KONGU ENGINEERING COLLEGE

(Autonomous Institution Affiliated to Anna University, Chennai)

PERUNDURAI ERODE – 638 060

TAMILNADU INDIA

Estd : 1984

REGULATIONS, CURRICULUM & SYLLABI - 2020

(CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION)

(For the students admitted during 2020 - 2021 and onwards)

BACHELOR OF TECHNOLOGY DEGREE IN INFORMATION TECHNOLOGY

DEPARTMENT OF INFORMATION TECHNOLOGY

KONGU
Assuring the Best

INDEX

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638060

(Autonomous)

REGULATIONS 2020

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 2020 – 2021 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" means authorized person who is responsible for all examination related activities of the College.

xi. "Head of the Department" means Head of the Department concerned of the College.

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 in relevant branches of study.

(OR)

The candidates who hold a BSc degree (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 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, 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

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, Comprehensive Test & Viva, Entrepreneurships/Start ups and Internship 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 169.

4.2.2. Honours Degree

If a candidate earns 18 to 20 additional credits in an emerging area, then he/she can be awarded with Honours degree mentioning that emerging area as his/her specialization. The respective board of studies shall recommend the specializations for honours degree and appropriate additional courses to be studied by the candidate which shall get approval from Academic Council of the institution. A candidate shall have not less than 8.0 CGPA and no history of arrears during the entire programme to opt for the honours degree.

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

S. No.	Specializations for Honours degree in emerging areas	To be offered as Honours, Only for the following branches mentioned against the specialization
1.	Construction Technology	Civil Engineering
2.	Robotics	Mechanical Engineering
3.	Electric Vehicles	Mechanical Engineering
4.	Artificial Intelligence and Machine Learning	Mechatronics Engineering
5.	Electric Vehicles	Automobile Engineering
6.	Artificial Intelligence and Machine Learning	Electronics and Communication Engineering
7.	Electric Vehicles	Electrical and Electronics Engineering
8.	Control Systems and Sensors Technology	Electronics and Instrumentation Engineering
9.	Cyber Security	Computer Science and Engineering
10.	Data Science	Computer Science and Engineering
11.	Cyber Security	Information Technology
12.	Data Science	Information Technology
13.	Waste Technology	Chemical Engineering
14.	Food Processing and Management	Food Technology

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, comprehensive test & viva, internship and entrepreneurships/start ups during the programme to gain/exhibit the knowledge/skills.

4.3.1 Professional Skills Training/ Entrepreneurships/Start Ups

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 fifth semester and phase II in sixth 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 sixth semester vacation period. Such candidate can earn two credits for this training course in place of Professional Skills Training course II in sixth semester. He/She shall attend Professional Skills Training Phase I in fifth 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 a maximum of 2 credits per semester for two semesters each in place of either Professional Skills Training I or 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 & 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 Internships

The curriculum enables a candidate to go for full time projects 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 I Phase II 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 Value Added 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 Value Added 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.

4.4 Value Added Courses / Online Courses / Self Study Courses

The candidates may optionally undergo Value Added Courses / Online Courses / Self Study Courses as elective courses.

4.4.1 Value Added Courses: Value Added courses each with One / Two credits 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 value added 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 value added 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 eighth 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. Total number of credits of such courses during the entire programme of study cannot exceed eight.

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), 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, Project Work, Professional Skills Training / Industrial Training, Internship 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:

<table>
<tr><th>Sl. No.</th><th>Category of Course</th><th>Continuous Assessment Marks</th><th>End Semester Examination Marks</th></tr>
<tr><td>1.</td><td>Theory / Practical</td><td>50</td><td>50</td></tr>
<tr><td>2.</td><td>Theory cum Practical</td><td colspan="2">The distribution of marks shall be decided based on the credit weightage assigned to theory and practical components.</td></tr>
<tr><td>3.</td><td>Professional Skills Training / / Comprehensive Test & Viva / Entrepreneurships / Start ups / Project Work 1 / Industrial Training / Mandatory Course</td><td>100</td><td>---</td></tr>
<tr><td>4.</td><td>Project Work 2 Phase I / Project Work 2 Phase II / Internships</td><td>50</td><td>50</td></tr>
<tr><td>5.</td><td>Value Added Course</td><td rowspan="2">The distribution of marks shall be decided based on the credit weightage</td><td rowspan="2">---</td></tr>
<tr><td>6.</td><td>All other Courses</td></tr>
</table>

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 50 marks and the end semester examination shall be for 50 marks. However, the end semester examinations shall be conducted for 100 marks and the marks obtained shall be reduced to 50. The continuous assessment tests shall be conducted as per the schedule laid down in the academic schedule. Three tests shall be conducted for 50 marks each and reduced to 30 marks each. 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	30	Average of best two
	Test - II	30	
	Test - III	30	
2.	Tutorial	15	Should be of Open Book/Objective Type. Average of best 4 (or more, depending on the nature of the course, as may be approved by Principal)
3.	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	50	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 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 50 marks and the end semester examination shall be for 50 marks. Every exercise / experiment shall be evaluated based on the candidate's performance during the practical class and the candidate's 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.

