fields, (Theorems without proof)		
Unit – II	**Simple Cryptosystems**	**9**
Enciphering Matrices – Encryption Schemes – Symmetric and AsymmetricCryptosystems – Substitution Cipher: Affine cipher – Vigenere Cipher- Modern Stream Ciphers: Onetime pad- LFSR -Block ciphers –Use of Block Ciphers - Hill Cipher - Transposition Cipher – MultipleEncryption — Secure Cryptosystem – Problems in Advanced Encryption Standard(AES) – Problemsin Data Encryption Standard. (Theorems without proof)		
Unit – III	**Public Key Cryptosystems**	**9**
The idea of public key cryptography – The Diffie – Hellman Key Agreement Protocol - RSA Cryptosystem – Rabin cryptosystem – ElGamal cryptosystem – Signature Algorithms: RSA signature- ElGamal signature- Schnorr Signature- Digital signature standard – Knapsack problem – Zero-Knowledge Protocols : Fiat Shamir protocol– Guillou Quisquater protocol-Hash and MAC algorithms: MD5-SHA and HMAC (Theorems without proof)		
Unit – IV	**Prime Generation, Testing and Factoring**	**9**
Generation: Mersenne Prime, Fermat Prime, Testing:Divisibility algorithm- Fermat test- Square root test- Miller Rabin test-Factorization: Trial divisionmethod-Fermat method – Pollard rho (γ) method – continued fraction method – the quadratic seieve method. (Theorems without proof)		
Unit – V	**Number Theory and Algebraic Geometry**	**9**
Elliptic curves – basic facts – elliptic curvecryptosystems – elliptic curve primality test – elliptic curve factorization-Lenstra's ecc factorization –elliptic curve confidentiality and signature.(Theorems without proof)		
		Total:45

TEXT BOOK:

1. William Stallings, "Cryptography and Network Security", 7th Edition, Pearson Education, New Delhi, 2017.

REFERENCES:

1. Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata McGraw-Hill Education, India, 2015.
2. Charles P Fleeger, "Security in Computing", 5th Edition, Prentice Hall of India, New Delhi, 2015.
3. Victor Shoup, "A Computational Introduction to Number Theory and Algebra", Cambridge University Press, 2005.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	construct number theory concepts in various security applications	Applying (K3)
CO2	apply symmetric key cryptography techniques for real world problems	Applying (K3)
CO3	build various public key cryptography, hashing and digital signature techniques for real case scenarios	Applying (K3)
CO4	Illustrate the techniques to generate, test and factories prime numbers	Applying (K3)
CO5	make use of elliptic curve, properties for security 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	2	1	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	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)

22ITE06 - ALGORITHMIC THINKING IN BIOINFORMATICS							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Data Structures, Design and Analysis of algorithm**	**5**	**PE**	**3**	**0**	**0**	**3**
Preamble	To prepare students to develop an algorithmic thinking to address key data science challenges in bioinformatics, to acquire knowledge of various problem formulations and algorithm paradigms, which have transformed the field of biomedicine in modern times, to obtain insights into many key bioinformatics algorithms on strings, trees, and graphs, many of which can be applied to other areas as well.						
Unit – I	**Replication Origins-Algorithmic warmup**						**9**
Genome Replication-Origin-Hidden Messages- frequent k-mers in a string-Reverse complement problem-Pattern Matching problem-The Clump finding problem-Minimum skew problem-Hamming distance problem-Approximate pattern matching problem-Frequent words with mismatches problem- Frequent words with mismatches and reverse complement problem.							
Unit – II	**Motif Identification-Randomized Algorithms**						**9**
Motif Finding problem-Brute force Motif search-Motif scoring function-Median String problem-Reformulated Motif finding-Greedy Motif Search-Randomized Motif search-Gibbs Sampling.							
Unit – III	**Genome Assembly-Graph Algorithms**						**9**
Genome sequencing-assembly-The String composition and reconstruction problem-Genome path problem-Overlap graph problem-Hamiltonian path problem-De Brujin graph-Eulerian Path problem.							
Unit – IV	**Antibiotic Sequencing-Dynamic Prgramming**						**9**
Antibiotics-Protein Translation problem-Peptide encoding problem- Generating Theoretical Spectrum Problem -The Cycleopeptide Sequencing problem- BFCyclopeptide Sequencing- Branch and Bound Cyclopeptide Sequencing- Cyclopeptide Scoring Problem.							
Unit – V	**Sequence Alignment-Dynamic programming**						**9**
Sequence Alignment-Introduction-Longest common subsequences problem- The Manhattan Tourist Problem-Longest path in a DAG problem-Change problem-DPManhattan Tourist problem-Manhattan to an arbitrary DAG-LCS backtracking problem-LCS scoring model.							
							Total:45

TEXT BOOK:

1.	Phillip Campeau, “Bioinformatics Algorithms: an Active Learning Approach”, 2nd Edition, Active Learning Publisher, 2015

REFERENCES:

1.	Richard Durbin, Sean Eddy, Anders Krogh, and Graeme Mitchison, "Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids", 7th reprint, CRC press, 2002.
2.	Neil C. Jones, Pavel A. Pevzner, “An Introduction to Bioinformatics Algorithms”, 1st Edition, MIT Press, 2004.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	interpret the genome as a DNA string using computational methods.	Applying (K3)
CO2	solve motif identification using randomized algorithms	Applying (K3)
CO3	elucidate genome sequencing problems using graph algorithms	Applying (K3)
CO4	determine antibiotic sequencing using dynamic programming approaches	Applying (K3)
CO5	implement sequence alignment using algorithmic design 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	1	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	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)

22ITE07 - DESIGN THINKING							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5**	**PE**	**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	2	3	3	3	2	2	3	3	3	3	3	3	2
CO2	3	2	3	3	3	2	2	3	3	3	3	3	3	2
CO3	3	2	3	3	3	2	2	3	3	3	3	3	3	2
CO4	3	2	3	3	3	2	2	3	3	3	3	3	3	2
CO5	3	2	3	3	3	2	2	3	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	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)

22ITE08 - ENTERPRISE APPLICATION DEVELOPMENT USING JAVA							
Programme & Branch	B.Tech. Information Technology	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5**	**PE**	**2**	**0**	**2**	**3**

Preamble	This course offers good knowledge on how to develop an enterprise oriented applications using java technologies and hosting with application server.

Unit – I	**Network Programming and RMI**	**6**

Network Programming - Basics - Classes and Interfaces - InetAddress - Factory methods - Instance Methods - Inet4Address and Inet6Address - TCP/IP Client Sockets - URL - URLConnection - HttpURLConnection -URI Class - Cookies - TCP/IP Server sockets - Datagrams - RMI architecture - Developing Simple RMI applications.

Unit – II	**Servlets and JSP**	**6**

Introduction - HTTP Servlet Basics: Servlet API - Page Generation - Web Applications. Servlet Life Cycle: Servlet Alternatives - Reloading - init and destroy - Single Thread Model - Background Processing - Load on Startup - Client-Side Caching - Server-Side Caching - Retrieving information - Sending HTML information - Java Server Pages : Basics - Expression and Declaration - Directives - Includes and Forwards - Custom Tag libraries - Simple JSP program.

Unit – III	**J2EE, Application Server and Software Architectures**	**6**

J2EE architecture - EJB - Session, Entity and Message driven beans - Model View Control (MVC) architecture – Case study: Application server - Apache Tomcat - Installation - services - Hosting Java Apps with server. Types of software architectures - SOA and Monolith Architecture - Micro Services - Micro Service Architecture - Application Layer - Business Layer - Enterprise Layer - Infra Layer - REST API - Advantages with Micro Services

Unit – IV	**Configuration of Spring Framework**	**6**

Basics of Spring framework - Annotation - Built annotations - Dependency injection - Starters : Web Starter - Data JPA Starter - DevTools for rapid application development : Run JAR - Application Properties - Automatic Restart - Live Reload - Server Port Number

Unit – V	**SpringBoot Framework and Database connectivity**	**6**

Spring Boot: Introduction to Spring vs. Spring Boot vs. Spring MVC - Architecture - Initializr Modules – Interface - Database - Working with JPA - POJO classes - MYSQL - Working with Hibernate - Data JPA with CRUD Repositories - Data JPA with custom methods - Data JPA with custom queries

LIST OF EXPERIMENTS / EXERCISES:

1.	Develop chat application using TCP and UDP
2.	Develop a RMI application
3.	Develop servlet based Login application for session tracking
4.	Develop a simple application using JSP
5.	Create web application using Servlets, JDBC and JSP
6.	Develop an EJB application that demonstrates Entity Bean
7.	Implement an EJB application that demonstrates Session Bean
8.	Implementing simple application using Hibernate with database connection
9.	Develop a simple application using Spring with database connectivity
10.	Deploy simple database application using SpringBoot

Lecture:30, Practical:30, Total:60

TEXT BOOK:

1.	Schildt, Herbert, “Java: The Complete Reference”, 9th Edition, Tata McGraw-Hill, New Delhi, 2014.
2.	Mark Heckler, “Spring Boot: Up and Running: Building Cloud Native Java and Kotlin Applications”, 1st Edition, O'Reilly Media Inc., USA, 2021.

REFERENCES/ MANUAL / SOFTWARE:

1.	Asbury, Stephen and Weiner, Scott R.,”Developing Java Enterprise Applications”, 2nd Edition, Wiley Publications, 2001.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	construct network with socket programming concepts and RMI architecture	Applying (K3) Precision (S3)
CO2	interpret server side programming using JSP and Servlets	Applying (K3) Precision (S3)
CO3	make use of EJB, application server and microservice to implement enterprise application	Applying (K3) Precision (S3)
CO4	experiment with annotations, dev tools in Spring framework	Applying (K3) Precision (S3)
CO5	utilize JPA/Hibernate for Spring Boot database connectivity	Applying (K3) Precision (S3)

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	3	2	2	3		3	2
CO2	3	2	3	3		3	3	3	2	2	3		3	2
CO3	3	2	3	3		3	3	3	2	2	3		3	2
CO4	3	2	3	3		3	3	3	2	2	3		3	2
CO5	3	2	3	3		3	3	3	2	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	20	30	50				100
CAT2	20	30	50				100
CAT3	20	30	50				100
ESE	20	30	50				100

* ±3% may be varied

22ITE09 - 3D MODELLING AND MIXED REALITY APPLICATIONS							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Mathematics I**	**6**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course imparts the basic concepts in Virtual Reality and Augmented Reality which include content creation and applications. It also provides foundations in 2D and 3D object modeling.	
Unit - I	**2D Modeling**	**9**
Two Dimensional Geometric Transformations – Basic Transformation – Matrix Representation and Homogeneous Coordinates – Composite Transformation – Other Transformations - Two Dimensional Clipping and Viewing		
Unit - II	**3D Modeling**	**9**
Three Dimensional Geometric and Modeling Transformations – Three Dimensional Viewing – Viewing Pipeline – Viewing Coordinates – Projections – Parallel Projection – Perspective Projection		
Unit - III	**Getting started with VR and AR**	**9**
Defining virtual and augmented reality – Introduction – Types of VR and AR – Exploring the current state of virtual reality - Exploring the current state of augmented reality.		
Unit - IV	**Consuming content in VR and AR**	**9**
Consuming content in VR: Exploring Consumer-Grade VR - Identifying Near-Future Hardware - Comparing Current and Future Options - Consuming Content in AR: Exploring Consumer-Grade AR - Identifying Near-Future Hardware - Comparing Current and Future Options.		
Unit - V	**Creating content in VR and AR**	**9**
Evaluating Project: Assessing Project's Technology Needs - Choosing VR - Choosing AR - Planning Virtual Reality Project- Planning Augmented Reality Project - Creating Content for Virtual and Augmented Reality: Assessing Design Software - Capturing Real Life.		
		Total:45

TEXT BOOK:

1.	Hearn, Donald and Baker, Pauline.M, "Computer Graphics C Version", 2nd Edition, Pearson Education, 2008. (for Units I,II)
2.	Allen Paul Mealy, "Virtual & Augmented Reality for Dummies", 1stEdition, John Wiley & Sons, 2018. (for Units III,IV,V)

REFERENCES:

1.	John F. Hughes, Andries Van Dam, Morgan Mcguire, David F. Sklar, James D. Foley, Steven K. Feiner, and Kurt Akeley, "Computer Graphics: Principles & Practice", 3rdEdition, Pearson Education, 2013.
2.	Steve Aukstakalnis, "Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR", 1st Edition, Addison Wesley, 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	manipulate 2D objects using transformation, clipping, and viewing operations	Applying (K3)
CO2	perform 3D transformations, viewing, projection and view volume	Applying (K3)
CO3	outline the current states of virtual and augmented reality	Applying (K3)
CO4	develop different applications for consuming VR and AR contents and indicate near future hardware for VR and AR experience.	Applying (K3)
CO5	design and develop contents for VR and AR projects	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	20	30	50				100
CAT2	20	35	45				100
CAT3	20	40	40				100
ESE	20	35	45				100

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

22ITE10 - KNOWLEDGE REPRESENTATION							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**6**	**PE**	**3**	**0**	**0**	**3**

Preamble	To understand the basics of Knowledge Engineering and discuss methodologies and modeling for Agent Design and Development.	
Unit – I	**Introduction**	**9**
Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering.		
Unit – II	**Methodology and Modeling**	**9**
Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios.		
Unit – III	**Ontologies – Design and Development**	**9**
Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching. Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation – Modelling-based Ontology Specification.		
Unit – IV	**Reasoning with Ontologies and Rules**	**9**
Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge.		
Unit – V	**Learning and Rule Learning**	**9**
Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning.		
		Total:45

TEXT BOOK:

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, “Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning”, 1st Edition, Cambridge University Press, 2016.

REFERENCES:

1. Ronald J. Brachman, Hector J. Levesque, “Knowledge Representation and Reasoning”, 1st Edition, Morgan Kaufmann, 2004.
2. Ela Kumar, “Knowledge Engineering”, Dreamtech Press, 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply probabilistic reasoning under uncertain conditions	Applying (K3)
CO2	apply learning methodologies and modelling for agent design and development	Applying (K3)
CO3	develop ontologies using concepts and instances	Applying (K3)
CO4	make use of ontologies and rules for reasoning	Applying (K3)
CO5	Utilize machine learning to model rule learning and refinement	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	40	50	10				100
CAT2	40	50	10				100
CAT3	40	50	10				100
ESE	30	50	20				100

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

22ITE11 - 5G WIRELESS NETWORKS							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**6**	**PE**	**3**	**0**	**0**	**3**

Preamble	To understand the basics of channel modeling, Mobile Communication Systems, Radio Access Networks and Interference Management systems.	
Unit – I	**Introduction and 5G channel modelling and use cases**	**9**
Historical background-Rationale of 5G - Use cases and requirements - system concept - Extreme mobile broadband - Massive machine-type communication - Ultra-reliable machine-type communication - Dynamic radio access network - Lean system control plane - Localized contents and traffic flows - Spectrum toolbox		
Unit – II	**Architecture**	**9**
Introduction - NFV and SDN - Basics about RAN architecture- High-level requirements- Functional architecture and 5G flexibility- Functional split criteria- alternatives-Functional optimization- Integration of LTE and new air interface- Enhanced Multi-RAT coordination features- Physical architecture and 5G deployment Machine-type communications: Fundamental techniques for MTC-Massive MTC.		
Unit – III	**Device-to-device (D2D) communications& MIMO**	**9**
D2D: 4G to 5G- standardization- research challenges- Radio resource management - RRM techniques for mobile broadband D2D-system design – example-Multi-hop communications - National security and public safety requirements- Device discovery without and with network assistance. Massive multiple-input multiple-output (MIMO) systems: Introduction - Theoretical background.		
Unit – IV	**Radio-access technologies**	**9**
Access design principles for multi-user communications - Multi-carrier with filtering- Non-orthogonal schemes- Radio access for dense deployments - Radio access for V2X communication- Radio access for massive machine type communication.		
Unit – V	**Interference management, mobility management, and Spectrum**	**9**
Network deployment types - Interference management -Mobility management - Dynamic network reconfiguration - Spectrum: Introduction - 5G spectrum landscape and requirements - access mode - technologies		
		Total:45

TEXT BOOK:

1.	Afif Osseiran, Jose F. Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology", 1st Edition, Cambridge University Press, 2016

REFERENCES:

1.	Erik Dahlman, Stefan Parkvall, Johan Sko¨ld, "5G NR: The Next Generation Wireless Access Technology", 1st Edition, Elsevier, 2015.
2.	Christopher Cox , "An Introduction to 5G: The New Radio, 5G Network and Beyond",1st Edition, Wiley publication ,2020

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explore the channel models and the use cases for 5G	Applying (K3)
CO2	interpret and explain 5G architecture, its components and functional criteria.	Applying (K3)
CO3	elaborate the device to device (D2D) communication , standardization and MIMO	Applying (K3)
CO4	illustrate the in-depth functioning of 5G radio access technologies	Applying (K3)
CO5	apply interference management, mobility management and spectrumtechniques in 5G.	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	30	50	20				100
CAT2	30	50	20				100
CAT3	30	50	20				100
ESE	30	50	20				100