7.6 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 (both Phase I and 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	Guide	Review Committee (excluding guide)	Guide	Review Committee (excluding guide)	Guide	Ext. Exr.	Guide	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 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 guide 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 Phase 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	Guide	Review Committee (excluding guide)	Guide	Review Committee (excluding guide)	Guide	Review Committee	Guide	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 4th semester vacation and during 5th semester. Phase II training shall be conducted for minimum of 80 hours in 5th semester vacation and during 6th semester. The evaluation procedure shall be approved by the Principal.

7.9 Comprehensive Test/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 two credits in sixth semester respectively 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 Projects through Internships

Each candidate shall submit a brief report about the internship undergone and a certificate issued from the organization concerned at the time of Viva-voce examination to the review committee. The evaluation method shall be same as that of the Project Work II as per clause 7.6.

7.12 Value Added Course

Minimum of two assessments shall be conducted during the value added course duration by the offering department concerned.

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 SF (Satisfactory). 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 Course

A candidate shall attend and complete the induction training program of duration three weeks at the beginning of the first semester. It is mandatory for all candidates who have joined in various branches of all BE/BTech programmes. The induction training program includes the courses recommended by AICTE. Apart from this induction program, a candidate shall undergo the courses listed by AICTE as mandatory courses during their programme. No credits shall be given for such courses and shall be evaluated through continuous assessment tests only vide clause 7.1 for a maximum of 100 marks each. Since these courses have no grade points assigned, these courses will not be counted for the purpose of GPA and CGPA calculations.

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

Courses such as YVHD and UHV shall be offered to all candidates of all BE/BTech programmes. 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, but the grade awarded shall be only the lowest passing grade irrespective of the marks secured.

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.

The candidates who have failed in the courses Professional Skill Training I/II and Comprehensive Test/Viva shall be permitted to take up supplementary examinations.

15. AWARD OF LETTER GRADES

Range of % of Total Marks	Letter Grade	Grade Point
91 to 100	O (Outstanding)	10
81 to 90	A+ (Excellent)	9
71 to 80	A (Very Good)	8
61 to 70	B+ (Good)	7
50 to 60	B (Average)	6
Less than 50	RA (Reappear)	0
Satisfactory	SF	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-2020 (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 and 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 7.00

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 Honours Degree:

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

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

18. MALPRACTICES IN TESTS AND EXAMINATIONS

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

19. AMENDMENTS

Notwithstanding anything contained in this manual, the Kongu Engineering College through the Academic council of the Kongu Engineering 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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CURRICULUM BREAKDOWN STRUCTURE										
Summary of Credit Distribution										
Category	**Semester**								**Total number of credits**	**Curriculum Content (% of total number of credits of the program)**
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**		
HS	**3**	**4**	**3**				**3**		**13**	**7.69**
BS	**11**	**11**	**4**	**4**					**30**	**17.75**
ES	**4**	**4**	**4**	**4**		**4**			**20**	**11.83**
PC	**4**	**4**	**12**	**12**	**13**	**8**	**3**		**56**	**33.14**
PE					**3**		**12**	**3**	**18**	**10.65**
OE				**4**	**4**	**3**		**3**	**14**	**8.28**
EC					**2**	**6**	**3**	**7**	**18**	**10.65**
Semesterwise Total	**22**	**23**	**23**	**24**	**21*/22#**	**23*/21#**	**21**	**12*/13#**	**169**	**100.00**

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

*2020-21 #2021-22

CATEGORISATION OF COURSES							
HUMANITIES AND SOCIAL SCIENCE INCLUDING MANAGEMENT (HS)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	20EGT11	English Language Skills	3	0	0	3	I
2.	20EGT21	Advanced Communication Skills	3	0	0	3	II
3.	20VEC11	Yoga Values for Holistic Development	1	0	1	1	II
4.	20EGL31	English for Workplace Communication Laboratory	0	0	2	1	III
5.	20GET31	Universal Human Values	2	0	0	2	III
6.	20GET71	Engineering Economics and Management	3	0	0	3	VII
Total Credits to be earned						**13**	

BASIC SCIENCES (BS)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	20MAC11	Matrices and Differential Equations	3	1*	2*	4	I
2.	20PHT11	Applied Physics	3	0	0	3	I
3.	20CYT11	Applied Chemistry	3	0	0	3	I
4.	20PHL11	Physical Sciences Laboratory I	0	0	2	1	I
5.	20MAC21	Multivariable Calculus and Complex Analysis	3	1	2*	4	II
6.	20PHT23	Physics for Communication and Computer Science Engineering	3	0	0	3	II
7.	20PHL28	Physical Sciences Laboratory II	0	0	2	1	II
8.	20CYT23	Chemistry of Electronic Materials	3	0	0	3	II
9.	20MAT34	Discrete Mathematical Structures	3	1	0	4	III
10.	20MAT42	Probability and Statistics	3	1	0	4	IV
Total Credits to be earned						**30**	