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

22ITE12 - CRYPTOGRAPHY AND NETWORK SECURITY							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Computer Networks**	**6**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course describes the explosive growth of security in computer systems and their interconnections via networks that has increased the dependence of both organizations and individuals on the information stored and communicated using cryptographic systems.	
Unit - I	**Symmetric Ciphers**	**9**
Computer Security Concepts – The OSI Security Architecture – Security Attacks – services and mechanisms – Model for Network Security – Classical encryption techniques – Block ciphers and Data Encryption Standard – Advanced Encryption Standard – Block cipher operation.		
Unit - II	**Asymmetric Ciphers**	**9**
Public key cryptography and RSA – Other Public key cryptosystems – Diffie-Hellman Key Exchange – Elgamal Cryptographic System – Elliptic Curve Arithmetic – Elliptic Curve Cryptography.		
Unit - III	**Cryptographic Data Integrity Algorithms**	**9**
Cryptographic hash functions – Message authentication codes: Message Authentication Requirements – Message Authentication Functions – Requirements for Message Authentication Codes – Security of MACs – MACs Based on Hash Functions: HMAC – Digital signatures: Elgamal Digital Signature Scheme – Schnorr Digital Signature Scheme – NIST Digital Signature Algorithm – Elliptic Curve Digital Signature Algorithm.		
Unit - IV	**Mutual Trust and User authentication**	**9**
Key management and distribution: symmetric key distribution using symmetric and asymmetric encryption – Distribution of public keys – X.509 Certificates – Public key infrastructure – Remote user authentication principles – Remote user authentication using symmetric and asymmetric encryption – Kerberos – Federated identity management – Personal identity verification.		
Unit - V	**Network and Internet Security**	**9**
Network access control and cloud security – Transport level security – Wireless network security – Electronic mail security – IP security		
		Total:45

TEXT BOOK:

1.	William Stallings, "Cryptography and Network Security", 7th Edition, Pearson Education, New Delhi, 2017.

REFERENCES:

1.	Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata McGraw-Hill Education, India, 2015.
2.	Charles P Fleeger, "Security in Computing", 5th Edition, Prentice Hall of India, New Delhi, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply symmetric key cryptography techniques to solve real world problems	Applying (K3)
CO2	apply various public key cryptography techniques to real case scenarios	Applying (K3)
CO3	demonstrate hashing and digital signature techniques to solve the problems	Applying (K3)
CO4	illustrate various mutual trust and User authentication mechanisms	Applying (K3)
CO5	make use of the different Security Protocols and standards for various layers of wired and wireless 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	1	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	20	40	40				100
CAT2	20	40	40				100
CAT3	30	40	30				100
ESE	20	40	40				100

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

22ITE13 - DEEP LEARNING							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Machine Learning**	**6**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course provides an introduction to machine learning, neural networks, and deep learning techniques. It also helps to understand and solve few real world problems using deep learning.	
Unit - I	**Overview of Machine Learning**	**9**
Learning Algorithms – Capacity, Overfitting and Underfitting – Hyperparameters and Validation Sets – Estimators, Bias and Variance – Bayesian Estimates – Maximum Likelihood Estimation – Supervised Learning Algorithms – Unsupervised Learning Algorithms – Stochastic Gradient Descent – Building a Machine Learning Algorithm – Challenges Motivating Deep Learning.		
Unit - II	**Deep Feed forward Networks**	**9**
Learning XOR problems – Gradient based learning – Hidden lists – Architecture design – Back propagation and other differential algorithms.		
Unit - III	**Regularization for Deep Learning**	**9**
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 – Dropout – Adversarial Training.		
Unit - IV	**Convolution Networks**	**9**
The Convolution Operation – Motivation – Pooling – Variants of the Basic Convolution Function – Structured Outputs - Efficient Convolution Algorithms - Random or Unsupervised Features. Application: Computer Vision		
Unit - V	**Sequence Modeling - Recurrent and Recursive Nets**	**9**
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 RNNs. Applications: Natural Language Processing.		
		Total:45

TEXT BOOK:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courvill, "Deep Learning", 1st Edition, MIT Press, USA, 2016.

REFERENCES:

1. Josh Patterson and Adam Gibsonosh Patterson and Adam Gibson, "Deep Learning – A Practitioner's Approach", 1st Edition, O'Reilly Media, 2017.
2. Indra Den Bakker, "Python Deep Learning Cookbook", 1st Edition, Packt Publishing, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify features of machine learning algorithms	Applying (K3)
CO2	explain the fundamentals of deep neural networks and solve simple problems	Applying (K3)
CO3	make use of different regularization methods for Deep learning	Applying (K3)
CO4	exemplify the concepts of CNN models and apply it for solving computer vision related problems	Applying (K3)
CO5	explicate the concepts of RNN models and apply it for solving Natural Language processing	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	20	60	20				100
CAT2	20	60	20				100
CAT3	20	60	20				100
ESE	20	60	20				100

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

22ITE14 – CODING AND SECURITY							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**6**	**PE**	**3**	**0**	**0**	**3**
Preamble	This course provides knowledge on basic concepts, policies, and mechanisms in designing and coding secure software systems						
Unit – I	**Introduction**						**9**
Software security- Security concepts-Security policy-security flaws – vulnerabilities – exploits – mitigation-Cand C++-Development Platforms-operating systems-compilers. Strings: Common String Manipulation Errors-String Vulnerabilities-Process Memory Organization-Stack Smashing- Code Injection- Arc Injection-Mitigation Strategies.							
Unit – II	**Pointer Subterfuge**						**9**
Data Locations-Function Pointers- Object Pointers-Modifying the Instruction Pointer-Global OffsetTable-The .dtors Section-Virtual Pointers-atexit(), on-exit(), longjmp()-Exception Handling-Mitigation Strategies. Dynamic Memory Management: Common C Memory Management Errors-Doug Lea's Memory Allocator-RtlHeap Mitigation Strategies.							
Unit – III	**Integer Security**						**9**
Integer Data types -Integer Conversions-Integer Error Conditions-Integer Operations – Integer Vulnerabilities- Non-exceptional Integer Logic Errors-Mitigation Strategies. Formatted Output:Variadic Functions-Formatted Output Functions-Exploiting Formatted Output Functions-Stack Randomization-Mitigation Strategies.							
Unit – IV	**Concurrency**						**9**
Introduction -Time of Check, Time of Use - Files as Locks and File Locking-File System Exploits-Mitigation Strategies. **Recommended Practices:** Secure Software Development Principles-System Quality Requirements Engineering-Threat Modeling-Use/Misuse Cases-Architecture and Design -Off-the-Shelf Software-Compiler Checks-Input Validation-Data Sanitization-Static Analysis-Quality Assurance-Memory Permissions-Defense in Depth-TSP-Secure.							
Unit – V	**Proactive Security Development Process**						**9**
Installing a Security Culture-The Defender's Dilemma and the Attacker's Advantage-Role of Education-Integrating Security into the Development Process-Security Principles. Language Independent Security Issues: Appropriate Access Control-Running with Least Privilege-Cryptographic Foibles Protecting Data-Input checking and canonicalization-Database input.							
							Total:45

TEXT BOOK:

1.	Robert C. Seacord, “Secure Coding in C and C++”, SEI Series (CERT Book), Addison-Wesley, 2006.

REFERENCES:

1.	Mark Dowd, John McDonald, and JustingSchuh, “The ART of Software Security Assessment: Identifying and Preventing Software Vulnerabilities”, Addison Wesley, 2007.
2.	Michael Howard and David LeBlanc, “Writing Secure Code”, Microsoft Press, 2003.
3.	Tom Gallagher, Bryan Jeffries, Lawrence Landauer, “Hunting Security Bugs”, Microsoft Press, 2006.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	demonstrate the string manipulation errors, vulnerabilities and mitigation strategies	Applying (K3)
CO2	implement arbitrary memory write exploits, programming defects, vulnerabilities and mitigation strategies in dynamic memory management	Applying (K3)
CO3	interpret the integral security issues, correct and incorrect use of formatted output functions.	Applying (K3)
CO4	demonstrate various vulnerabilities associated with file I/O and specific development practices for improving the overall security in C code	Applying (K3)
CO5	adopt the proactive security development process and language independent 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	1	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	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)

22ITE15 - DIGITAL IMAGE PROCESSING FOR COMPUTER VISION							
Programme & Branch	**B.Tech. & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course provides the basic knowledge on image processing with intensity transformation, filtering and wavelet transforms.	
Unit – I	**Fundamentals of image processing**	**9**
What is Digital Image Processing (DIP)? – the origins – use of DIP – Fundamental steps – components of image processing systems – elements of visual perception – Light and the electromagnetic spectrum – Image sensing and acquisition –Image sampling and quantization – some basic relationship between pixels – Basic mathematical tools used in DIP.		
Unit – II	**Intensity transformation and spatial filtering**	**9**
Background - Basic intensity transformation functions – Histogram processing – Fundamentals of spatial filtering – Lowpass filtering – Highpass filtering –Bandpass and Band reject filtering from lowpass filters – Combining spatial enhancement methods.		
Unit – III	**Filtering in the frequency domain**	**9**
Background – Preliminary concepts – Sampling and the FT of sampled functions – DFT of one variable – Extensions to functions of two variables – Properties of 2D DFT and 1D DFT – Image smoothing – Filters – Image sharpening using highpass filters – Selective filtering – Fast Fourier Transforms.		
Unit – IV	**Color image processing and wavelet transforms**	**9**
Color fundamentals – Color models – Pseudo-color image processing – Full color image processing – Color transformations – Color Image smoothing and sharpening – Using colors in image segmentation. Matrix based transforms – Correlation – Basis functions in the time-frequency plane – Basis images – Fourier related transforms – Walsh Hadamard transforms – Slant Transform – Haar Transform – Wavelet Transform		
Unit – V	**Image compression and watermarking**	**9**
Fundamentals – Huffman coding – Golomb coding – Arithmetic coding – LZW coding – Run-length coding – Symbol based coding – Bit-plane coding – Block transform coding – Predictive coding – Wavelet coding – Digital image watermarking		
		Total:45

TEXT BOOK:

1. Rafael Gonzalez, Richard E. Woods, “Digital Image Processing”, 4th Edition, Pearson Education, New York, 2018

REFERENCES:

1. Anil K. Jain, “Fundamentals of Digital Image Processing”, 1st Edition, Pearson, India, 2015
2. Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image processing analysis and machine vision”, 4th edition, Cengage Learning, 2015

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	use basic mathematical tools for image processing operations	Applying (K3)
CO2	apply intensity transformation and perform spatial filtering	Applying (K3)
CO3	illustrate filtering in the frequency domain using Fourier Transforms	Applying (K3)
CO4	manipulate color images and make use of Wavelet transforms	Applying (K3)
CO5	make use of image compression and digital image watermarking	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	20	50	30				100
CAT2	20	50	30				100
CAT3	20	50	30				100
ESE	20	60	20				100

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

22ITE16 - SOFTWARE TESTING							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Software Engineering**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course provides an introduction to software testing with an emphasis on how to perform the various testing process and automated testing using open source tools	
Unit - I	**Basics of Software Testing**	**9**
Introduction- Definition - Testing Approaches-Essentials of software Testing –Important Features of testing process- Principles of software testing-salient features of good testing- Challenges- Test team approach - Cost of testing- Categories of defect – Test methodologies – Skills required by Tester.		
Unit - II	**Software Testing Environment**	**9**
Assessing Capabilities, Staff Competency, and User Satisfaction-Creating an environment supportive of software testing -Building the software testing process – Testing Guidelines. Overview of the Software Testing process- The Seven Step Software Testing Process		
Unit - III	**Testing Process**	**9**
Organizing for testing- Workbench- Procedure, Developing the test plan-Workbench- Procedure, Verification testing- Workbench-Procedure -Validation testing-Workbench- Procedure		
Unit - IV	**Testing Process**	**9**
Analyzing and reporting test results-Workbench-Procedure, Testing software system security- Using Agile Methods to improve Software Testing		
Unit - V	**Testing Process and Tools**	**9**
Testing client/server systems- Testing web-based systems, Selenium: Introduction- History- Selenium IDE- Basic IDE Script -XPath finder -Basic test suits -Locator Types: ID, ClassName, Name, Link Text, XPath-CSS Selector -Locating elements in browser. Overview of Selenium WebDriver. Case Study - Using Selenium IDE, Write a test suite containing minimum 4 test cases -Conduct a test suite for any two web sites -Write and test a program to login a specific web page		
		Total:45

TEXT BOOK:

1.	Limaye M.G., “Software Testing -Principles, Techniques and Tools”, 1st Reprint, Tata McGraw-Hill, 2009. (For Unit I)
2.	Perry William, “Effective Methods for Software Testing”, 3rd Edition, Wiley India, Reprint 2013. (For Units II, III, IV, V)

REFERENCES:

1.	David Burns, “Selenium 2 Testing Tools – Beginners Guide”, 2nd Edition, Packt Publishing, UK, 2012
2.	RajaniRenu and Oak Pradeep, “Software Testing Effective Methods: Tools and Techniques”, Tata McGraw-Hill, New Delhi, 2017
3.	Gopalswamy Ramesh and Srinivasan Desikan, “Software Testing: Principles and Practices”, 6th Impression, Pearson Education, New Delhi, 2014

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	make use of the features, approaches and methodologies of software testing.	Applying (K3)
CO2	apply the step by step activities and set up environment for software testing.	Applying (K3)
CO3	develop procedures and workbenches for various testing processes.	Applying (K3)
CO4	identify the agile methods for improving the testing process and apply testing for client server, web based and software security systems.	Applying (K3)
CO5	use selenium tool to perform automated testing.	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	30	50	20				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

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

22ITE17 - NATIVE MOBILE APPLICATION DEVELOPMENT							
Programme& Branch	**B.Tech – Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Java and Kotlin**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course provides knowledge on developing mobile applications using Android.	
Unit – I	**Introduction to Android**	**9**
Introduction to Kotlin– Android Architecture – Environmental setup – Develop simple Hello World application – AppFolder structure - Android virtual device - Application Components –Toast message - Activity – Activity Life cycle - App Manifest file – Permissions - Log messages.		
Unit – II	**Layout and UI**	**9**
Intent –types - Intent filters - Views - Layouts – Fragments - UI components:TextView,EditText, Button, ToggleButton, RadioGroup,CheckBox,AutoCompleteTextView,ProgressBar,TimePicker,DatePicker,RatingBar – Array adapters - Spinner -Event Listeners and Handlers		
Unit – III	**Resources and Alerts**	**9**
Resources overview – Styles and Themes - Menu: Option menu, Context menu –Alert dialog - Notification – Tool tip –Broadcast receivers - WebView - Phone call.		
Unit – IV	**Storage**	**9**
Introduction to Storages - Bundle - SQL Lite: CRUD operations - Content providers – Shared preferences – Firebase: CRUD operations– Dependency injection.		
Unit – V	**Services and Sensors**	**9**
Services –Send and receive SMS –Sensors: Motion and Position -Camera – Accessing geo location – JSON parsing - Basic Animations:rotate, fade, zoom, slide and move–Google map integration – Best practices.		
		Total:45

TEXT BOOKS:

1.	Dawn Griffiths and David Griffiths, “Head First Android Development”, 3rd Edition, OReilly, 2021.

REFERENCES:

1.	Bill Phillips, Chris Stewart and Kristin Marsicano, “Android Programming”, 3rdEdition, BigNerd Ranch Guides, 2017.
2.	https://developer.android.com

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Illustrate the steps to create android application and discuss its activity life cycle	Applying (K3)
CO2	develop an Android application using Layouts, Fragments, UI components with event handling	Applying (K3)
CO3	design styles, themes, alerts and menu	Applying (K3)
CO4	perform CRUD operations on SQLite and firebase.	Applying (K3)
CO5	create applications using services and access data from sensors	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	3	3	3	2	2	3		3	2
CO2	3	2	1	1	3	3	3	3	2	2	3		3	2
CO3	3	2	1	1	3	3	3	3	2	2	3		3	2
CO4	3	2	1	1	3	3	3	3	2	2	3		3	2
CO5	3	2	1	1	3	3	3	3	2	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	30	30	40				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	25	35	40				100

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

22ITE18 - SOFTWARE DEFINED NETWORKS							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Computer Networks**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course deals with the concepts of Software Defined Networking and its use cases in various environments.

Unit - I	**Introduction to SDN**	**9**

Basic packet switching terminology – The modern data center – Traditional switch architecture – Autonomous and dynamic forwarding table. Why SDN?: 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

Unit - II	**SDN and OpenFlow**	**9**

How SDN works: 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, 1.2 &1.3 Additions – OpenFlow Limitations.

Unit - III	**SDN Definitions &open source**	**9**

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 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 – 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.

Total:45

TEXT BOOK:

1. Paul Goransson and Chuck Black, "Software Defined Networks: A Comprehensive Approach", 2nd Edition, Morgan Kaufmann, USA, 2017.

REFERENCES:

1. Bruce Davie, "Software-Defined Networks ", 1st Edition, Systems Approach LLC, 2021
2. Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks", 1st Edition, O'Reilly Media, 2013

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify the concepts of traditional networks and software defined networks	Applying (K3))
CO2	model a networking task using OpenFlow	Applying (K3)
CO3	make use of SDN APIs and open-source tools	Applying (K3)
CO4	utilize SDN in the data center	Applying (K3)
CO5	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	1	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	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)

22ITE19 - VIDEO ANALYTICS							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course aims to provide a broad view on processing and analyzing images and video.	
Unit - I	**Introduction**	**9**
Deep Neural Networks – Introduction to Tensor flow – Keras Deep Learning library – OpenCV Library - Hand Written Number Recognition with Keras and OpenCV		
Unit - II	**Convolutional Neural Network for Computer Vision**	**9**
Convolution Neural Network – CNN architectures and drawbacks of DNN- convolution and pooling operations in tensor flow – training and evaluating CNN – model performance optimization – ImageNet – LeNet – AlexNet – VGGNet – GoogleLENet - ResNet.		
Unit - III	**Feature extraction, object detection and segmentation**	**9**
Feature extraction approach – transfer learning example – multi-task learning – Auto encoders of CNN – difference between object detection and image classification - Traditional, nonCNN approaches to object detection - R-CNN – Regions with CNN features - Fast R-CNN – fast region-based CNN - Faster R-CNN – faster region proposal network-based CNN -Mask R-CNN – Instance segmentation with CNN		
Unit - IV	**Generative Models**	**9**
Pix2pix - Image-to-Image translation - GAN – code example – feature matching –applications of generative models – neural artistic style transfer – generative adversarial networks – visual dialogue model.		
Unit - V	**Video Classification**	**9**
Understanding and classifying videos – exploring video classification dataset – splitting videos in to frames – approaches for classifying videos – extending image based approaches to videos: Regressing the human pose- segmenting videos – generating videos.		
		Total:45

TEXT BOOK:

1.	Mohit Sewak, Md. Rezaul Karim and Pradeep Pujari, “Practical Convolutional NeuralNetworks”, Packt Publishing, 2018. (For Units I,II,III)
2.	Rajalingappaa Shanmugamani, “Deep Learning for Computer Vision”, Packt Publishing, 2018. (For Units IV,V)

REFERENCE BOOKS:

1.	D. L. Baggio et al., “Mastering OpenCV with Practical Computer Vision Projects”, Packt Publishing, 2012.
2.	Jan Erik Solem, “Programming Computer Vision with Python: Tools and algorithms for analyzing images”, O'Reilly Media, 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 of image processing and its libraries	Applying (K3)
CO2	interpret the various CNN models used for image analytics	Applying (K3)
CO3	apply the various levels of segmentation and interpret the results for object detection and feature extraction.	Applying (K3)
CO4	make use of the GAN model to solve the real world problems.	Applying (K3)
CO5	identify various approaches for classifying and segmenting videos.	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	20	50	30				100
CAT2	20	50	30				100
CAT3	20	50	30				100
ESE	20	40	40				100

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

22ITE20 – CONTEMPORARY CRYPTOGRAPHY							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Cryptography and Network Security**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course enables the students to focus on how cryptographic algorithms and protocols work and how to use them to build provably secure encryption and digital signatures.	
Unit - I	**Cryptographic Protocols**	**9**
Key Exchange and Entity Authentication- Identification Schemes- Commitment Schemes- Electronic Elections - Digital Cash- Probabilistic Algorithms		
Unit - II	**One-Way Functions**	**9**
Discrete Exponential Function- Uniform Sampling Algorithms- Modular Powers- Modular Squaring- Quadratic Residuosity Property- Formal Definition of One-Way Functions- Hard-Core Predicates- Bit Security of One-Way Functions- One-Way Functions and Pseudorandomness		
Unit - III	**Provably Secure Encryption and Digital Signatures**	**9**
Classical Information-Theoretic Security- Perfect Secrecy and Probabilistic Attacks- Public-Key One-Time Pads- Passive Eavesdroppers - Chosen-Ciphertext Attacks- A Security Proof in the Random Oracle Model - Security Under Standard Assumptions - Unconditional Security of Cryptosystems- The Bounded Storage Model -The Noisy Channel Model- Attacks and Levels of Security -Claw-Free Pairs and Collision-Resistant Hash Functions- Authentication-Tree-Based Signatures - A State-Free Signature Scheme.		
Unit - IV	**Transport Layer Security(TLS)**	**9**
Target Applications and Requirements-The TLS Protocol Suite- The TLS and SSL Family of Protocols- TLS in a Nutshell- Certificates and Certificate Authorities-The Record Protocol-The TLS Handshake Protocol- TLS 1.3 Cryptographic Algorithms-TLS 1.3 Improvements over TLS 1.2- Downgrade Protection-Single Round-Trip Handshake- Session Resumption- The Strengths of TLS Security-Authentication-Forward Secrecy-How Things Can Go Wrong-Compromised Certificate Authority-Compromised Server-Compromised Client-Bugs in Implementations		
Unit - V	**Quantum and Post-Quantum**	**9**
How Quantum Computers Work- Quantum Bits- Quantum Gates- Quantum Speed-Up-Exponential Speed-Up and Simon's Problem-The Threat of Shor's Algorithm- Shor's Algorithm- The Factoring Problem- Shor's Algorithm and the Discrete Logarithm Problem-Grover's Algorithm- Why Is It So Hard to Build a Quantum Computer?- Post-Quantum Cryptographic Algorithms- Code-Based Cryptography- Lattice-Based Cryptography-Multivariate Cryptography- Hash-Based Cryptography		
		Total:45

TEXT BOOK:

1.	Hans Delfs and Helmut Knebl, "Introduction to Cryptography: Principles and Applications", 2nd Edition, Springer Verlag, 2007. (For Units I, II, III)
2.	Wenbo Mao, "Modern Cryptography: Theory and Practice", Prentice Hall, 2003. (For Units IV,V)

REFERENCES/ MANUAL / SOFTWARE:

1.	Shaffi Goldwasser and Mihir Bellare, Lecture Notes on Cryptography, Available athttp://citeseerx.ist.psu.edu/.
2.	Oded Goldreich, "Foundations of Cryptography: Volume II Basic Applications", CRC Press, 2009.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	interpret the basic principles of cryptographic protocols	Applying (K3)
CO2	determine the ways of generating one way functions	Applying (K3)
CO3	identify the use of provably secure encryption and digital signatures	Applying (K3)
CO4	articulate the cryptographic algorithms to compose, build and analyze transport layer security	Applying (K3)
CO5	express the use of quantum and post quantum 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	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	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)

22GEE01 - FUNDAMENTALS OF RESEARCH							
(Common to All BE/BTech branches)							
Programme & Branch	**All BE/BTech branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course familiarizes 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 - Outcomes 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 – Data Collection – Primary Data Analysis – Experimental Methods 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**
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”. 2nd edition, Routledge, 2017., for Units I, II, III, IV & V

REFERENCES:

1. Mishra, S.B. and Alok, S. “Handbook of research methodology” Educreation Publishing, 2017
2. Kumar, Ranjit. “Research Methodology: A step-by-step guide for beginners”. SAGE Publications Limited, 2019.
3. Nayak, J.K. and Singh, P. “Fundamentals of Research Methodology Problems and Prospects”. SSDN Publishers & Distributors, 2021.

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	Applying (K3)
CO2	formulate a research problem from published literature/journal papers	Evaluating (K5)
CO3	write, present a journal paper/ project report in proper format	Creating (K6)
CO4	select suitable journal and submit a research paper	Applying (K3)
CO5	compile a research report and the presentation	Applying (K3)

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

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

ASSESSMENT PATTERN - THEORY

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

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

22ITE21 - ETHICAL HACKING							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Computer Networks**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course provides the fundamental knowledge about risks in computer and network security. It also provides information about various vulnerabilities and countermeasures	
Unit - I	**Penetration Testing**	**9**
Terminologies - Categories of Penetration Test - Writing Reports - Structure of a Penetration Testing Report - Vulnerability Assessment Summary - Risk Assessment – Methodology - Linux Basics: Major Linux Operating Systems - File Structure - Linux Scheduler -Users inside of Linux - Common Applications – BackTrack.		
Unit - II	**Information Gathering, Target Enumeration and Port Scanning Techniques**	**9**
Active , Passive and Sources of information gathering - Copying Websites Locally –Traceroute - NeoTrace - Cheops-ng - Intercepting a Response –WhatWeb –Netcraft - Basic Parameters -Xcode Exploit Scanner - Interacting with DNS Servers –Nslookup – DIG - Fierce, Zone Transfer with Host Command and Automation - DNS Cache Snooping-Attack Scenario - Automating Attacks - SNMP –Problem - Sniffing Passwords - SolarWinds Toolset -Sweep, Brute Force and Dictionary – Tools - Attack – Enumeration - Intelligence Gathering using Shodan - Target enumeration and Port Scanning Techniques.		
Unit - III	**Vulnerability Assessment & Network Sniffing**	**9**
Introduction to Vulnerability Assessment - Pros and Cons –Nmap -Updation of database - Testing SCADA Environments with Nmap – Nessus. Sniffing: Types - Hubs versus Switches -Promiscuous versus Nonpromiscuous Modes - MITM Attacks - ARP Protocol Basics – working – Attacks -DoS Attacks –Dsnifftool - Using ARP Spoof to Perform MITM Attacks - Sniffing the Traffic with Dsniff - Sniffing Pictures with Drifnet - Urlsnarf and Webspy - Sniffing with Wireshark –Ettercap-ARP Poisoning - Hijacking Session with MITM Attack - ARP Poisoning with Cain and Abel - Sniffing Session Cookies with Wireshark - Hijacking the Session.		
Unit - IV	**Basics of Exploitation**	**9**
Introduction to Remote Exploitation -Understanding Network Protocols – Server Protocols - Attacking Network Remote Services - Common Target Protocols -Tools for cracking network remote services - Attacking SMTP - Attacking SQL Servers - Client Side Exploitation Methods: E-Mails Leading to Malicious Attachments & Malicious Links - Compromising Client Side Update - Malware Loaded on USB Sticks - Postexploitation:Acquiring Situation Awareness - Privilege Escalation - Maintaining Access - Data Mining - Identifying and Exploiting Further Targets.		
Unit - V	**Wireless & Web Hacking**	**9**
Wireless Hacking - Requirements -Aircracking- Hidden SSIDs - Monitor Mode - Monitoring Tool- Beacon Frames on Wireshark, Airodumping- Wireless Adapter in Monitor Mode - Determining the Target - Cracking a WPA/WPA2 Wireless Network using Aircracking- Capturing Packets and Four-Way Handshake. Web Hacking:Attacking the Authentication - Brute Force and Dictionary Attacks - Types of Authentication - Crawling Restricted Links - Testing for the Vulnerability - Authentication Bypass with Insecure Cookie Handling - SQL injection - XSS –DOM based XSS,BeEF – CSRF - Bypassing CSRF and BeEF with XSS.		
		Total:45

TEXT BOOK:

1.	Rafay Baloch, “Ethical Hacking and Penetration Testing Guide”, 1st Edition, CRC Press, 2015.

REFERENCES:

1.	Sean-Philip Oriyano, “CEH v9: Certified Ethical Hacker Version 9”, 3rd Edition, Wiley publication, 2016.
2.	Stuart McClure, Joel Scambray and Goerge Kurtz, “Hacking Exposed 7: Network Security Secrets & Solutions”, Tata Mc Graw Hill Publishers, 7th Edition, 2012.
3.	EC- Council, “Ethical Hacking and Countermeasures: Attack Phases”, Cengage Learning, 2009.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Illustrate about penetration testing, vulnerabilities and risks available in a system and explain about linux operating system	Applying (K3)
CO2	outline about gathering information and execution of enumeration and scanning to identify various types of vulnerabilities and attacks.	Applying (K3)
CO3	interpret various vulnerabilities and apply suitable tools to carry out sniffing in the networks	Applying (K3)
CO4	make use of the exploitation available in network protocols, servers, clients, services and USBs.	Applying (K3)
CO5	demonstrate how to execute wireless and web hacking using appropriate tools	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	3	3	3	2	2	3		3	2
CO2	3	2	1	1	3	3	3	3	2	2	3		3	2
CO3	3	2	1	1	3	3	3	3	2	2	3		3	2
CO4	3	2	1	1	3	3	3	3	2	2	3		3	2
CO5	3	2	1	1	3	3	3	3	2	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	30	40	30				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)

22ITE22 - NATURAL LANGUAGE PROCESSING							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course deals with models which make computers perform useful tasks involving human or natural language - conversational agent - dialogue system - machine translation - question and answering.

Unit - I	**Computer Language Processing and Regular Expressions**	**9**

Regular Expressions – words Corpora Text-Normalization Minimum Edit Distance - N-Grams. - Evaluating Language Models - Sampling sentences from a language model - Generalization and Zeros – SmoothingHuge Language Models and Stupid Backoff - Advanced: Kneser-Ney Smoothing - Advanced: Perplexity's Relation to Entropy

Unit - II	**Naïve Bayes Classification and Logistic Regression**	**9**

Naïve Bayes Classifiers - Training the Naïve Bayes Classifier - Worked example - Optimizing for Sentiment Analysis - Naïve Bayes for other text classification tasks - Naïve Bayesian Language Model - Evaluation: Precision - Recall - F-measure - Testsets - and Cross-validation Statistical Significance Testing - Avoiding Harms in Classification

Logistic Regression: The sigmoid function - Classification with Logistic Regression - Multinomial Logistic Regression - Learning in Logistic Regression - The cross-entropy loss function - Gradient Descent - Regularization - Learning in Multinomial Logistic Regression - Interpreting models.

Unit - III	**Vector Embeddings and Neural Language Models**	**9**

Lexical Semantics - Vector Semantics - Words and Vector - Cosine for measuring similarity - TF-IDF: Weighing terms in the vector - Pointwise Mutual Information (PMI) - Applications of the TD-IDF for PPMI vector models - Word2vec - Visualizing Embeddings - Semantic properties of embeddings - Bias and Embeddings - Evaluating Vector Models.

Neural Networks Units - The XOR problem - Feedforward Neural Networks - Feedforward Networks for NLP: Classification - Feedforward Neural Language Modeling - Training Neural Nets - Training the neural language model.

Unit - IV	**Sequence Labelling, RNN, and LSTM**	**9**

English Word Classes - Part-of-Speech Tagging - Named Entities and Named Entity Tagging - HMM Part-of-Speech Tagging - Conditional Random Fields (CRFs) and Evaluation of Named Entity Recognition. Recurrent Neural Networks - RNNs as Language Models - RNNs for other NLP tasks - Stacked and Bidirectional RNN architectures - The LSTM - Summary: Common RNN NLP Architectures - The Encoder-Decoder Model with RNNs - Attention.

Unit - V	**Transformer and Pretrained Language Models**	**9**

Self-Attention Networks: Transformers - Transformers as Language Models - Sampling - Beam Search - Pretraining Large Language Models - Language Models for Zero-shot Learning. Potential Harms from Language Models - Bidirectional Transformer Encoders - Training Bidirectional Encoders - Transfer Learning through Fine-Tuning - Training Corpora.

Total:45

TEXT BOOK:

1. Jurafsky Daniel, Martin, James H, "Speech and Language Processing, An Introduction to Natural Language Processing - Computational Linguistics, and Speech Recognition", 3rd Edition, Pearson Education India, 2023.

REFERENCES:

1. Eisenstein, Jacob, "Natural Language Processing", 1st Edition, MIT Press, 2019.
2. Palash Goyal, Sumit Pandey, Karan Jain, "Deep Learning for Natural Language Processing: Creating Neural Networks with python", 1st Edition, APress, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	summarize the concepts in speech and language processing and utilize regular expressions and other statistical methods to create Language Models.	Applying (K3)
CO2	make use of the Naïve Bayes classifier and Logistic regression on standard corpora and improve accuracy through regularization.	Applying (K3)
CO3	apply Vector Embedding to words and build Neural Language models.	Applying (K3)
CO4	solve sequence labeling problems (Named Entity Tagging and POS tagging) using RNN and LSTM.	Applying (K3)
CO5	apply the novel Transformers model to train large Language 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	2	1	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	30	50	20				100
CAT2	30	40	30				100
CAT3	30	40	30				100
ESE	30	40	30				100

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

22ITE23 - SOCIAL NETWORK ANALYSIS							
Programme & Branch	**B.Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Machine Learning**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	The course introduces various methods, models and concepts behind social network analysis. This course also describes about how to manipulate, analyze and visually display social network data.	
Unit – I	**Introduction and Random Walks in Social Networks:**	**9**
Statistical Properties of Social Networks – Preliminaries – Static Properties – Dynamic Properties – Random Walks on Graphs: Background – Random Walk based Proximity Measures – Other Graph-based Proximity Measures – Graph-theoretic Measures for Semi-supervised Learning – Clustering with random walk based measures – Algorithms – Applications – Evaluation and datasets		
Unit – II	**Community Discovery and Node Classification in Social Networks:**	**9**
Communities in Context – Core Methods – Quality Functions – The Kernighan-Lin(KL) algorithm – Agglomerative/Divisive Algorithms – Spectral Algorithms – Multi-level Graph Partitioning – Markov Clustering – Node Classification in Social Networks: Problem Formulation – Methods using Local Classifiers – Random Walk based Methods – Applying Node Classification to Large Social Networks.		
Unit – III	**Social Influence Analysis and Expert Location in Social Networks:**	**9**
Influence Related Statistics – Social Similarity and Influence – Influence Maximization in Viral Marketing – Expert Location in Social Networks: Expert Location without Graph Constraints – Expert Location with Score Propagation – Expert Team Formation – Other related approaches.		
Unit – IV	**Link Prediction and Privacy In Social Networks:**	**9**
Feature based Link Prediction – Feature Set Construction – Classification Models – Bayesian Probabilistic Models – Link Prediction by Local Probabilistic Models – Network Evolution based Probabilistic Model – Hierarchical Probabilistic Model – Probabilistic Relational Models: Relational Bayesian Network – Relational Markov Network – Privacy in Social Networks: Privacy breaches in social networks – Privacy definitions for publishing data – Privacy preserving mechanisms.		
Unit – V	**Visualization and Text Mining in Social Networks:**	**9**
Structural Visualization – Semantic and Temporal Visualization – Statistical Visualization – Text Mining in Social Networks: Keyword Search: Query Semantics and Answer Ranking – Keyword search over XML and relational data – Keyword search over graph data – Classification Algorithms – Clustering Algorithms.		
		Total:45

TEXT BOOK:

1. Charu C. Aggarwal, "Social Network Data Analytics", Springer (e book), 2011.

REFERENCES:

1. Peter Mika, "Social Networks and the Semantic Web", 1st Edition, Springer, 2007.
2. Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Summarize statistical properties of Social Networks and apply random walk approaches for social network analysis	Applying (K3)
CO2	Make use of statistical methods for classification and community discovery in Social Networks	Applying (K3)
CO3	identify social influence and expert location in Social Networks	Applying (K3)
CO4	Apply statistical methods for link prediction and describe privacy preservation methods in Social Networks	Applying (K3)
CO5	Summarize visualization techinques and apply text mining techniques in Social 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	1	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	25	40	35				100
CAT2	25	40	35				100
CAT2	30	40	30				100
ESE	30	40	30				100

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

22ITE24 - MOBILE AND WIRELESS SECURITY

Programme & Branch	B.Tech & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	7	PE	3	0	0	3

Preamble	This course aims to focus on the security issues in wireless networks

UNIT – I	Introduction to Mobile and Wireless Networks	9

Cellular Networks, 1G through 3G, IEEE Network - WLAN IEEE 802.11, WPAN IEEE 802.15, WMAN IEEE 802.16, IEEE 802.20, MIH IEEE 802.21, WRAN IEEE 802.22, Mobile Internet Networks – Macro and Micro mobility – Personal mobility – SIP – Identity based mobility, NEMO and MANETs – Vulnerabilities of Wireless Networks – Review of security basics – symmetric and asymmetric cryptography, Hash functions – Electronic signatures – MAC – PKI and electronic certificate – IPSec – AAA protocol – Firewalls – Intrusion detection.