ENGINEERING SCIENCES (ES)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	20ITT11	Foundations of IT	3	0	0	3	I
2.	20ITL11	IT Essentials Laboratory	0	0	2	1	I
3.	20MEC11	Engineering Graphics	2	0	2	3	II
4.	20MEL11	Engineering Practices Laboratory	0	0	2	1	II
5.	20ITC31	Digital Logic and Microprocessors	3	0	2	4	III
6.	20ITT41	Principles of Communication	3	1	0	4	IV
7.	20ITT61	Internet of Things and its Applications	3	0	0	3	VI
8.	20ITL61	Internet of Things Laboratory	0	0	2	1	VI
Total Credits to be earned						**20**	

PROFESSIONAL CORE (PC)								
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**	**Domain/ Stream**
1.	20ITC11	Problem Solving and Programming	3	0	2	4	I	SD
2.	20ITT21	Programming and Linear Data Structures	3	0	2	4	II	SD
3.	20ITT31	Data Structures	3	0	0	3	III	SD
4.	20ITT32	Object Oriented Programming	3	0	0	3	III	SD
5.	20ITT33	Computer Organization	3	1	0	4	III	AP
6.	20ITL31	Data Structures Laboratory	0	0	2	1	III	SD
7.	20ITL32	Object Oriented Programming Laboratory	0	0	2	1	III	SD
8.	20ITT42	Database Management Systems	3	0	0	3	IV	AP
9.	20ITT43	Design and Analysis of Algorithms	3	1	0	4	IV	SD
10.	20ITT44	Web Technology	3	0	0	3	IV	SD
11.	20ITL41	Database Management Systems Laboratory	0	0	2	1	IV	SD
12.	20ITL42	Web Technology Laboratory	0	0	2	1	IV	SD
13.	20ITT51	Computer Networks	3	1	0	4	V	NW
14.	20ITT52	Operating Systems	3	0	0	3	V	AP
15.	20ITT53	Software Engineering	3	0	0	3	V	SD
16.	20ITL51	CASE Tools Laboratory	0	0	2	1	V	SD
17.	20ITL52	Network Laboratory	0	0	2	1	V	NW
18.	20ITL53	Operating Systems Laboratory	0	0	2	1	V	AP
19.	20ITT62	Machine Learning	3	0	0	3	VI	CI
20.	20ITT63	Cloud Computing	3	0	0	3	VI	NW
21.	20ITL62	Machine Learning Laboratory	0	0	2	1	VI	CI
22.	20ITL63	Cloud Computing Laboratory	0	0	2	1	VI	NW
23.	20ITT71	Block Chain Technology	3	0	0	3	VII	NW
Total Credits to be earned						**56**		

PROFESSIONAL ELECTIVE (PE)								
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**	**Domain/ Stream**
		Elective – I						
1.	20ITE01	Computer Graphics	3	0	0	3	V	AP
2.	20ITE02	Advanced Java Programming	3	0	0	3	V	AP
3.	20ITE03	User Interface Design	3	0	0	3	V	SD
4.	20ITE04	Search Methods for Problem Solving	3	0	0	3	V	SD
5.	20ITE05	Information Theory and Coding	3	0	0	3	V	NW
6.	20ITE06	Fundamentals of Research	3	0	0	3	V	GE
		Elective – II						
7.	20ITE07	Native Application Development using Android	3	0	0	3	VI	AP
8.	20ITE08	3D Modelling and Mixed Reality Applications	3	0	0	3	VI	SD
9.	20ITE09	Network Communication Protocols and Standards	3	0	0	3	VI	NW
10.	20ITE10	Big Data Analytics	3	0	0	3	VI	CI
11.	20ITE11	Cryptography and Network Security	3	0	0	3	VI	NW
		Elective – III						
12.	20ITE12	Digital Image Processing	3	0	0	3	VII	AP
13.	20ITE13	Software Testing	3	0	0	3	VII	SD
14.	20ITE14	Mobile Communication	3	0	0	3	VII	NW
15.	20ITE15	Embedded Linux Basics	3	0	0	3	VII	AP
16.	20ITE16	Deep Learning	3	0	0	3	VII	CI
		Elective – IV						
17.	20ITE17	Ethical Hacking	3	0	0	3	VII	NW
18.	20ITE18	Information Retrieval	3	0	0	3	VII	CI
19.	20ITE19	Software Defined Networks	3	0	0	3	VII	NW
20.	20ITE20	Game Theory and its Applications	3	0	0	3	VII	CI
21.	20ITE21	Software Quality Assurance	3	0	0	3	VII	SD
		Elective – V						
22.	20ITE22	Cyber Forensics	3	0	0	3	VII	NW
23.	20ITE23	Multicore Architecture	3	0	0	3	VII	AP
24.	20ITE24	Business Intelligence and its Applications	3	0	0	3	VII	CI