UNIT – II	Wi-Fi Security Architectures	9

Hotspot architecture – WIDS – Rogue AP detection – IEEE 802.11 geolocation techniques – Honeypots – Passive and Active attacks – DOS attacks – Trojan attack – Dictionary Attack. Bluetooth Security – Protocol architecture – Radio physical layer – Device addressing – SCO and ACL logical transports – Security mode – Authentication and pairing – Attacks – BlueSmack.

UNIT – III	Security in IEEE 802.11	9

WEP – WEP2 – IV collisions – RC4 weakness – 802.1x authentication -802.11i security architecture – policy negotiation – radio security policies – RADIUS – EAP – PKI – WiMAX security – TEK , KEK, IEEE 802.16e – PKMv2-RSA – Security Association – 3 way handshake – role of smart cards in WiMAX.

UNIT – IV	Security in Ad Hoc Networks	9

Attacks to routing protocols – Security mechanisms – Auto-configuration – Key management – Self-managed PKI – Resurrecting Duckling – Group key management – Wireless Sensor Networks – Attacks – Preventive mechanisms – Intrusion tolerance – SNEP - µTELSA – TinySec – key management in WSNs.

UNIT – V	Security in Mobile Telecommunication Networks	9

SS7 – GSM security – GRPS security – UMTS infrastructure and security – H.323 – SIP – Megaco – VoIP security flaws and countermeasures– IMS architecture – security flaws – 4G security – Protection of interception – Security issues in Mobile IP – HIP – NetLMM.

Total:45

TEXT BOOK:

1. Hakima Chaouchi and Maryline Laurent-Maknavicius, “Wireless and Mobile Network Security: Security basics, Security in On-the-shelf and Emerging Technologies”, 2nd Edition, John Wiley & Sons, 2009. (For Units I,II,III)
2. Pallapa Venkataram and Sathish Babu, Wireless and Mobile Network Security, 1st Edition, Tata McGrawHill, 2010. (For Units IV,V)

REFERENCES:

1. Lei Chen, Jiahuang Ji, and Zihong Zhang, “Wireless Network Security: Theories and Applications”, Springer Higher Education Press, 2013.
2. Amitabh Mishra, “Security and Quality of Service in Ad Hoc and Wireless Networks”, 1st Edition, Cambridge University Press, 2008.
3. S. Kami Makki, Peter Reiher, Kia Makki, Niki Pissinou, Shamila Makki, “Mobile and Wireless Security and Privacy”, Springer Science, 2007.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	make use of the mathematical models of security algorithms to wireless and mobile environment	Applying (K3)
CO2	identify the specific vulnerabilities in wide range of WiFi systems	Applying (K3)
CO3	develop robust systems against state-of-the-art security attacks	Applying (K3)
CO4	plan for providing security in ad hoc networks	Applying (K3)
CO5	identify the security issues in mobile telecommunication 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	1	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	40	40	20				100
CAT2	40	40	20				100
CAT3	40	40	20				100
ESE	40	40	20				100

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

22ITE25 - CYBER FORENSICS							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Cryptography and Network Security**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course imparts knowledge on fundamental principles and techniques essential for digital forensics investigation and security management.	
Unit – I	**Digital Forensics Investigations**	**9**
Digital Investigations: Overview - Preparing a Digital forensic investigation – Procedures for private sector high-tech investigations – Conducting an Investigation – Completing the case		
Unit – II	**Data Acquisition**	**9**
Understanding storage formats for digital evidence – Determining the best acquisition method - Contingency planning for image acquisitions – Using Acquisition tools– Validating Data Acquisitions: Windows Validation Methods – Performing RAID Data Acquisitions – Using Remote Network Acquisition tools – Using other Forensics Acquisition tools.		
Unit – III	**Processing Crime and Incident Scenes**	**9**
Identifying Digital Evidence – Collecting Evidence in Private Sector Incident Scenes – Processing Law Enforcement Crime Scenes – Preparing for a Search –Securing a Digital Incident or Crime Scene –Seizing Digital Evidence at the Scene –Storing Digital Evidence –Obtaining a Digital Hash –Reviewing a Case.		
Unit – IV	**Computer Forensic Tools, Analysis and Validation**	**9**
Evaluating Digital Forensics Tool Needs -Digital Forensics Software Tools – Digital Forensics Hardware Tools – Validating and Testing Forensic Software - Digital Forensics Analysis and Validation: Determining Data Collection and Analysis – Validating Forensic Data – Addressing Data-Hiding Techniques.		
Unit – V	**Recovering Graphics Files, Email Investigations**	**9**
Recognizing Graphics File - Understanding Data Compression - Locating And Recovering Graphics Files - Identifying Unknown File Formats - Understanding Copyright Issues - Investigating Email Crimes And Violations - Understanding Email Servers - Using Specialized Email Forensic Tools.		
		Total:45

TEXT BOOK:

1. Nelson Bill, Phillips Amelia and Steuart Christopher, "Guide to Computer Forensics and Investigations", 6th Edition, Cengage Learning, USA, 2021.

REFERENCES:

1. Marie-Helen Mara, "Computer Forensics", 2nd Edition, Jones and Bartlett Learning, 2015.
2. Dejey, Murugan, “Cyber Forensics”, 1st Edition, Oxford University Press, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply digital forensic investigation with a systematic approach	Applying (K3)
CO2	make use of various tools for data acquisition	Applying (K3)
CO3	explore the significance of digital evidence in a crime scene	Applying (K3)
CO4	apply forensic tools in forensic examination	Applying (K3)
CO5	build the recovery of graphic files and investigate E-mail crimes	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	25	50	25				100
CAT2	25	50	25				100
CAT3	25	50	25				100
ESE	20	50	30				100

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

22ITE26 - MULTICORE ARCHITECTURE							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Computer Organization**	**7**	**PE**	**3**	**0**	**0**	**3**
Preamble	This course focuses on performance improvement of the systems using instruction level, data level, thread level and request level parallelism.						
Unit - I	**Fundamentals of Quantitative Design and Analysis**						**9**
Classes of Computers – Trends in Technology, Power, Energy and Cost – Dependability – Measuring, Reporting and Summarizing Performance – Quantitative Principles of Computer Design – Classes of Parallelism ILP, DLP, TLP and RLP – Multi Threading – SMT and CMP Architectures – Limitations of Single Core Processors – The Multicore era – Case Studies of Multicore Architectures.							
Unit - II	**Memory Hierarchy Design**						**9**
Introduction – Basics of Memory Hierarchies – Memory Technology and Optimizations – Ten Advanced Optimizations of Cache Performance – Virtual Memory and Virtual Machines – Design of Memory Hierarchies – Case Studies							
Unit - III	**TLP and Multiprocessors**						**9**
Introduction – Vector Architectures – SIMD Instruction Set Extensions for Multimedia – Graphics Processing Units – Detecting and Enhancing Loop Level Parallelism – Comparison of a GPU and a MIMD With Multimedia SIMD – Case Studies							
Unit - IV	**TLP and Multiprocessors**						**9**
Centralized Shared-Memory Architectures – Performance of Symmetric Shared-Memory Multiprocessors – Distributed Shared-Memory and Directory-Based Coherence – Synchronization basics – Models of Memory Consistency - introduction – Inter Connection Networks – Buses, Crossbar and Multi-stage interconnection networks – Performance and Energy Efficiency of the Intel i7 920 Multicore – Shared Memory Programming with OpenMP							
Unit - V	**RLP and DLP in Warehouse Scale Computers**						**9**
Programming Models and Workloads for Warehouse scale Computers – Computer Architecture of Warehouse - Scale Computers – Domain Specific Architectures: Introduction – Guidelines for DSAs – Example Domain: Deep Neural Network – Google's Tensor Processing Unit, an interface Data Center Accelerator							
							Total:45
TEXT BOOK:							
1.	John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", 6th Edition, Morgan Kaufmann, Elsevier, 2019.						
REFERENCES:							
1.	Richard Y. Kain, "Advanced Computer Architecture: A Systems Design Approach", 1st Edition, Pearson, 2015.						

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	investigate the limitations of ILP and the need for multicore architectures	Applying (K3)
CO2	analyze the importance of memory hierarchy and benefits of cache memory	Applying (K3)
CO3	explain the architecture of Vector/GPU processor and make use of loop level parallelism to achieve data level parallelism	Applying (K3)
CO4	analyze the cache coherence issues using different memory architectures and different types of inter connection networks	Applying (K3)
CO5	inspect the architectures of GPUs, warehouse scale computers and choose an appropriate model for 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	1	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	20	50	30				100
CAT2	20	50	30				100
CAT3	20	60	20				100
ESE	20	50	30				100

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

22ITE27 - BUSINESS INTELLIGENCE AND ITS APPLICATIONS							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Database Management Systems**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course enables the students to apply Business Intelligence concepts and techniques to various applications for making better decisions.	
Unit – I	**Introduction and 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, TenToTen 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 Kimball'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**
Measures, Metrics, KPIs and Performance Management: 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	**Business Intelligence Applications**	**9**
Understanding Business Intelligence and Mobility– the need for business intelligence on the move – BI Mobility time line – Data Security Concerns for Mobile BI – Business Intelligence and Cloud Computing – Business Intelligence for ERP systems – Social CRM and Business Intelligence.		
		Total:45

TEXT BOOK:

1. Prasad R.N. and Seema Acharya, "Fundamentals of Business Analytics", 2nd Edition, Wiley, 2016.

REFERENCES:

1. Ramesh Sharda, Dursun Delen, Efraim Turban, "Business Intelligence, Analytics, and Data Science: A Managerial Perspective", 4th Edition, Pearson Education, 2017.
2. David Loshin, "Business Intelligence: The Savvy Manager's Guide", 2nd Edition, Morgan Kaufmann, USA, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	demonstrate the enterprise view of IT applications and identify the different types of digital data	Applying (K3)
CO2	make use of business intelligence concepts and techniques to experiment ETL process	Applying (K3)
CO3	illustrate OLTP, OLAP systems and design their multi-dimensional models	Applying (K3)
CO4	design model dashboard, balanced score card for performance management	Applying (K3)
CO5	apply business intelligence 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	1	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	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)

22ITE28 - CONSTRAINT SATISFACTION PROBLEM							
Programme& Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**PE**	**3**	**0**	**0**	**3**
Preamble	The objective of this course is to introduce the concepts of solving problems subjected to some constraints. This course discusses about topics such as constraint networks, constraint propagation, directional consistency, and look ahead and look back strategies.						
Unit – I	**Basics of Constraint Processing: Constraint Networks-Constraint Propagation**						**9**
Basic concepts and examples - Constraint Networks and Constraint Satisfaction - Numeric and Boolean Constraints - Properties of Binary Constraint Networks – Consistency - Enforcing and Constraint Propagation - Propagating constraints - Arc-consistency							
Unit – II	**Directional Consistency**						**9**
Directional Consistency - Graph Concepts: Induced Width - Directional Local Consistency - Width Versus Local Consistency - Adaptive Consistency and Bucket Elimination							
Unit – III	**General Search Strategies: Look ahead**						**9**
Look Ahead - The State Space Search- Backtracking - Look-Ahead Strategies - Look Ahead Algorithms for value selection - Look Ahead for variable ordering - The cycle cut set effect - Extension to Stronger Look Ahead - Satisfiability: Look-Ahead in Backtracking							
Unit – IV	**General Search Strategies: Look back**						**9**
Look-Back - Conflict Sets - Backjumping Styles- Complexity of Backjumping - Learning Algorithms - Look-Back Techniques for Satisfiability - Integration and Comparison of Algorithms							
Unit – V	**Constraint Satisfaction Problems with examples**						**9**
N-Queen, - Scene Labelling - Minimum Width orderings - Value and variable ordering							
							Total:45

TEXTBOOK:

1. Rina Dechter, “Constraint Processing”, 1st Edition, Morgan Kaufmann Publishers, 2003. (For Units I,II, III, IV)
2. Deepak Khemani, “A First course in Artificial Intelligence”, 1st Edition, Mc Graw Hill,2017. (For Unit V)

REFERENCES:

1. Khaled Ghedira, "Constraint Satisfaction Problems: CSP Formalisms and techniques", 1st Edition, Wiley, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	solve problems using constraint networks, constraint propagation and Arc consistency	Applying (K3)
CO2	make use of directional consistency in Constraint Satisfaction Problems	Applying (K3)
CO3	apply look-ahead strategies to solve problems in state space search.	Applying (K3)
CO4	model constraint satisfiability using lookback and backjumping strategies.	Applying (K3)
CO5	identify and solve typical problems in the domain of constraint satisfaction.	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	10	60	30				100
CAT2	10	60	30				100
CAT3	10	60	30				100
ESE	10	50	40				100

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

22GEE02 - TOTAL QUALITY MANAGEMENT							
(Common to All BE/BTech branches)							
Programme & Branch	**All BE/BTech branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course deals with quality concepts and Total Quality Management (TQM) principles focusing on process quality for customer perspective. It also deals with the basic and modern quality management tools including ISO standards	
Unit – I	**Quality Concepts and Principles**	**9**
Definition of Quality - Dimensions of Quality - Quality Planning - Quality Assurance and Control - Quality Costs with Case Studies - Elements / Principles of TQM - Historical Review – Leadership – Qualities / Habits - Quality Council - Quality Statements, Strategic Planning – Importance - Case Studies - Deming Philosophy - Barriers to TQM Implementation – Cases with TQM Success and Failures.		
Unit – II	**TQM-Principles and Strategies**	**9**
Customer Satisfaction - Customer Perception of Quality - Customer Complaints - Customer Retention, Employee Involvement – Motivation - Empowerment - Teams - Recognition and Reward - Performance Appraisal, Continuous Process Improvement - Juran'sTrilogy - PDSA Cycle - 5S - Kaizen, Supplier Partnership - Partnering - Sourcing - Supplier Selection - Supplier Rating - Relationship Development, Performance Measures – Purpose – Methods - Cases.		
Unit – III	**Control Charts for Process Control**	**9**
Basic Seven Tools of Quality and its Role in Quality Control, Statistical Fundamentals - Measures of Central Tendency and Dispersion, Population and Sample - Normal Curve - Control Charts for Variables and Attributes - Process Capability - Case Study - Introduction to Six Sigma.		
Unit – IV	**TQM-Modern Tools**	**9**
New Seven Tools of Quality, Benchmarking - Need - Types and Process, Quality Function Deployment - House of Quality (HOQ) Construction - Case Studies, Introduction to Taguchi's Robust Design - Quality Loss Function - Design of Experiments (DOE), TotalProductive Maintenance (TPM) - Uptime Enhancement, Failure Mode and Effect Analysis (FMEA) - Risk Priority Number (RPN) – Process - Case Studies.		
Unit – V	**Quality Systems**	**9**
Need for ISO 9000 and Other Quality Systems - ISO 9000: 2015 Quality System – Elements - Implementation of Quality System - Documentation - Quality Auditing, Introduction to ISO 14000 - IATF 16949 - TL 9000-IEC 17025 - ISO 18000 - ISO 20000 - ISO 22000 - ISO21001. Process of Implementing ISO - Barriers in ISO Implementation.		
		Total:45

TEXT BOOK:

1.	Besterfield Dale H., Besterfield Carol, Besterfield Glen H., Besterfield Mary, Urdhwareshe Hemant, UrdhwaresheRashmi. "Total Quality Management", 5th Edition, Pearson Education, Noida, 2018.

REFERENCES:

1.	Subburaj Ramasamy, "Total Quality Management", McGraw Hill Education, New Delhi, 2017.
2.	James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, Cengage Learning, 2012.
3.	David Goetsch & Stanley Davis, "Quality Management for Organizational Excellence: Introduction to Total Quality", 8th Edition,Pearson, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	demonstrate the evolution of TQM principles	Understanding (K2)
CO2	illustrate the principles and strategies of TQM	Understanding (K2)
CO3	use control charts and identify process capability of a process	Applying (K3)
CO4	apply various quality tools and techniques in both manufacturing and service industry	Applying (K3)
CO5	choose appropriate quality standards and implement them in the respective 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	1	1				2	2	3	2	2	1	1		3
CO2	1	1				3	2	3	3	3	1	1	2	3
CO3	3	2	2	2	2	2		1	2	2	1	1	1	3
CO4	2	2	2	2	2	2		1	2	2	1	1	2	3
CO5						3	3	2	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	45	30				100
CAT2	20	40	40				100
CAT3	25	45	30				100
ESE	20	40	40				100

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

22ITE29 - COMPUTER SECURITY, AUDIT AND ASSURANCE							
Programme& Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course provides a comprehensive introduction to Information Security and discusses about legal issues, the audit process, ISO standards and certification, implementation of ISO 27001.	
UNIT – I	**Introduction**	**9**
History of Information Security – What is security? – CNSS Security Model – Components of Information Systems – balancing Information Security and Access – Information Security implementation. Systems development life cycle – The security systems development life cycle – Communities of Interest.		
UNIT – II	**The Need for Information Security and its Legal, ethical, and professional issues**	**9**
Business needs first – Threats – Attacks – Secure Software Development. Law and Ethics – US laws – international laws and legal bodies – Ethics and Information Technology – Code of Ethics and Professional Organizations.		
UNIT – III	**Audit Planning, Preparation, and Techniques**	**9**
Reasons – Audit Principles – Process of Audit Programme Management – Audit Competence and evaluation methods – Audit Responsibilities – Audit time and Process flow – Information Security and Management System (ISMS) Audit checklist. Auditor Quality and Selection – Audit script – Audit stages – Audit techniques – Collecting evidence through questions – Observation – Reporting to audit findings – Audit Team meetings – non-conformities and observations – Corrective and Preventive actions.		
UNIT – IV	**ISO 27001**	**9**
Overview of an ISMS – ISO standards that focus on an organization's ISMS – ISO/IEC standards – Scope of ISMS – Identifying applicable legislation – Risk Assessment – Information Assets and Protection – Identifying Risks – Assessing Risks – Objectives and Controls - Policies, Procedures and documented information on control risks – Resources and staff training – Monitoring and implementing ISMS – Preparing the certification for Audit.		
UNIT – V	**Asset Management**	**9**
Assets according to ISO 27001 – the importance of Assets – Asset inventory – Asset Owner – ISO 27001/ISO 27005 Risk Assessment – The six basic steps – ISO 27001 Controls – ISO2 27001 Statement of Applicability – ISO 27001 Asset Management – Responsibility for Assets – Information Classification – Media handling – BYOD.		
		Total:45

TEXT BOOK:

1.	Michael E. Whitman and Herbert. J. Mattord, "Principles of Information Security", 4th Edition, Cengage Learning, USA, 2012. (For Units I,II)
2.	Rajkumar Banoth, Narasimha Gugulothu, Aruna Kranthi Godishala, "A Comprehensive Guide to Information Security Management and Audit", CRC Press Taylor and Francis Group, USA, 2023. (For Units III,IV,V)

REFERENCES:

1.	Joseph M.Kizza, "Computer Network Security", Springer, 2005
2.	Matt Bishop, "Introduction to Computer Security", Addison-Wesley Professional, 2005.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Plan the organization's security needs with the CNSS security model.	Applying (K3)
CO2	apply legal aspects and code of ethics in Information Security.	Applying (K3)
CO3	Organize an audit and use the best practices of ISMS.	Applying (K3)
CO4	apply ISO 27001 and conduct a risk assessment.	Applying (K3)
CO5	illustrate Asset management in compliance with ISO 27001.	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	40	40	20				100
CAT2	40	40	20				100
CAT3	40	40	20				100
ESE	40	40	20				100

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

22ITE30 - BUILDING ENTERPRISE APPLICATIONS							
Programme& Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Object Oriented Programming**	**8**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course provides knowledge about design, development and roll-out of high quality enterprise applications.	
Unit - I	**Analysis and Modeling**	**9**
Introduction to enterprise applications and their types - Software engineering methodologies - Life cycle of raising an enterprise application - Introduction to skills required to build an enterprise application - Key determinants of successful enterprise applications - Measuring the success of enterprise applications. Inception of enterprise applications: Enterprise analysis - business modeling - requirements elicitation and analysis - requirements validation - planning and estimation.		
Unit - II	**Architecture and Designing**	**9**
Architecture, view and viewpoints - Enterprise application architecture perspective - Logical architecture - Technical architecture and Design- - Data architecture and design		
Unit - III	**Architectural Design**	**9**
Infrastructure architecture and design - Documentation: system architecture documentation - design documentation		
Unit - IV	**Construction**	**9**
Construction readiness of enterprise applications: defining a construction plan - defining a package structure - setting up a configuration management plan - setting up a development environment - introduction to the concept of Software Construction Maps - constructing the solution layers - code review - static code analysis - build and testing - Dynamic code analysis.		
Unit - V	**Testing and Rolling out Enterprise Applications**	**9**
Testing enterprise applications – enterprise application environments - integration testing - system testing - user acceptance testing - rolling out enterprise application		
		Total:45

TEXT BOOK:

1. Anubhav Pradhan, Satheesha B. Nanjappa, Senthil K. Nallasamy, Veerakumar Esakimuthu, "Raising Enterprise Applications: A Software Engineering Perspective", 1st Edition, Wiley India Pvt. Ltd, 2010.

REFERENCES:

1. Brian Berenbach, Daniel J. Paulish, Juergen Kazmeier, Arnold Rudorfer, "Software Systems Requirements and Engineering: In Practice", 1st Edition, McGraw-Hill Education, 2009.
2. Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing Principles and Practices ", 1st Edition, Pearson Education, 2006.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify challenges in building an enterprise application and build a business model	Applying (K3)
CO2	build a logical, technical and data architecture of an application	Applying (K3)
CO3	design infrastructure architecture of an application and document key elements of architecture	Applying (K3)
CO4	construct application framework components and perform code review and analysis	Applying (K3)
CO5	apply various testing methods and rolling out an enterprise 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	1	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	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)

22ITE31- WEB APPLICATION SECURITY							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Web Technology**	**8**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course deals with various components of web application from the security point of view and imparts knowledge of web application testing methodologies.	
Unit - I	**Security Fundamentals and Security Principles**	**9**
Web Security Fundamentals- Input Validation, Attack surface reduction, classifying and prioritizing threads, Authentication-Securing Password, Best Practices, Authorization - Access control - Session Management - Securing web application session management		
Unit - II	**Browser and Database Security Principles**	**9**
Browser security principles - cross-site scripting - cross-site request forgery- Database security principles – SQL injection - setting database permissions - stored procedure security- Insecure Direct object references		
Unit - III	**File security and Security Methodologies**	**9**
File security principles - source code secret - forceful browsing - directory traversal - secure development methodologies - application security - industry standard secure development methodologies and maturity models - SDL - CLASP- SAMM – BSIMM		
Unit - IV	**Web Testing Fundamentals**	**9**
Web Application Testing Fundamentals - Basic Observation -Viewing a Page's HTML Source, Advanced - Observing Live Request Headers with Firebug - Observing Live Post Data with Web Scarab - Seeing Hidden Form Fields - Observing Live Response Headers with Tamper Data – Web Oriented Data Encoding		
Unit - V	**Bypass client-side input validation and Session Manipulation**	**9**
Automating with LibWWWPerl, Seeking Design Flaws, Attacking AJAX, Manipulating Sessions -Finding Session Identifiers in Cookies – Finding Session Identifiers in Requests - Finding Authorization Headers - Analyzing Session ID Expiration - Analyzing Session Identifiers with Burp		
		Total:45

TEXT BOOK:

1.	Bryan Sullivan, Vincent Liu, "Web Application Security- A Beginner's Guide", 1st Edition, McGrawHill Education, New Delhi, 2011. (For Units I, II, III)
2.	Paco Hope, Ben Walther, "Web Security Testing Cookbook", 1st Edition, O'Reilly Media, 2009. (For Units IV,V)

REFERENCES:

1.	Georgia Weidman, "Penetration Testing: A Hands-on Introduction to Hacking", 1st Edition, No Starch Press, San Francisco, USA, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	illustrate web security fundamentals, authentication and authorization	Applying (K3)
CO2	apply the principles of browser security and database security	Applying (K3)
CO3	make use of file security and secure development methodologies	Applying (K3)
CO4	build various testing techniques for web application	Applying (K3)
CO5	identify client side validation and secure session manipulation for web 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	1	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	30	50	20				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)

22ITE32 - WIRELESS SENSOR NETWORKS							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Computer Networks**	**8**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course provides the fundamental concepts of wireless sensor networks and explains functionalities of different layers. It also helps to devise appropriate node and network management strategies and further throws light on sensor networks security.	
Unit - I	**Introduction**	**9**
Introduction-Motivation and Wireless Sensor Nodes: Definitions and Background, Challenges and Constraints - Applications: Structural Health Monitoring, Traffic Control, Health Care, Pipeline Monitoring, Precision Agriculture, Active Volcano, Underground Mining - Node Architecture: The Sensing Subsystem, The Processor Subsystem, Communication Interfaces, Prototypes - Operating Systems: Functional Aspects, Nonfunctional Aspects, Prototypes, Evaluation.		
Unit - II	**Basic Architectural Framework and Medium Access Control**	**9**
Physical Layer: Basic Components, Source Encoding, Channel Encoding, Modulation, Signal Propagation. Medium Access Control: Overview, Wireless MAC Protocols, Characteristics of MAC Protocols in Sensor Networks, Contention-Free MAC Protocols, Contention-Based MAC Protocols, and Hybrid MAC Protocols.		
Unit - III	**Routing Protocols and Power Management**	**9**
Network Layer: Overview, Routing Metrics, Flooding and Gossiping, Proactive Routing, On-Demand Routing, Hierarchical Routing, Location-Based Routing, QoS-based Routing Protocols. Power Management: Local Power Management Aspects, Dynamic Power Management, Conceptual Architecture.		
Unit - IV	**Node and Network Management and Localization**	**9**
Node and Network Management: Time Synchronization: Clocks and the Synchronization Problem, Time Synchronization in Wireless Sensor Networks, Basics of Time Synchronization, Time Synchronization Protocols. Localization: Overview, Ranging Techniques, Range-Based Localization, Range-Free Localization, Event-Driven Localization.		
Unit - V	**Security and Sensor Network Programming**	**9**
Security: Fundamentals of Network Security, Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks, Protocols and Mechanisms for Security, IEEE 802.15.4 and ZigBee Security. Sensor Network Programming: Challenges in Sensor Network Programming, Macro programming, Dynamic Reprogramming, Sensor Network Simulators.		
		Total:45

TEXT BOOK:

1. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", 1st Edition, John Wiley & Sons, 2011.

REFERENCES:

1. Mohammad S. Obaidat, Sudip Misra, "Principles of Wireless Sensor Networks", 1st Edition, Cambridge University Press, London, 2014.
2. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks", 1st Edition, Elsevier, 2004.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the basic concepts of wireless sensor networks in real life applications	Applying (K3)
CO2	illustrate the basic architectural framework using physical and MAC layer protocols	Applying (K3)
CO3	utilize various ranking layer protocols for inter and intra communication patterns	Applying (K3)
CO4	apply different synchronization and localization algorithms for managing node and network level functions	Applying (K3)
CO5	plan how to tackle various challenges of security in wireless sensor 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	1	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	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)

22ITE33 - REALTIME PROGRAMMING FOR EMBEDDED SYSTEMS

Programme & Branch	B. Tech & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Python and C Programming, Operating Systems	8	PE	3	0	0	3

Preamble	This course provides knowledge on real-time programming with embedded systems using raspberry pi.	
Unit - I	**Exploring Embedded Linux Systems**	**9**
Introducing Embedded Linux - Managing Linux Systems - Raspberry Pi Hardware: Introduction to the Platform - RPi Documentation - The RPi Hardware-Raspberry Pi Accessories - HATs - Raspberry Pi Software: Linux on the Raspberry Pi -Connecting to a Network - Communicating with the RPi - Controlling the Raspberry Pi - Configuring the Raspberry Pi.		
Unit - II	**Programming on the Raspberry Pi**	**9**
Introduction - Scripting Languages - Dynamically Compiled Languages - C and C++ on the RPi - Overview of Object - Oriented Programming - Interfacing to the Linux OS - Improving the Performance of Python - Interfacing to the Raspberry Pi Input/Outputs: Introduction - General-Purpose Input/Outputs - C++ - Control of GPIOs using sysfs - Memory-Based GPIO Control.		
Unit - III	**Cross-Compilation and the Eclipse IDE**	**9**
Setting up a Cross - Compilation Tool chain - Cross-Compilation using Eclipse - Building Linux - Interfacing to the Raspberry Pi Buses: Introduction to Bus Communication - I^2C - SPI - UART - Logic-Level Translation.		
Unit - IV	**Interacting with the Physical Environment**	**9**
Interfacing to Actuators, Interfacing to Analog Sensors, Interfacing to Local Displays, Building C/C++ Libraries - Real-Time Interfacing using the Arduino: The Arduino - An Arduino Serial Slave - An Arduino I2C Slave - An Arduino SPI Slave - Programming the Arduino from the RPi Command Line		
Unit - V	**The Internet of Things**	**9**
The Internet of Things (IoT) - The RPi as an IoT Sensor - The RPi as a Sensor Web Server - A C/C++ Web Client - The RPi as a "Thing" - Large-Scale IoT Frameworks - The C++ Client/Server - IoT Device Management.		
		Total:45

TEXT BOOK:

1. Derek Molloy, "Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux", 1st Edition, John Wiley & Sons Inc., Indianapolis, 2016

REFERENCES:

1. Qing Li, Caroline L.Yao, "Real-Time Concepts for Embedded Systems", 1st Edition, CMP Books, UK, 2003.
2. Rajkamal, "Embedded Systems Architecture, Programming and Design", 3rd Edition, McGraw-Hill, New Delhi, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	interpret various hardware and software features in embedded programming using Raspberry Pi.	Applying (K3)
CO2	experiment with programming and interfacing of Raspberry Pi hardware.	Applying (K3)
CO3	manipulate cross compilation tools and bus communication of Raspberry Pi.	Applying (K3)
CO4	illustrate interfacing concepts with real physical environment and Arduino	Applying (K3)
CO5	apply embedded programming knowledge for IoT applications development	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	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)

22ITE34 - INFORMATION STORAGE AND MANAGEMENT							
Programme & Branch	**B. Tech & Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Database Management Systems**	**8**	**PE**	**3**	**0**	**0**	**3**

Preamble	This course provides an insight into the recent technologies in Information storage and describes various operations involved in it.

Unit - I	**Introduction to Information storage**	**9**

Introduction to evolution of storage architecture - Data center Infrastructure - Virtualization and cloud computing - data center environment: Application - DBMS – Host (or computer) - connectivity- storage - Disk drive components - Disk drive performance. Data Protection: RAID implementation methods - RAID array components - RAID techniques - RAID levels – RAID impact on Disk performance - Components of an intelligent storage system - storage provisioning

Unit - II	**Storage Networking Technologies**	**9**

Fibre channel SAN components - FC connectivity – Fibre channel architecture – Fabric services – switched fabric login types – zoning - FC SAN topologies - virtualization in SAN, IP SAN and FCoE: iSCSI - iSCSI Topologies – FCIP - FCoE - Network Attached Storage: purpose - benefits - components - NAS I/O Operation - NAS Implementations - NAS file sharing protocols - File level virtualization - Object based storage devices - content addressed storage - CAS Use Cases - Unified storage

Unit - III	**Backup, Archive and Replication**	**9**

Information Availability - Business continuity terminology - planning life cycle - failure analysis – business impact analysis – BC technology solutions – automatic path failover - Backup and archive: Backup purpose, considerations, granularity, methods, architecture, backup and restore operations and topologies. Backup in NAS environments - Backup targets - Data Deduplication for backup - Backup in virtualized environments - Data archive - Archiving Solution Architecture – Local replication: Replication Terminology – Replica Consistency – local replication technologies - Remote replication technologies

Unit - IV	**Cloud Computing**	**9**

Cloud Computing: Cloud Enabling Technologies **-** Definition of Cloud computing, Characteristics of cloud computing, benefits, cloud service models - deployment models - Cloud computing infrastructure - cloud challenges - Cloud adoption considerations.

Unit - V	**Securing and Managing Storage Infrastructure**	**9**

Securing the Storage Infrastructure: Information security Framework – Risk Triad – Storage security domain - Security Implementations in Storage Networking: FC SAN – NAS – IP SAN - Managing the storage Infrastructure: Monitoring the storage infrastructure – Storage Infrastructure Management Activities - Information lifecycle management - Storage tiering

Total:45

TEXT BOOK:

1.	EMC Education Services, "Information Storage and Management: Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments", 2nd Edition, Wiley, 2015.