25.	20ITE25	Pattern Recognition	3	0	0	3	VII	CI
26.	20ITE26	Software Project Management	3	0	0	3	VII	SD
		Elective – VI						
27.	20ITE27	Building Enterprise Applications	3	0	0	3	VIII	SD
28.	20ITE28	Web Application Security	3	0	0	3	VIII	NW
29.	20ITE29	Wireless Sensor Networks	3	0	0	3	VIII	NW
30.	20ITE30	Realtime Programming for Embedded Systems	3	0	0	3	VIII	AP
31.	20ITE31	Information Storage and Management	3	0	0	3	VIII	AP
32.	20ITE32	Total Quality Management	3	0	0	3	VIII	GE
Total Credits to be earned						**18**		

EMPLOYABILITY ENHANCEMENT COURSES (EC)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	20GEL51/ 20GEL151	Professional Skills Training I / Industrial Training I	0	0	0	2	V
2.	20GEL61/ 20GEL161	Professional Skills Training II / Industrial Training II	0	0	0	2	VI
3.	20ITP61	Project Work 1	0	0	4	2	VI
4.	20GEP61	Comprehensive Test / Viva	0	0	0	2	VI
5.	20ITP71	Project Work 2 Phase 1	0	0	6	3	VII
6.	20ITP81	Project Work 2 Phase 2	0	0	14	7	VIII
Total Credits to be earned						**18**	

OPEN ELECTIVE COURSES OFFERED TO OTHER DEPARTMENTS (OE)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	20ITO01	Artificial Intelligence	3	1	0	4	IV
2.	20ITO02	Web Technologies	3	1	0	4	IV
3.	20ITO03	Introduction to Operating Systems	3	1	0	4	IV
4.	20ITO04	Programming in Python	3	1	0	4	IV
5.	20ITO05	Computer Vision	3	1	0	4	V
6.	20ITO06	Data Science	3	1	0	4	V
7.	20ITO07	Advanced Java Programming	3	1	0	4	V
8.	20ITO08	NCC Studies (Air Wing) - I	3	0	2	4	V/VI
9.	20ITO09	Bio Natural Language Processing	3	0	0	3	VI
10.	20ITO10	Disaster Management for InformationTechnology	3	0	0	3	VI
11.	20ITO11	Modern Application Development	3	0	0	3	VIII
12.	20ITO12	Object Oriented System Developmentusing UML	3	0	0	3	VIII
13.	20ITO13	Reinforcement Learning	3	0	0	3	VIII
Total Credits to be earned						**14**	

OPEN ELECTIVE COURSES OFFERED TO OTHER DEPARTMENTS (OE)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	20CEO01	Remote Sensing and its Applications	3	0	2	4	IV
2.	20MEO01	Renewable Energy Sources	3	0	2	4	IV
3.	20MTO01	Designof MechatronicsSystems	3	1	0	4	IV
4.	20AUO01	Automotive Engineering	3	0	2	4	IV
5.	20ECO01	Wearable Technology	3	1	0	4	IV
6.	20ECO02	Basics of Electronics in Automation Appliances	3	1	0	4	IV
7.	20ECO03	Principles of Quantum Computing	3	0	2	4	IV
8.	20EEO01	Solar and Wind Energy Systems	3	1	0	4	IV
9.	20EEO02	Electrical Wiring and Lighting	3	1	0	4	IV
10.	20EEO03	Electrical Safety	3	1	0	4	IV
11.	20CSO01	Fundamentals of Databases	3	0	2	4	IV
12.	20CSO02	Python Programming and Frameworks	3	0	2	4	IV