REFERENCES:

1.	Anthony T Velte, "Cloud Computing: A practical Approach", 1st Edition, Tata McGraw-Hill, New Delhi, 2009.
2.	Mark Lippitt and Erik Smith, "Networked Storage Concepts and Protocols Tech book", V2.3 Edition, EMC Tech books, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	outline different implementations of storage systems like virtualization and RAID	Applying (K3)
CO2	illustrate various storage networking technologies and demonstrate the effectiveness of NAS	Applying (K3)
CO3	interpret the concept of storage management and data backup in virtualized environment	Applying (K3)
CO4	outline the cloud architecture and practice on public clouds	Applying (K3)
CO5	interpret the need for security in storage networking	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	40	50	10				100
CAT2	30	50	20				100
CAT3	30	50	20				100
ESE	20	50	30				100

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

22ITE35 - SOFTWARE PROJECT MANAGEMENT

Programme & Branch	B. Tech & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Software Engineering	8	PE	3	0	0	3

Preamble	This course provides knowledge about project management activities which include project evaluation, planning, estimation, monitoring and control essential for software projects.

Unit - I	Introduction to Software Project Management	9

Introduction - Importance – Types of project – Activities – Plans, methods and methodologies – Ways of Categorizing software projects – Stakeholders – Setting objectives – Business case – Project success and failure - Management and management control – Traditional vs. Modern project management practices. Project Evaluation: Introduction – A business case – Project Portfolio Management – Evaluation of Individual Projects – Cost Benefit Evaluation Techniques – Risk Evaluation – Programme management – Managing the allocation of resources within programme – Strategic programme management – Creating a programme – Aids to programme management – Reservations about programme management – Benefits.

Unit - II	Project Planning	9

Project Planning: Introduction – Select project - Identify project scope and objectives, Identify project infrastructure – Analyse project characteristics – Identify project products and activities – Estimate effort for each activity – Identify activity risks - Allocate Resources – Review plan – Execute plan. Software Effort Estimation : Introduction – Estimates – Problems with over and under estimates – Basis for software estimation – Software effort estimation techniques – Bottom-up Estimating – Top down approach and parametric models – Expert Judgement – Estimating by analogy – Albrecht Function Point Analysis – Function Points Mark II - COSMIC Full Function Points – COCOMO II.

Unit - III	Activity Planning	9

Activity Planning: Objectives – Project Schedule – Projects and Activities - Sequencing and Scheduling Activities – Network Planning Models – Formulating a network modes - Time dimension - Forward Pass – Backward Pass – Identifying the critical path - Activity Float – Shortening the Project Duration – Identifying critical activities - Activity on Arrow Networks. Risk Management: Risk – Categories of Risk – Framework for dealing with risk – Risk Identification – Risk Assessment – Risk Planning – Risk management – Evaluating risks to the schedule – Applying the PERT Technique – Monte Carlo Simulation – Critical chain concepts.

Unit - IV	Monitoring and Control	9

Monitoring and Control: Creating Framework – Collecting the Data – Review - Visualizing Progress – Cost Monitoring – Earned Value Analysis – Prioritizing Monitoring – Getting Project Back to Target – Change Control. Managing Contracts: Introduction – Types of Contract – Stages In Contract Placement – Typical Terms of a Contract – Contract Management – Acceptance.

Unit - V	Managing People	9

Managing People: Introduction – Understanding Behaviour – Organizational Behaviour: A Background – Selecting the Right Person for The Job – Instruction in the best methods – Motivation – The Oldham–Hackman Job Characteristics Model – Stress –Health and Safety. Working in Teams: Introduction - Becoming a Team – Decision Making – Organizational & Team Structures – Coordination Dependencies – Dispersed and virtual teams – Communication Generes – Communication Plans – Leadership.

Total:45

TEXT BOOK:

1. Bob Hughes, Mike Cotterell and Rajib Mall, "Software Project Management", 6th Edition, Tata McGraw Hill, New Delhi, 2018.

REFERENCES:

1. Pankaj Jalote, "Software Project Management in Practice", 8th Edition, Pearson Education, 2002.
2. Watts S. Humphrey, "PSP: A self-improvement process for software engineers", 1st Edition, Addison-Wesley, 2005.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	carry out the process of software project management	Applying (K3)
CO2	build a project plan and calculate the efforts required.	Applying (K3)
CO3	organize planning, schedule and sequence activities and determine the risks.	Applying (K3)
CO4	develop visualization charts to monitor the progress of projects and manage the contracts	Applying (K3)
CO5	outline the methods of managing people and organising teams.	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	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	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)

22ITO01 - ARTIFICIAL INTELLIGENCE							
(Offered by Department of Information Technology)							
Programme & Branch	**All BE/BTech branches except Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5**	**OE**	**3**	**1**	**0**	**4**

Preamble	This course focuses on the methodology of how to translate a data driven business problem into an effective solution by using powerful AI technologies and Machine Learning paradigm.	
Unit - I	**Introduction to Artificial Intelligence**	**9+3**
Introduction– Definition, Symbolic and Non-Symbolic Representation, Research Focus of Artificial Intelligence. Artificial Intelligence: History, Applications, Objectives, Artificial Intelligence Programming and future of AI.		
Unit - II	**Machine Learning Definition and Basics**	**9+3**
Introduction- Resurgence of ML, Relation with Artificial Intelligence (AI), Machine Learning Problems. Mathematical needs – Basics of Matrices, Numerical Methods, Probability and Statistics, Linear Algebra and Differential Calculus towards Machine Learning.		
Unit - III	**Machine Learning Categories and Tool Box**	**9+3**
Supervised Learning – Unsupervised Learning – Reinforcement Learning – ML Toolbox: Data – Infrastructure - Algorithms. Advanced Toolbox: Big data – Infrastructure – Advanced Algorithms. Machine Learning tool kit in MATLAB.		
Unit - IV	**Data Scrubbing and Setting up your Data**	**9+3**
Data Scrubbing: Feature Selection – Row Comparison – One hot Encoding – Binning – Handling Missing Data – Calculation of Mean, Variance and Standard Deviation. Setting up your Data: Generalization of Data – Train and Test segments – Deciding of total quantity of data needed – Cross Validation.		
Unit - V	**Basics of Regression, Clustering and Error Measurements**	**9+3**
Linear Regression – Multilinear Regression - Logistic Regression – Clustering: K-Nearest Neighbors – K Means – Setting K. Bias and Variance. Error calculation: Mean Absolute Error (MAE) - Root Mean Squared Error (RMSE) - Relative Squared Error (RSE) - Relative Absolute Error (RAE) - Coefficient of Determination (R2 or R-squared)		
Lecture:45, Tutorial:15, Total:60		

TEXT BOOK:

1. Oliver Theobald, “Machine Learning for Absolute Beginners”, Independently Published, 2nd Edition, 2017.

REFERENCES:

1. Rajendra Akerkar, “Introduction to Artificial Intelligence”, PHI Learning Pvt Ltd, 2nd Edition, 2014.
2. Gopinath Rebala, Ajay Ravi, Sanjay Churiwala, “An Introduction to Machine Learning”, Springer, 1st Edition, 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	illustrate AI-based problems, and identify its key competitive advantages and issues.	Applying (K3)
CO2	plan to relate machine learning basics and the importance of mathematics towards machine learning technologies.	Applying (K3)
CO3	use toolbox for basic methods for different AI-based applications	Applying (K3)
CO4	organize pre-processing on data to be used in machine learning models	Applying (K3)
CO5	formulate own learning model for a specified AI 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	1	1		3	3	3	2	2	3			
CO2	3	2	1	1		3	3	3	2	2	3			
CO3	3	2	1	1		3	3	3	2	2	3			
CO4	3	2	1	1		3	3	3	2	2	3			
CO5	3	2	1	1		3	3	3	2	2	3			

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

ASSESSMENT PATTERN - THEORY

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

22ITX01 - NEXT GENERATION DATABASES							
(Offered by Department of Information Technology)							
Programme & Branch	**All BE/BTech branches except Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Web Technology**	**5**	**OE**	**3**	**0**	**2**	**4**

Preamble	This course provides an understanding of how to use Django framework to create a complete static and dynamic website from scratch very easily. The course also covers the integration of databases with Django in order to get a complete application. In addition, the course also introduces NoSQL and HDFS databases.	
Unit - I	**Introduction to Django, Templates and Models**	**9**
Installing Django , Starting a project, Views and URLconfs : generating static and dynamic contents –URLConfs and loose coupling – Dynamic URLs, Templates : Template System basic – using Template System – Basic template tags and Filters – Limitations – Using templates in views – template loading - Inheritance, Models : MTV Development pattern – Configuring database – defining Models in Python – Installing the Model – Data Access - Adding Model String Representations - Inserting and Updating Data - Selecting Objects - Deleting Objects .		
Unit - II	**Forms, Advanced Templates and Models in Django**	**9**
The Django Admin Site : Activating the Admin Interface - Using the Admin Site - Adding Your Models to the Admin Site - Customizing Field Labels - Custom ModelAdmin classes - Users, Groups, and Permissions, Forms : Simple validation - Making a Contact Form - Tying Form Objects Into Views – Working with form fields, Advanced Views and URLconf, Advanced Templates : RequestContext and Context Processors - Automatic HTML Escaping -Extending the Template - Writing Custom Template Loaders - Configuring the Template System in Standalone Mode, Advanced Models		
Unit – III	**Session Management, caching and Database integration**	**9**
Generic Views: Generic Views of Objects - Extending Generic Views, Deploying Django : Django with Apache, mod_python and FastCGI, Generating Non-HTML content : views and MIME-types - Producing CSV and PDFs - Syndication Feed Framework, Sessions, users and registration: Framework – Authentication – Permission – Groups – Messages, Caching : Setting Up the Cache - The Per-Site Cache -The Per-View Cache - Template Fragment Caching, Integrating with databases.		
Unit – IV	**NoSQL Databases**	**9**
Introduction to MongoDB – Term used in RDBMS and MongoDB – Data Types in MongoDB – MongoDB Query Language – Introduction to Apache Cassandra – CRUD operations –Collections – Using a counter – Time to Live – Alter Commands – Import and Export – Querying System Tables.		
Unit - V	**Big Data Storage Systems**	**9**
Introduction to Hive – Hive Architecture – Hive Data Types – Hive File Format – Hive Query Language – DDL – DML – Starting Hive Shell – Database – Tables – Partitions – Bucketing – Views – Subquery – Joins – Aggregation – Group by and Having –RCFile Implementation – User Defined Function.		

LIST OF EXPERIMENTS / EXERCISES:

1.	Create a simple Django application with static and dynamic content
2.	Develop a Django application using templates and models
3.	Implement form processing in Django
4.	Develop a Django Admin site
5.	Create RSS and Atom feeds using Syndication Feed Framework
6.	Session management in Django
7.	Implement CRUD operations in MongoDB
8.	Create and use collections in MongoDB
9.	Implement DML and DDL in Hive
10.	Implement joins, Aggregation and GroupBy/Having in Hive

Lecture:45, Practical:30, Total:75

TEXT BOOK:	
1.	Adrian Holovaty, Jacob Kaplan Moss, “The Django Book Release 2.0”, A press, 2013. (For Units I,II,III)
2.	Seema Acharya and Subhashini Chellappan, "Big Data and Analytics", 1st Edition, Wiley India Pvt. Ltd, 2015. (For Units IV, V)
REFERENCES/ MANUAL / SOFTWARE:	
1.	Andrew Pinkham, “Django unleashed”, Sams Publishing, 1st Edition, 2015
2.	Beau Curtin, “Django Cookbook: Web Development with Django Step by Step Guide”, 2nd Edition, 2016

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	develop static and dynamic web content using Django templates with models	Applying (K3), Precision (S3)
CO2	create Django user models, templates and forms and develop simple web applications	Applying (K3), Precision (S3)
CO3	build Django applications using sessions and databases	Applying (K3), Precision (S3)
CO4	identify the significant features of NOSQL Databases	Applying (K3), Precision (S3)
CO5	apply the bigdata storage concepts using Hive	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	3	3	3	3	2	2	3			
CO2	3	2	1	1	3	3	3	3	2	2	3			
CO3	3	2	1	1	3	3	3	3	2	2	3			
CO4	3	2	1	1	3	3	3	3	2	2	3			
CO5	3	2	1	1	3	3	3	3	2	2	3			

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

ASSESSMENT PATTERN - THEORY

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

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

22GEX02 - NCC STUDIES (AIRWING) – I							
(Offered by Department of Information Technology)							
Programme & Branch	**All BE/BTech branches except Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**5**	**OE**	**3**	**1**	**0**	**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:15, Total:60

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										
CO6														
CO7														
CO8														

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

ASSESSMENT PATTERN - THEORY

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

22ITX02 - ADVANCED JAVA ROGRAMMING							
(Offered by Department of Information Technology)							
Programme & Branch	**All BE/BTech branches except Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**6**	**OE**	**3**	**0**	**2**	**4**

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 – Features - Advantages, Microservices, System Requirements, Setting up the environment, 12-factor app, Spring Initializr, 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**
Introduction – Data Type Conversion – Operators – Arrays – Strings Comparisons – String Processing: Searching for Expressions – Representing Patterns – Finding Matches – Character Classes – Finding Multiple Instance of a Pattern – Regular Expressions – Form Processing – Database Connectivity – Session Tracking.		

LIST OF EXPERIMENTS / EXERCISES:

1.	Build simple micro services using Java
2.	Develop a simple web application Maven and Gradle
3.	Utilize Bootstrap Application Context and Spring Boot Starter Dependencies to configure a web application
4.	Develop a simple web application to access relational data using JdbcTemplate in SpringBoot
5.	Implement advanced search operations in a relational data from your web application using Query methods in Spring Data JPA
6.	Create a RESTFul API using SpringBoot and consume it in your web application
7.	Create a secured web application using various security features in SpringBoot
8.	Implementation of fault tolerance and load balancing in your microservices using Resilience4J
9.	Testing your web application and RestFul Web Serives
10.	Deploying your web application using Docker and Containerization

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:

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.

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	Demonstrate thecommon 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	Implement Resilience4J and Swagger API and host the apps on Cloud.	Applying (K3), Precision (S3)
CO5	Learn to demonstrate 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	1			3	3	3	2	2	3			
CO2	3	2	1			3	3	3	2	2	3			
CO3	3	2	1			3	3	3	2	2	3			
CO4	3	2	3	2	1	3	3	3	2	2	3			
CO5	3	2	3	2	1	3	3	3	2	2	3			

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	5	20	75				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)

22ITO02 - INTERNET OF THINGS							
(Offered by Department of Information Technology)							
Programme & Branch	**All BE/BTech branches except Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Computer Networks**	**6**	**OE**	**3**	**1**	**0**	**4**

Preamble	This course provides an introduction to Internet of Things and its technologies that enable the students to develop real world applications using it.	
Unit - I	**Introduction to Internet of Things**	**9+3**
Introduction to Internet of Things: Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT Communication Models - IoT Communication APIs – IoT enabled Technologies – Wireless Sensor Networks - Cloud Computing – Big data analytics – Communication Protocols- Embedded Systems – IoT Levels and Templates.		
Unit - II	**Design Methodology and Endpoints**	**9+3**
M2M – Difference between M2M &IoT – Software defined networks – Network function Virtualization – IoT Platform design Methodologies – Domain Specific IoT – Home Automation – Smart Agriculture.**Endpoints:** Introduction to Raspberry PI – Interfaces: serial- SPI- 12C- Programming –Interfacing with external gadgets – controlling output – reading input from pins – Modern IoT controllers.		
Unit - III	**IoT Protocols**	**9+3**
IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4,802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, ConstrainedNodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing overLow Power and Lossy Networks – Application Transport Methods: Supervisory Control and DataAcquisition – Application Layer Protocols: CoAP and MQTT.		
Unit - IV	**Data Analytics and Supporting Services**	**9+3**
Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning –No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analyticsand Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django –AWS for IoT – System Management with NETCONF-YANG.		
Unit - V	**IoT Seurity and Case Studies**	**9+3**
Attacks and Countermeasures – Authentication and Authorization at IoT Layers – Other security features and related issues – Middleware – Cross Layer security – Privacy and Risk Mitigations – Blockchain – 5G – Fog and Edge Computing. **IoT USECASES**: Asset Management The Smart Grid Commercial Building Automation Smart Cities.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1.	Arshdeep Bahga and Vijay Madisetti, "Internet of Things – A Hands-on Approach", 1st Edition, University Press, 2015. (For Units I, II, V)
2.	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, 2017. (For Units III, IV)

REFERENCES:

1.	Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", 1st Edition, CRC Press, 2012
2.	Madhusanka Liyanage, An Braeken, Pradeep Kumar, Mika Ylianttila, “IoT Security: Advances in Authentication”, Wiley Publications, 2020. (For Unit V)
3.	https://aws.amazon.com/

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	make use of IoT architecture, infrastructure and constraints of Internet of Things	Applying (K3)
CO2	utilize the design methodologies for IoT applications and experiment with simple applications using Raspberry Pi	Applying (K3)
CO3	apply the IoT protocols for local and global connectivity	Applying (K3)
CO4	develop IoT products with the use of data analytics and supporting services	Applying (K3)
CO5	identify the security challenges and opportunities in the different domains of Internet of Things	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	3	3	2	2	3			
CO2	3	2	1	1		3	3	3	2	2	3			
CO3	3	2	1	1		3	3	3	2	2	3			
CO4	3	2	1	1		3	3	3	2	2	3			
CO5	3	2	1	1		3	3	3	2	2	3			

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

ASSESSMENT PATTERN - THEORY

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

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

22ITO03 - FUNDAMENTALS OF SOFTWARE DEVELOPMENT

(Offered by Department of Information Technology)

Programme & Branch	**All BE/BTech branches except Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**6**	**OE**	**3**	**1**	**0**	**4**

Preamble	This course provides knowledge on basic concepts of software construction, Quality of code and Effective coding in software development	
Unit - I	**Foundation on Software Construction**	**9+3**
Software Construction – Metaphors – Upstream Prerequisites: Importance of Prerequisites-Determining the kind of Software, Problem-Definition, Requirement, Architecture Prerequisites-Amount of time to spend on Upstream Prerequisites – Key Construction Decisions: Choice of Programming Language - Programming Conventions - Selection of Major Construction Practices.		
Unit - II	**Creating High–Quality Code**	**9+3**
Design in Construction: Design Challenges and Concepts - Design Building Blocks and Practices - Working Classes: Class Foundation – Interfaces - Design and Implementation Issues - Reason for Class Creation - High-Quality Routines- Defensive Programming: Assertion - Error-Handling Techniques - Exceptions.		
Unit - III	**Variables**	**9+3**
General Issues in using Variables -The Power of Variable Names - Fundamental Data Types - Unusual Data Types – Statements: Organizing Straight-Line Code - Using Conditionals - Controlling Loops - Unusual Control Structures- General Control Issues: Boolean Expressions - Compound and null Statements.		
Unit - IV	**Code Improvements**	**9+3**
The Software-Quality Landscape: Characteristics - Techniques for improvement - Relative Effectiveness of Quality Techniques - Quality Assurance - Collaborative Construction – Developer Testing – Debugging – Introduction to Refactoring – Code tuning Strategies and Techniques.		
Unit - V	**System Considerations**	**9+3**
Program size Vs Construction – Managing Construction – Integration – Programming Tools.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1.	Steve McConnell, “Code Complete - A practical handbook of software construction”, 2nd edition, Microsoft press, 2006.

REFERENCES:

1.	Ali Bahrami, "Object Oriented Systems Development", 1st Edition, Tata McGraw-Hill, New Delhi, 2008.
2.	Infosys spring board contents provided by Infosys at https://infyspringboard.onwingspan.com/web/en/page/home

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	plan for software construction prerequisites and key construction decisions	Applying (K3)
CO2	develop the ability to create high-quality code that adheres to best practices and standards in software development	Applying (K3)
CO3	acquire a comprehensive understanding of variables, data types, statements, and control structures to write efficient, organized, and error-free code for solving complex problems	Applying (K3)
CO4	gain a comprehensive understanding of software quality and effective techniques for improving it, including quality assurance, collaborative construction, testing, debugging, refactoring, and code tuning	Applying (K3)
CO5	develop skills in managing program size and construction, integrating software components, and using programming tools to develop efficient and scalable software solutions.	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	3	3	2	2	3			
CO2	3	2	1	1		3	3	3	2	2	3			
CO3	3	2	1	1		3	3	3	2	2	3			
CO4	3	2	1	1		3	3	3	2	2	3			
CO5	3	2	1	1		3	3	3	2	2	3			

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

ASSESSMENT PATTERN - THEORY

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

22ITO04 - MOBILE APPLICATION DEVELOPMENT							
(Offered by Department of Information Technology)							
Programme& Branch	**All BE/BTech branches except Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Java Programming**	**6**	**OE**	**3**	**1**	**0**	**4**

Preamble	This course provides knowledge on developing mobile applications using Android.	
Unit – I	**Introduction to Android**	**9+3**
Introduction – Android Architecture – Environmental setup – Develop simple Hello World application – App Folder structure - Android virtual device - Application Components –Toast message - Activity – Activity Life cycle – Log messages.		
Unit – II	**Layout and UI**	**9+3**
Intent –types - Intent filters - Views – Layouts - UI components: Text View, Edit Text, Button, Toggle Button, Radio Group, Check Box, AutoComplete Text View, Progress Bar, Rating Bar – Event Listeners and Handlers.		
Unit – III	**Resources and Alerts**	**9+3**
Resources overview – Styles and Themes - Menu: Option menu, Context menu – Notification – Broadcast receivers – Web View - Phone call.		
Unit – IV	**Storage**	**9+3**
Introduction to Storages - Bundle - SQL Lite: CRUD operations - Content providers – Shared preferences - JSON parsing		
Unit – V	**Services and Sensors**	**9+3**
Services –Sending SMS – Sensors: Motion and Position - Accessing geo location – Basic Animations: rotate, fade, zoom, slide and move.		

Lecture:45, Tutorial:15,Total:60

TEXT BOOK:

1. John Horton, “Android Programming for Beginners”, 3rd Edition, Packt Publishing, 2021

REFERENCES:

1. Bill Phillips, Chris Stewart and Kristin Marsicano, “Android Programming”, 3rd Edition, BigNerd Ranch Guides, 2017.
2. https://developer.android.com

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Illustrate the steps to create android application and discuss its activity life cycle	Applying (K3)
CO2	develop an Android application using Layouts, UI components with event handling	Applying (K3)
CO3	design styles, themes and menu	Applying (K3)
CO4	plan to execute CRUD operations on SQLite	Applying (K3)
CO5	build applications using services, animations and sensors	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	2	3	3	3	2	2	3			
CO2	3	2	1	1	2	3	3	3	2	2	3			
CO3	3	2	1	1	2	3	3	3	2	2	3			
CO4	3	2	1	1	2	3	3	3	2	2	3			
CO5	3	2	1	1	2	3	3	3	2	2	3			

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

ASSESSMENT PATTERN - THEORY

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

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

22ITO05 - FUNDAMENTALS OF CLOUD COMPUTING							
(Offered by Department of Information Technology)							
Programme & Branch	**All BE/BTech branches except Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**OE**	**3**	**0**	**0**	**3**

Preamble	This course provides a basic introduction to cloud computing and utility computing. It also deals with analyzing a few case studies to appreciate the emergence of the cloud as the next-generation computing paradigm.	
Unit – I	**Introduction**	**9**
Introduction to Cloud Computing – Roots of Cloud Computing – Desired Features of Cloud Computing – Challenges and Risks – Benefits and Disadvantages of Cloud Computing.		
Unit – II	**Virtualization**	**9**
Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices – Virtualization Support and Disaster Recovery.		
Unit – III	**Cloud Architecture, Services And Storage**	**9**
NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage.		
Unit – IV	**Resource Management and Security In Cloud**	**9**
InterCloud Resource Management – Resource Provisioning Methods – Security Overview – Cloud Security Challenges – Data Security –Application Security – Virtual Machine Security.		
Unit – V	**Case Studies**	**9**
Google App Engine (GAE) – GAE Architecture – Functional Modules of GAE – Amazon Web Services (AWS) – Microsoft Azure – Cloud Software Environments – Eucalyptus – Open Nebula – Open Stack.		
		Total:45

TEXT BOOK:

1.	Buyya R., Broberg J., Goscinski A., “Cloud Computing: Principles and Paradigm”, 1st Edition, John Wiley & Sons, 2011. (For Unit I)
2.	Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2017. (For Units II,III,IV,V)

REFERENCES:

1.	Rittinghouse, John W., and James F. Ransome, “Cloud Computing: Implementation, Management and Security”, CRC Press, 2017.
2.	Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, “Mastering Cloud Computing”, Tata McGraw Hill, 2013
3.	Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach”, Tata McGraw Hill, 2009

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	summarize the main concepts, key technologies, strengths, and limitations of cloud computing and identify suitable scenarios for moving to the cloud platform.	Applying (K3)
CO2	interpret the role of virtualization as the key enabling technology that helped in the development of the cloud platform	Applying (K3)
CO3	develop the ability to understand and use the architecture of compute cloud and storage cloud services and delivery models	Applying (K3)
CO4	examine the core issues of cloud computing architecture namely resource management and security.	Applying (K3)
CO5	experiment with several public cloud offerings and cloud development tools to choose the appropriate service provider for one's requirements.	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	2	3	3	3	2	2	3			
CO2	3	2	1	1	2	3	3	3	2	2	3			
CO3	3	2	1	1	2	3	3	3	2	2	3			
CO4	3	2	1	1	2	3	3	3	2	2	3			
CO5	3	2	1	1	2	3	3	3	2	2	3			

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

ASSESSMENT PATTERN - THEORY

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

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

22ITO06 - INTRODUCTION TO ETHICAL HACKING							
(Offered by Department of Information Technology)							
Programme & Branch	**All BE/BTech branches except Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**OE**	**3**	**0**	**0**	**3**

Preamble	This course provides basic knowledge about different kinds of hacking methods and their countermeasures.	
Unit- I	**Introduction to Hacking**	**9**
Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing - Numbering Systems. - Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security		
Unit- II	**Foot printing & Scanning**	**9**
What is foot printing? - Internet Foot printing- Scanning – Determining if the system is alive – Determining which services are running or Listening – Detecting the operating system – Processing and storing scan data.		
Unit- III	**Enumeration**	**9**
Enumeration - basic banner grabbing- Enumerating Common Network services and its countermeasures. Hacking Windows – Unauthenticated attacks – authenticated attacks – windows security features.		
Unit- IV	**Hardware & Wireless Hacking**	**9**
Hacking Hardware – Physical access – Hacking Devices – Default Configurations – Reverse Engineering Hardware. VPN Hacking. Wireless Equipment – Discovery and monitoring - Denial of Service Attacks – Common DoS Attack Techniques – DoS- Countermeasures - Encryption attacks –Authentication attack.		
Unit- V	**Application hacking & Countermeasures**	**9**
Web and Database Hacking – Web Server Hacking - Web application Hacking - Common web application Vulnerabilities – Database Hacking. Mobile Hacking – Hacking android – iOS.		
		Total:45

TEXT BOOK:

1.	Michael T. Simpson, Kent Backman, and James E. Corley, “Hands-on Ethical Hacking and Network Defense, Course Technology”, Delmar Cengage Learning, 2010. (For Unit I)
2.	Stuart McClure, Joel Scambray, Goerge Kurtz, “Hacking Exposed 7: Network Security Secrets and Solutions”, 7th Edition, Tata McGraw Hill Publishers, 2012. (For Units II,III,IV,V)

REFERENCES:

1.	Patrick Engebretson, “The Basics of Hacking and Penetration Testing”, SYNGRESS, Elsevier, 2013.
2.	Rafay Baloch, “Ethical Hacking and Penetration Testing Guide”, CRC Press, 2014.
3.	Kevin Beaver, “Ethical Hacking for Dummies”, 6th Edition, Wiley, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Organize a computer and network against a variety of attacks	Applying (K3)
CO2	Identify and explain the basic vulnerabilities in any computing system	Applying (K3)
CO3	Enumerate the Computer network services and determine the possible security attacks in Windows machine.	Applying (K3)
CO4	Identify and assess the vulnerabilities in hardware and wireless environment.	Applying (K3)
CO5	formulate research problems in the computer security 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	1	1	3	3	3	3	2	2	3			
CO2	3	2	1	1	3	3	3	3	2	2	3			
CO3	3	2	1	1	3	3	3	3	2	2	3			
CO4	3	2	1	1	3	3	3	3	2	2	3			
CO5	3	2	1	1	3	3	3	3	2	2	3			

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

ASSESSMENT PATTERN - THEORY

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

22ITO07 - BUSINESS CONTINUITY PLANNING							
(Offered by Department of Information Technology)							
Programme & Branch	**All BE/BTech branches except Information Technology**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**8**	**OE**	**3**	**0**	**0**	**3**

Preamble	This course introduces the concept of Business Continuity Process and Recovery from a natural or manmade disaster. It also discusses various aspects like risk evaluation, strategies, awareness and training programmes on business continuity.	
Unit - I	**Introduction:**	**9**
Introduction: Vulnerability of today's business organizations-Disaster - Classification of Disasters-Direct impact: unavailability and loss of information-Alternative Business operations –Loss of information-Indirect impact-rippling effects of business operations-Long Term Impact –Image-Market Position-Growth or decline -Risk management – Building Continuity- Rebuilding the Infrastructure-Resumption of Business activities-Business Continuity planning Strategy		
Unit - II	**Multilateral Continuity Planning:**	**9**
Multilateral Continuity Planning: Multilateral continuity planning-MCP approach-Project success factors-Benefits of multilateral continuity planning-Marketing protection: a justification for funding of total asset protection programme-Total asset protection-Brand value-Operational risk management-Senior management arrangements, systems and controls- Understanding the organization's business-Business strategy and business continuity planning-BCP within a business strategic context		
Unit - III	**Business Continuity Planning:**	**9**
Business Continuity Planning: The business continuity planning methodology - The business continuity management lifecycle-BCM programme management-Understanding the organization - A practical approach-Risk evaluation and control:practical guidelines for risk assessment-Risk evaluation and control-Business impact analysis-A walk through a comprehensive BIA-Developing business continuity strategies for the business or work areas-Business/work area recovery-Types of contingencies-Vital records and paper documentation issues-Salvage considerations		
Unit - IV	**Developing Business Continuity Strategies:**	**9**
Developing Business Continuity Strategies Business continuity for telecommunications-Business continuity strategies- General strategies-Hardware strategies-Software strategies- Network service strategies-offsite storages and facility strategies-Call centre Strategies-Strategies for communications products and services -Understanding the business information flow-Vulnerability assessment-Business challenges-Marketplace trends-Planning to recover your data – Availability-Tape backup – Disk-to-disk-High availability-WAN availability-Virtualization		
Unit - V	**Awareness and training:**	**9**
Awareness and training-Establish BC policy-Acquiring or developing training aids-Awareness through maintenance, review, audit and testing-BC plan testing – Overview – Testing – Maintenance-BC audit-Audit objective-Determining the maturity level of the organization-Defining the audit programme-Audit planning – Fieldwork-Analysis		
		Total:45

TEXT BOOK:

1.	Andrew Hiles, "The Definitive Handbook of Business Continuity Management", 2nd Edition, John Wiley& Sons, 2007

REFERENCES:

1.	Snedaker, Susan, "Business continuity & disaster recovery planning for IT professionals", 2nd Edition, Syngress, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	utilize the significance of Business Continuity Planning in the event of a disaster	Applying (K3)
CO2	illustrate multilateral continuity planning and describe organization‘s business process and Strategy	Applying (K3)
CO3	plan to carry out risk evaluation and control guidelines for risk assessment	Applying (K3)
CO4	choose appropriate Business continuity strategies for telecommunications and IT	Applying (K3)
CO5	make use of training, testing and auditing in Business continuity planning	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	3	3	2	2	3			
CO2	3	2	1	1		3	3	3	2	2	3			
CO3	3	2	1	1		3	3	3	2	2	3			
CO4	3	2	1	1		3	3	3	2	2	3			
CO5	3	2	1	1		3	3	3	2	2	3			

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

ASSESSMENT PATTERN - THEORY

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

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)

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE-638060

(AUTONOMOUS)

BOARD OF INFORMATION TECHNOLOGY

DEGREE & PROGRAMME: BTECH & INFORMATION TECHNOLOGY

HONOURS DEGREE TITLE: CYBER SECURITY

The following courses are identified to earn additional 18 credits to get a Honours degree with specialization in **Cyber Security**

S.No.	Course Code	Course Title	Credits	Prerequisites	Semester
1.	22ITH01	Mathematical Foundations for Information Security	4	Nil	5
2.	22ITH02	Secure Coding	4	Nil	5
3.	22ITH03	Modern Cryptography	4	Nil	6
4.	22ITH04	Mobile and Wireless Security	3	Nil	6
5.	22ITH05	Computer Security Audit and Assurance	3	Nil	7
		TOTAL	**18**		

22ITH01 - MATHEMATICAL FOUNDATIONS FOR INFORMATION SECURITY							
(Common to IT, AI&DS, AI&ML, CSE and CSD Branches)							
Programme& Branch	**B. Tech – IT, AI&DS, AI&ML, BE – CSE and CSD Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**5/6/7**	**HN**	**3**	**1**	**0**	**4**

Preamble	This course describes the explosive growth of security in computer systems and their interconnections via networks that have increased the dependence of both organizations and individuals on the information stored and communicated using cryptographic systems.	
Unit – I	**Elementary Number Theory**	**9+3**
Divisibility and the Euclidean algorithm- Linear Diophantine equations – Congruences: Definitions and properties– linear congruences and Quadratic congruences- residue classes- Euler's phi function – Fermat'sLittle Theorem – Chinese Remainder Theorem – Exponentiation and Discrete logarithm- Quadraticresidues – Legendre symbol – Jacobi symbol – Algebraic structures: groups, rings, fields, GF(p)fields,GF(2^n)fields, (Theorems without proof)		
Unit – II	**Simple Cryptosystems**	**9+3**
Enciphering Matrices – Encryption Schemes – Symmetric and AsymmetricCryptosystems – Substitution Cipher: Affine cipher – Vigenere Cipher- Modern Stream Ciphers: Onetime pad- LFSR -Block ciphers –Use of Block Ciphers - Hill Cipher - Transposition Cipher – MultipleEncryption –– Secure Cryptosystem – Problems in Advanced Encryption Standard(AES) – Problemsin Data Encryption Standard. (Theorems without proof)		
Unit – III	**Public Key Cryptosystems**	**9+3**
The idea of public key cryptography – The Diffie – Hellman Key Agreement Protocol - RSA Cryptosystem – Rabin cryptosystem – ElGamal cryptosystem – Signature Algorithms: RSA signature- ElGamal signature- Schnorr Signature- Digital signature standard – Knapsack problem – Zero-Knowledge Protocols : Fiat Shamir protocol– Guillou Quisquater protocol-Hash and MAC algorithms: MD5-SHA and HMAC (Theorems without proof)		
Unit – IV	**Prime Generation, Testing and Factoring**	**9+3**
Generation: Mersenne Prime, Fermat Prime, Testing:Divisibility algorithm- Fermat test- Square root test- Miller Rabin test-Factorization: Trial divisionmethod-Fermat method – Pollard rho (γ) method – continued fraction method – the quadratic seieve method. (Theorems without proof)		
Unit – V	**Number Theory and Algebraic Geometry**	**9+3**
Elliptic curves – basic facts – elliptic curvecryptosystems – elliptic curve primality test – elliptic curve factorization-Lenstra's ecc factorization –elliptic curve confidentiality and signature.(Theorems without proof)		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. William Stallings, "Cryptography and Network Security", 7th Edition, Pearson Education, New Delhi, 2017.