13.	20CHO01	Drugs and Pharmaceuticals Technology	3	1	0	4	IV
14.	20CHO02	Process Automation	3	1	0	4	IV
15.	20FTO01	Baking Technology	3	0	2	4	IV
16.	20FTO02	Food Processing Technology	3	1	0	4	IV
17.	20CEO02	Disaster Management	3	1	0	4	V
18.	20MEO02	Design of Experiments	3	0	2	4	V
19.	20MTO02	FactoryAutomation	3	0	2	4	V
20.	20MTO03	DataAcquisitionand VirtualInstrumentation	3	0	2	4	V
21.	20GEO04	InnovationandBusiness ModelDevelopment	3	1	0	4	V
22.	20AUO02	Automotive Electronics	3	0	2	4	V
23.	20ECO04	PCB Design and Fabrication	3	0	2	4	V
24.	20ECO05	Neural Networks and Fuzzy Logic for Engineering Applications	3	0	2	4	V
25.	20EEO04	Energy Conservation and Management	3	1	0	4	V
26.	20EEO04	AI with MATLAB	3	1	0	4	V
27.	20EIO01	Neural Networks and Deep Learning	3	1	0	4	V
28.	20CSO03	Computational science for Engineers	3	1	0	4	V
29.	20CSO04	Formal languages and automata	3	1	0	4	V
30.	20CSO05	Design thinking for engineers	3	1	0	4	V
31.	20CHO03	Fundamentals of Nanoscience and Nanotechnology	3	0	0	3	V
32.	20CHO04	Principles of bioprocessing	3	0	0	3	V
33.	20FTO03	Processing of milk and milk products	3	0	2	4	V
34.	20FTO04	Processing of Fruits and Vegetables	3	0	2	4	V
35.		Fundamentals of User Interactive Design	3	0	0	3	V
36.	20GEO01	German LanguageLevel 1	3	1	0	4	V/VI/VII/VII
37.	20GEO02	Japanese LanguageLevel 1	3	1	0	4	V/VI/VII/VII
38.	20GEO05	German Language Level 2	3	1	0	4	V/VI/VII/VII
39.	20GEO06	German Language Level 3	3	0	0	3	V/VI/VII/VII
40.	20GEO07	German Language Level 4	3	0	0	3	V/VI/VII/VII
41.	20GEO08	Japanese Language Level 2	3	1	0	4	V/VI/VII/VII
42.	20GEO09	Japanese Language Level 3	3	0	0	3	V/VI/VII/VII
43.	20GEO10	Japanese Language Level 4	3	0	0	3	V/VI/VII/VII

44.	20CEO03	Introduction to Smart Cities	3	0	0	3	VI
45.	20CEO04	Environmental Health and Safety	3	0	0	3	VI
46.	20MEO03	Fundamentals of Ergonomics	3	0	0	3	VI
47.	20MEO04	Principles of Management and Industrial Psychology	3	0	0	3	VI
48.	20MTO04	3DPrinting andDesign	3	0	0	3	VI
49.	20MTO05	Drone System Technology	3	0	0	3	VI
50.	20GEO11	EntrepreneurshipDevelopment	3	0	0	3	VI
51.	20AUO03	Vehicle Maintenance	3	0	0	3	VI
52.	20ECO06	Electronic Hardware and Troubleshooting	2	0	2	3	VI
53.	20ECO07	Bioinspired Computing Technologies	2	0	2	3	VI
54.	20EEO06	Micro Grid and Smart Grid	3	0	0	3	VI
55.	20EEO07	E-Waste Management	3	0	0	3	VI
56.	20EIO02	Digital Image Processing and Its Applications	3	1	0	4	VI
57.	20EIO03	Industrial Automation	3	1	0	4	VI
58.	20CSO06	Java Programming	2	0	2	3	VI
59.	20CSO07	Web Engineering	2	0	2	3	VI
60.	20CSO08	Foundations of Data Analytics	2	0	2	3	VI
61.	20CSO09	Nature inspired optimization techniques	3	0	0	3	VI
62.	20ITO09	Disaster Management for Information Technology	3	0	0	3	VI
63.	20CHO05	Bio Energy	3	0	0	3	VI
64.	20CHO06	Rubber Technology	3	0	0	3	VI
65.	20FTO05	Principles of Food safety	3	0	0	3	VI
66.	20FTO06	Fundamentals of Food Packaging and Storage	3	0	0	3	VI
67.		Fundamentals of User Experience Design	3	0	0	3	VI
68.	20EIO04	Biomedical Instrumentation and Applications	3	0	0	3	VII
69.	20EIO05	PLC Programming and Its Applications	3	0	0	3	VII
70.	20EIO06	Instrumentation for Industry 4.0	3	0	0	3	VII
71.		Introduction to Mobile Game Design	3	0	0	3	VII
72.	20CEO05	Infrastructure Planning and Management	3	0	0	3	VIII
73.	20CEO06	Environmental Laws and Policy	3	0	0	3	VIII
74.	20MEO05	Safety Measures for Engineers	3	0	0	3	VIII

75.	20MEO06	Energy Conservation in Thermal Equipments	3	0	0	3	VIII
76.	20MTO06	Robotics	3	0	0	3	VIII
77.	20MTO07	Virtual and Augment Reality in Industry4.0	3	0	0	3	VIII
78.	20AUO04	Public Transport Management	3	0	0	3	VIII
79.	20AUO05	Autonomous Vehicles	3	0	0	3	VIII
80.	20ECO08	Optical Engineering	3	0	0	3	VIII
81.	20ECO09	Neural Networks and Deep Learning with Python	2	0	2	3	VIII
82.	20EEO08	Electric Vehicle	3	0	0	3	VIII
83.	20EIO07	Measurements and Instrumentation	3	0	0	3	VIII
84.	20EIO08	Graphical Programming using Virtual Instrumentation	3	0	0	3	VIII
85.	20EIO09	Testing of Materials	3	0	0	3	VIII
86.	20CSO10	Fundamentals of IoT	3	0	0	3	VIII
87.	20CSO11	Machine Translation	3	0	0	3	VIII
88.	20CSO12	Applied Machine Learning	3	0	0	3	VIII
89.	20CSO13	Fundamentals of Blockchain	3	0	0	3	VIII
90.	20CHO07	Nuclear Engineering	3	0	0	3	VIII
91.	20CHO08	Membrane Technology	3	0	0	3	VIII
92.	20FTO07	Food Ingredients	3	0	0	3	VIII
93.	20FTO08	Food and Nutrition	3	0	0	3	VIII
94.		Introduction to Graphics Design	3	0	0	3	VIII

KEC R2020: SCHEDULING OF COURSES – B.Tech Information Technology Total Credits : 169

Sem.	Course1	Course2	Course3	Course4	Course5	Course6	Course7	Course8	Course9	Course10	Credits
I	20EGT11 English Language Skills (3-0-0-3)	20MAC11 Matrices and Differential Equations (3-1-2-4)	20PHT11 Applied Physics (3-0-0-3)	20CYT11 Applied Chemistry (3-0-0-3)	20ITC11 Problem Solving and Programming (3-0-2-4)	20ITT01 Foundations of IT (3-0-0-3)	20PHL11 Physical Sciences Laboratory I (0-0-2-1)	20ITL11 IT Essentials Laboratory (0-0-2-1)	20MNT11 Induction Training Program (0-0-0-0)		**22**
II	20EGT21 Advanced Communication Skills (3-0-0-3)	20MAC21 Multivariable Calculus and Complex Analysis (3-1-2-4)	20PHT23 Physics for Communication and Computer Science Engineering (3-0-0-3)	20CYT23 Chemistry of Electronic Materials (3-0-0-3)	20MEC11 Engineering Graphics (2-0-2-3)	20ITT21 Programming and Linear Data Structures (3-0-2-4)	20PHL28 Physical Sciences Laboratory II (0-0-2-1)	20MEL11 Engineering Practices Laboratory (0-0-2-1)	20VEC11 Yoga Values for Holistic Development (1-0-1-1)		**23**
III	20MAT34 Discrete Mathematical Structures (3-1-2-4)	20ITC31 Digital Logic and Microprocessors (3-0-2-4)	20ITT31 Data Structures (3-0-0-3)	20ITT32 Object Oriented Programming (3-0-0-3)	20ITT33 Computer Organization (3-1-0-4)	20ITL31 Data Structures Laboratory (0-0-2-1)	20ITL32 Object Oriented Programming Laboratory (0-0-2-1)	20EGL31 English for Workplace Communication Laboratory (0-0-2-1)	20GET31 Universal Human Values (2-0-0-2)		**23**
IV	20MAT42 Probability and Statistics (3-1-0-4)	20ITT41 Principles of Communication (3-1-0-4)	20ITT42 Database Management Systems (3-0-0-3)	20ITT43 Design and Analysis of Algorithms (3-1-0-4)	20ITT44 Web Technology (3-0-0-3)	Open Elective 1 (3-1/0-0/2-4)	20ITL41 Database Management Systems Laboratory (0-0-2-1)	20ITL42 Web Technology Laboratory (0-0-2-1)	20MNT31 Environmental Science (2-0-0-0)		**24**
V	20ITT51 Computer Networks (3-1-0-4)	20ITT52 Operating Systems (3-0-0-3)	20ITT53 Software Engineering (3-0-0-3)	Professional Elective 1 (3-0-0-3)	Open Elective II (3-1/0-0/2-4)	20ITL51 Network Laboratory (0-0-2-1)	20ITL52 Operating Systems Laboratory (0-0-2-1)	20ITL53 Case Tools Laboratory (0-0-2-1)	20GEL51/20GEI51 Professional Skills Training I / Industrial Training I (0-0-0-2)		**21*/22#**
VI	20ITT61 Internet of Things and its Applications (3-0-0-3)	20ITT62 Machine Learning (3-0-0-3)	20ITT63 Cloud Computing (3-0--0-3)	Open Elective III (3-0-0-3)	20ITL61 Internet of Things Laboratory (0-0-2-1)	20ITL62 Machine Learning Laboratory (0-0-2-1)	20ITL63 Cloud Computing Laboratory (0-0-2-1)	20GEL61/20GE161 Professional Skills Training II / Industrial Training II (0-0-0-2)	20GEP61 Comprehensive Test / Viva (0-0-0-2)	20ITP61 Project Work 1 (0-0-4-2)	**23*/21#**
VII	20GET71 Engineering Economics and Management (3-0-0-3)	20ITT71 Block Chain Technology	Professional Elective II (3-0-0-3)	Professional Elective III (3-0-0-3)	Professional Elective IV (3-0-0-3)	Professional Elective V (3-0-0-3)	20ITP71 Project Work 2 Phase I (0-0-6-3)				**21**
VIII	Professional Elective VI (3-0-0-3)	Open Elective IV (3-0-0-3)	20ITP81 Project Work 2 Phase II (0-0-14-7)								**12*/13#**