REFERENCES:

1. Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata McGraw-Hill Education, India, 2015.
2. Charles P Fleeger, "Security in Computing", 5th Edition, Prentice Hall of India, New Delhi, 2015.
3. Victor Shoup, "A Computational Introduction to Number Theory and Algebra", Cambridge University Press, 2005.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	construct number theory concepts in various security applications	Applying (K3)
CO2	apply symmetric key cryptography techniques for real world problems	Applying (K3)
CO3	build various public key cryptography, hashing and digital signature techniques for real case scenarios	Applying (K3)
CO4	Illustrate the techniques to generate, test and factories prime numbers	Applying (K3)
CO5	make use of elliptic curve, properties for security 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	2	1		3	3	3	2	2	3			3	2
CO2	3	2	1		3	3	3	2	2	3			3	2
CO3	3	2	1		3	3	3	2	2	3			3	2
CO4	3	2	1		3	3	3	2	2	3			3	2
CO5	3	2	1		3	3	3	2	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	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)

22ITH02 - SECURE CODING							
(Common to IT, AI&DS, AI&ML, CSE and CSD Branches)							
Programme & Branch	**B. Tech – IT, AI&DS, AI&ML, BE – CSE and CSD Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**5/6/7**	**HN**	**3**	**1**	**0**	**4**

Preamble	This course provides knowledge on basic concepts, policies, and mechanisms in designing and coding secure software systems	
Unit – I	**Introduction**	**9+3**
Software security- Security concepts-Security policy-security flaws – vulnerabilities – exploits – mitigation-Cand C++-Development Platforms-operating systems-compilers. **Strings:** Common String Manipulation Errors-String Vulnerabilities-Process Memory Organization-Stack Smashing- Code Injection- Arc Injection-Mitigation Strategies.		
Unit – II	**Pointer Subterfuge**	**9+3**
Data Locations-Function Pointers- Object Pointers-Modifying the Instruction Pointer-Global OffsetTable-The .dtors Section-Virtual Pointers-atexit(), on-exit(), longjmp()-Exception Handling-Mitigation Strategies. **Dynamic Memory Management:** Common C Memory Management Errors-Doug Lea's Memory Allocator-RtlHeap Mitigation Strategies.		
Unit – III	**Integer Security**	**9+3**
Integer Data types -Integer Conversions-Integer Error Conditions-Integer Operations – Integer Vulnerabilities- Non-exceptional Integer Logic Errors-Mitigation Strategies. **Formatted Output:**Variadic Functions-Formatted Output Functions-Exploiting Formatted Output Functions-Stack Randomization-Mitigation Strategies.		
Unit – IV	**Concurrency**	**9+3**
Introduction -Time of Check, Time of Use - Files as Locks and File Locking-File System Exploits-Mitigation Strategies. **Recommended Practices:** Secure Software Development Principles-System Quality Requirements Engineering-Threat Modeling-Use/Misuse Cases-Architecture and Design -Off-the-Shelf Software-Compiler Checks-Input Validation-Data Sanitization-Static Analysis-Quality Assurance-Memory Permissions-Defense in Depth-TSP-Secure.		
Unit – V	**Proactive Security Development Process**	**9+3**
Installing a Security Culture-The Defender's Dilemma and the Attacker's Advantage-Role of Education-Integrating Security into the Development Process-Security Principles. **Language Independent Security Issues:** Appropriate Access Control-Running with Least Privilege-Cryptographic Foibles Protecting Data-Input checking and canonicalization-Database input.		
Lecture:45, Tutorial:15, Total:60		

TEXT BOOK:

1.	Robert C. Seacord, “Secure Coding in C and C++”, SEI Series (CERT Book), Addison-Wesley, 2006.

REFERENCES:

1.	Mark Dowd, John McDonald, and JustingSchuh, “The ART of Software Security Assessment: Identifying and Preventing Software Vulnerabilities”, Addison Wesley, 2007.
2.	Michael Howard and David LeBlanc, “Writing Secure Code”, Microsoft Press, 2003.
3.	Tom Gallagher, Bryan Jeffries, Lawrence Landauer, “Hunting Security Bugs”, Microsoft Press, 2006.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	demonstrate the string manipulation errors, vulnerabilities and mitigation strategies	Applying (K3)
CO2	implement arbitrary memory write exploits, programming defects, vulnerabilities and mitigation strategies in dynamic memory management	Applying (K3)
CO3	interpret the integral security issues, correct and incorrect use of formatted output functions.	Applying (K3)
CO4	demonstrate various vulnerabilities associated with file I/O and specific development practices for improving the overall security in C code	Applying (K3)
CO5	adopt the proactive security development process and language independent 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	1	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	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)

22ITH03 - MODERN CRYPTOGRAPHY							
(Common to IT, AI&DS, AI&ML, CSE and CSD Branches)							
Programme & Branch	**B. Tech – IT, AI&DS, AI&ML, BE – CSE and CSD Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**5/6/7**	**HN**	**3**	**1**	**0**	**4**

Preamble	This course enables the students to focus on how cryptographic algorithms and protocols work and how to use them to build provably secure encryption and digital signatures.	
Unit - I	**Cryptographic Protocols**	**9+3**
Key Exchange and Entity Authentication- Identification Schemes- Commitment Schemes- Electronic Elections - Digital Cash- Probabilistic Algorithms		
Unit - II	**One-Way Functions**	**9+3**
Discrete Exponential Function- Uniform Sampling Algorithms- Modular Powers- Modular Squaring- Quadratic Residuosity Property- Formal Definition of One-Way Functions- Hard-Core Predicates- Bit Security of One-Way Functions- One-Way Functions and Pseudorandomness		
Unit - III	**Provably Secure Encryption and Digital Signatures**	**9+3**
Classical Information-Theoretic Security- Perfect Secrecy and Probabilistic Attacks- Public-Key One-Time Pads- Passive Eavesdroppers - Chosen-Ciphertext Attacks- A Security Proof in the Random Oracle Model - Security Under Standard Assumptions - Unconditional Security of Cryptosystems- The Bounded Storage Model -The Noisy Channel Model- Attacks and Levels of Security -Claw-Free Pairs and Collision-Resistant Hash Functions- Authentication-Tree-Based Signatures - A State-Free Signature Scheme.		
Unit - IV	**Transport Layer Security(TLS)**	**9+3**
Target Applications and Requirements-The TLS Protocol Suite- The TLS and SSL Family of Protocols- TLS in a Nutshell- Certificates and Certificate Authorities-The Record Protocol-The TLS Handshake Protocol- TLS 1.3 Cryptographic Algorithms-TLS 1.3 Improvements over TLS 1.2- Downgrade Protection-Single Round-Trip Handshake- Session Resumption- The Strengths of TLS Security-Authentication-Forward Secrecy-How Things Can Go Wrong-Compromised Certificate Authority-Compromised Server-Compromised Client-Bugs in Implementations		
Unit - V	**Quantum and Post-Quantum**	**9+3**
How Quantum Computers Work- Quantum Bits- Quantum Gates- Quantum Speed-Up-Exponential Speed-Up and Simon's Problem-The Threat of Shor's Algorithm- Shor's Algorithm- The Factoring Problem- Shor's Algorithm and the Discrete Logarithm Problem-Grover's Algorithm- Why Is It So Hard to Build a Quantum Computer?- Post-Quantum Cryptographic Algorithms- Code-Based Cryptography- Lattice-Based Cryptography-Multivariate Cryptography- Hash-Based Cryptography		
Lecture: 45, Tutorial: 15, Total: 60		

TEXT BOOK:

1.	Hans Delfs and Helmut Knebl, "Introduction to Cryptography: Principles and Applications", 2nd Edition, Springer Verlag, 2007. (For Units I, II, III)
2.	Wenbo Mao, "Modern Cryptography: Theory and Practice", Prentice Hall, 2003. (For Units IV,V)

REFERENCES/ MANUAL / SOFTWARE:

1.	Shaffi Goldwasser and Mihir Bellare, Lecture Notes on Cryptography, Available athttp://citeseerx.ist.psu.edu/.
2.	Oded Goldreich, "Foundations of Cryptography: Volume II Basic Applications", CRC Press, 2009.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	interpret the basic principles of cryptographic protocols	Applying (K3)
CO2	determine the ways of generating one way functions	Applying (K3)
CO3	identify the use of provably secure encryption and digital signatures	Applying (K3)
CO4	articulate the cryptographic algorithms to compose, build and analyze transport layer security	Applying (K3)
CO5	express the use of quantum and post quantum 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	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	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)

22ITH04 - MOBILE AND WIRELESS SECURITY							
(Common to IT, AI&DS, AI&ML, CSE and CSD Branches)							
Programme & Branch	**B. Tech – IT, AI&DS, AI&ML, BE – CSE and CSD Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**5/6/7**	**HN**	**3**	**0**	**0**	**3**

Preamble	This course aims to focus on the security issues in wireless networks	
UNIT – I	**Introduction to Mobile and Wireless Networks**	**9**
Cellular Networks, 1G through 3G, IEEE Network - WLAN IEEE 802.11, WPAN IEEE 802.15, WMAN IEEE 802.16, IEEE 802.20, MIH IEEE 802.21, WRAN IEEE 802.22, Mobile Internet Networks – Macro and Micro mobility – Personal mobility – SIP – Identity based mobility, NEMO and MANETs – Vulnerabilities of Wireless Networks – Review of security basics – symmetric and asymmetric cryptography, Hash functions – Electronic signatures – MAC – PKI and electronic certificate – IPSec – AAA protocol – Firewalls – Intrusion detection.		
UNIT – II	**Wi-Fi Security Architectures**	**9**
Hotspot architecture – WIDS – Rogue AP detection – IEEE 802.11 geolocation techniques – Honeypots – Passive and Active attacks – DOS attacks – Trojan attack – Dictionary Attack. Bluetooth Security – Protocol architecture – Radio physical layer – Device addressing – SCO and ACL logical transports – Security mode – Authentication and pairing – Attacks – BlueSmack.		
UNIT – III	**Security in IEEE 802.11**	**9**
WEP – WEP2 – IV collisions – RC4 weakness – 802.1x authentication -802.11i security architecture – policy negotiation – radio security policies – RADIUS – EAP – PKI – WiMAX security – TEK , KEK, IEEE 802.16e – PKMv2-RSA – Security Association – 3 way handshake – role of smart cards in WiMAX.		
UNIT – IV	**Security in Ad Hoc Networks**	**9**
Attacks to routing protocols – Security mechanisms – Auto-configuration – Key management – Self-managed PKI – Resurrecting Duckling – Group key management – Wireless Sensor Networks – Attacks – Preventive mechanisms – Intrusion tolerance – SNEP - µTELSA – TinySec – key management in WSNs.		
UNIT – V	**Security in Mobile Telecommunication Networks**	**9**
SS7 – GSM security – GRPS security – UMTS infrastructure and security – H.323 – SIP – Megaco – VoIP security flaws and countermeasures– IMS architecture – security flaws – 4G security – Protection of interception – Security issues in Mobile IP – HIP – NetLMM.		
		Total:45

TEXT BOOK:

1.	Hakima Chaouchi and Maryline Laurent-Maknavicius, “Wireless and Mobile Network Security: Security basics, Security in On-the-shelf and Emerging Technologies”, 2nd Edition, John Wiley & Sons, 2009.(For UNITS I,II,III)
2.	Pallapa Venkataram and Sathish Babu, Wireless and Mobile Network Security, 1st Edition, Tata McGrawHill, 2010.(For UNITS IV,V)

REFERENCES:

1.	Lei Chen, Jiahuang Ji, and Zihong Zhang, “Wireless Network Security: Theories and Applications”, Springer Higher Education Press, 2013.
2.	Amitabh Mishra, “Security and Quality of Service in Ad Hoc and Wireless Networks”, 1st Edition, Cambridge University Press, 2008.
3.	S. Kami Makki, Peter Reiher, Kia Makki, Niki Pissinou, Shamila Makki, “Mobile and Wireless Security and Privacy”, Springer Science, 2007.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	make use of the mathematical models of security algorithms to wireless and mobile environment	Applying (K3)
CO2	identify the specific vulnerabilities in wide range of WiFi systems	Applying (K3)
CO3	develop robust systems against state-of-the-art security attacks	Applying (K3)
CO4	plan for providing security in ad hoc networks	Applying (K3)
CO5	identify the security issues in mobile telecommunication 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	1	1		3	3	3	2	2	3		3	2
CO2	3	2	1	1		3	3	3	2	2	3		3	2
CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	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	40	40	20				100
CAT2	40	40	20				100
CAT3	40	40	20				100
ESE	40	40	20				100

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

22ITH05 - COMPUTER SECURITY, AUDIT AND ASSURANCE							
(Common to IT, AI&DS, AI&ML, CSE and CSD Branches)							
Programme& Branch	**B. Tech – IT, AI&DS, AI&ML, BE – CSE and CSD Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**5/6/7**	**HN**	**3**	**0**	**0**	**3**

Preamble	This course provides a comprehensive introduction to Information Security and discusses about legal issues, the audit process, ISO standards and certification, implementation of ISO 27001.	
UNIT – I	**Introduction**	**9**
History of Information Security – What is security? – CNSS Security Model – Components of Information Systems – balancing Information Security and Access – Information Security implementation. Systems development life cycle – The security systems development life cycle – Communities of Interest.		
UNIT – II	**The Need for Information Security and its Legal, ethical, and professional issues**	**9**
Business needs first – Threats – Attacks – Secure Software Development. Law and Ethics – US laws – international laws and legal bodies – Ethics and Information Technology – Code of Ethics and Professional Organizations.		
UNIT – III	**Audit Planning, Preparation, and Techniques**	**9**
Reasons – Audit Principles – Process of Audit Programme Management – Audit Competence and evaluation methods – Audit Responsibilities – Audit time and Process flow – Information Security and Management System (ISMS) Audit checklist. Auditor Quality and Selection – Audit script – Audit stages – Audit techniques – Collecting evidence through questions – Observation – Reporting to audit findings – Audit Team meetings – non-conformities and observations – Corrective and Preventive actions.		
UNIT – IV	**ISO 27001**	**9**
Overview of an ISMS – ISO standards that focus on an organization's ISMS – ISO/IEC standards – Scope of ISMS – Identifying applicable legislation – Risk Assessment – Information Assets and Protection – Identifying Risks – Assessing Risks – Objectives and Controls - Policies, Procedures and documented information on control risks – Resources and staff training – Monitoring and implementing ISMS – Preparing the certification for Audit.		
UNIT – V	**Asset Management**	**9**
Assets according to ISO 27001 – the importance of Assets – Asset inventory – Asset Owner – ISO 27001/ISO 27005 Risk Assessment – The six basic steps – ISO 27001 Controls – ISO2 27001 Statement of Applicability – ISO 27001 Asset Management – Responsibility for Assets – Information Classification – Media handling – BYOD.		
		Total:45

TEXT BOOK:

1.	Michael E. Whitman and Herbert. J. Mattord, "Principles of Information Security", 4th Edition, Cengage Learning, USA, 2012.
2.	Rajkumar Banoth, Narasimha Gugulothu, Aruna Kranthi Godishala, "A Comprehensive Guide to Information Security Management and Audit", CRC Press Taylor and Francis Group, USA, 2023.

REFERENCES:

1.	Joseph M.Kizza, "Computer Network Security", Springer, 2005
2.	Matt Bishop, "Introduction to Computer Security", Addison-Wesley Professional, 2005.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Plan the organization's security needs with the CNSS security model.	Applying (K3)
CO2	apply legal aspects and code of ethics in Information Security.	Applying (K3)
CO3	Organize an audit and use the best practices of ISMS.	Applying (K3)
CO4	apply ISO 27001 and conduct a risk assessment.	Applying (K3)
CO5	illustrate Asset management in compliance with ISO 27001.	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
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CO3	3	2	1	1		3	3	3	2	2	3		3	2
CO4	3	2	1	1		3	3	3	2	2	3		3	2
CO5	3	2	1	1		3	3	3	2	2	3		3	2

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