MAPPING OF COURSES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Sem	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	20EGT11	English Language Skills						✓			✓	✓	✓	✓		
1	20MAC11	Matrices and Differential Equations	✓	✓	✓	✓	✓									
1	20PHT11	Applied Physics	✓	✓	✓											
1	20CYT11	Applied Chemistry	✓	✓	✓	✓										
1	20ITC11	Problem Solving and Programming	✓	✓	✓	✓									✓	✓
1	20ITT11	Foundations of IT	✓	✓	✓										✓	✓
1	20PHL11	Physical Sciences Laboratory I				✓										
1	20ITL11	IT Essentials Laboratory	✓	✓	✓	✓									✓	✓
1	20MNT11	Induction Training Program #														
2	20EGT21	Advanced Communication Skills					✓				✓	✓	✓	✓		
2	20MAC21	Multivariable Calculus and Complex Analysis	✓	✓	✓		✓									
2	20PHT23	Physics for Communication and Computer Science Engineering	✓	✓	✓											
2	20CYT23	Chemistry of Electronic Materials	✓	✓	✓	✓										
2	20MEC11	Engineering Graphics	✓	✓	✓	✓						✓	✓	✓	✓	✓
2	20ITT21	Programming and Linear Data Structures	✓	✓	✓	✓									✓	✓
2	20PHL28	Physical Sciences Laboratory II			✓											
2	20MEL11	Engineering Practices Laboratory	✓		✓	✓	✓	✓			✓	✓		✓		

2	20VEC11	Yoga Values for Holistic Development						✓		✓	✓			✓		
3	20MAT34	Discrete Mathematical Structures	✓	✓	✓										✓	
3	20ITC31	Digital Logic and Microprocessors	✓	✓	✓	✓									✓	✓
3	20ITT31	Data Structures	✓	✓	✓	✓									✓	✓
3	20ITT32	Object Oriented Programming	✓	✓	✓	✓									✓	✓
3	20ITT33	Computer Organization	✓	✓	✓	✓									✓	✓
3	20ITL31	Data Structures Laboratory	✓	✓	✓	✓									✓	✓
3	20ITL32	Object Oriented Programming Laboratory	✓	✓	✓	✓									✓	✓
3	20EGL31	English for Workplace Communication Laboratory									✓	✓		✓	✓	✓
3	20GET31	Universal Human Values						✓	✓	✓	✓	✓				
4	20MAT42	Probability and Statistics	✓	✓	✓	✓									✓	
4	20ITT41	Principles of Communication	✓	✓	✓	✓									✓	✓
4	20ITT42	Database Management Systems	✓	✓	✓	✓									✓	✓
4	20ITT43	Design and Analysis of Algorithms	✓	✓	✓	✓	✓								✓	✓
4	20ITT44	Web Technology	✓	✓	✓	✓									✓	✓
4	20ITL41	Database Management Systems Laboratory	✓	✓	✓	✓									✓	✓
4	20ITL42	Web Technology Laboratory	✓	✓	✓	✓									✓	✓
4	20MNT31	Environmental Science	✓	✓	✓				✓							
5	20ITT51	Computer Networks	✓	✓	✓	✓									✓	✓

5	20ITT52	Operating Systems	✓	✓	✓	✓									✓	✓
5	20ITT53	Software Engineering	✓	✓	✓	✓									✓	✓
5	20ITL51	Network Laboratory	✓	✓	✓	✓									✓	✓
5	20ITL52	Operating Systems Laboratory	✓	✓	✓	✓									✓	✓
5	20ITL53	CASE Tools Laboratory	✓	✓	✓	✓									✓	✓
5	20GEL51/ 20GEI51	Professional Skills Training I / Industrial Training I $	✓	✓	✓	✓									✓	✓
6	20ITT61	Internet of Things and its Applications	✓	✓	✓	✓									✓	✓
6	20ITT62	Machine Learning	✓	✓	✓	✓									✓	✓
6	20ITT63	Cloud Computing	✓	✓	✓	✓									✓	✓
6	20ITL61	Internet of Things Laboratory	✓	✓	✓	✓									✓	✓
6	20ITL62	Machine Learning Laboratory	✓	✓	✓	✓									✓	✓
6	20ITL63	Cloud Computing Laboratory	✓	✓	✓	✓									✓	✓
6	20GEL61/ 20GEI61	Professional Skills Training II / Industrial Training II	✓	✓	✓	✓									✓	✓
6	20GEP61	Comprehensive Test / Viva	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6	20ITP61	Project Work 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7	20GET71	Engineering Economics and Management	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
7	20ITE11	Block Chain Technology	✓	✓	✓	✓									✓	✓
7	20ITP71	Project Work 2 Phase 1 $	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	20ITP81	Project Work 2 Phase 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	20ITE01	Computer Graphics	✓	✓	✓	✓									✓	✓

5	20ITE02	Advanced Java Programming	✓	✓	✓	✓									✓	✓
5	20ITE03	User Interface Design	✓	✓	✓	✓									✓	✓
5	20ITO02	Search Methods for Problem Solving	✓	✓	✓	✓										
5	20ITE05	Information Theory and Coding	✓	✓	✓	✓									✓	✓
5	20ITE06	Fundamentals of Research	✓	✓	✓	✓									✓	✓
7	20ITE07	Native Application Development using Android	✓	✓	✓	✓									✓	✓
7	20ITE08	3D Modelling and Mixed Reality Applications	✓	✓	✓	✓									✓	✓
7	20ITE09	Network Communication Protocols and Standards	✓	✓	✓	✓									✓	✓
7	20ITE10	Big Data Analytics	✓	✓	✓	✓									✓	✓
7	20ITE04	Cryptography and Network Security	✓	✓	✓	✓									✓	✓
7	20ITE12	Digital Image Processing	✓	✓	✓	✓									✓	✓
7	20ITE13	Software Testing	✓	✓	✓	✓									✓	✓
7	20ITE14	Mobile Communication	✓	✓	✓	✓									✓	✓
7	20ITE15	Embedded Linux Basics	✓	✓	✓	✓									✓	✓
7	20ITE16	Deep Learning	✓	✓	✓	✓									✓	✓
7	20ITE17	Ethical Hacking	✓	✓	✓	✓									✓	✓
7	20ITE18	Information Retrieval	✓	✓	✓	✓									✓	✓
7	20ITE19	Software Defined Networks	✓	✓	✓	✓									✓	✓
7	20ITE20	Game Theory and its Applications	✓	✓	✓	✓									✓	✓

7	20ITE21	Software Quality Assurance	✓	✓	✓	✓									✓	✓
7	20ITE22	Cyber Forensics	✓	✓	✓	✓									✓	✓
7	20ITE23	Multicore Architecture	✓	✓	✓										✓	✓
7	20ITE24	Business Intelligence and its Applications	✓	✓	✓	✓									✓	✓
7	20ITE25	Pattern Recognition	✓	✓	✓	✓									✓	✓
7	20ITE26	Software Project Management	✓	✓	✓	✓									✓	✓
8	20ITE27	Building Enterprise Applications	✓	✓	✓	✓									✓	✓
8	20ITE28	Web Application Security	✓	✓	✓	✓									✓	✓
8	20ITE29	Wireless Sensor Networks	✓	✓	✓	✓									✓	✓
8	20ITE30	Real time Programming for Embedded Systems	✓	✓	✓	✓									✓	✓
8	20ITE31	Information Storage and Management	✓	✓	✓	✓									✓	✓
8	20ITE32	Total Quality Management	✓	✓	✓	✓									✓	✓

Sem	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		Open Elective Courses														
4	20ITO01	Artificial Intelligence	✓	✓	✓	✓										
4	20ITO02	Web Technologies	✓	✓	✓	✓										
4	20ITO03	Introduction to Operating Systems	✓	✓	✓	✓										
4	20ITO04	Programming in Python	✓	✓	✓	✓										
5	20ITO05	Computer Vision	✓	✓	✓	✓										
5	20ITO06	Data Science	✓	✓	✓	✓										
5	20ITO07	Advanced Java Programming	✓	✓	✓	✓										
5/6	20ITO08	NCC Studies (Air Wing) - I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
6	20ITO09	Bio Natural Language Processing	✓	✓	✓	✓										
6	20ITO10	Disaster Management for InformationTechnology	✓	✓	✓	✓										
8	20ITO11	Modern Application Development	✓	✓	✓	✓										
8	20ITO12	Object Oriented System Developmentusing UML	✓	✓	✓	✓										
8	20ITO13	Reinforcement Learning	✓	✓	✓	✓										

B.TECH. DEGREE IN INFORMATION TECHNOLOGY
CURRICULUM UNDER REGULATIONS 2020
(For the candidates admitted from academic year 2020-21 onwards)

SEMESTER – I

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
	Theory/Theory with Practical								
20EGT11	English Language Skills	3	0	0	3	50	50	100	HS
20MAC11	Matrices and Differential Equations	3	1*	2*	4	50	50	100	BS
20PHT11	Applied Physics	3	0	0	3	50	50	100	BS
20CYT11	Applied Chemistry	3	0	0	3	50	50	100	BS
20ITC11	Problem Solving and Programming	3	0	2	4	50	50	100	PC
20ITT11	Foundations of IT	3	0	0	3	50	50	100	ES
	Practical								
20PHL11	Physical Sciences Laboratory I	0	0	2	1	50	50	100	BS
20ITL11	IT Essentials Laboratory	0	0	2	1	50	50	100	ES
20MNT11	Student Induction Program #	-	-	-	0	100	0	100	MC
					Total		**22**		

SEMESTER – II

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
	Theory/Theory with Practical								
20EGT21	Advanced Communication Skills	3	0	0	3	50	50	100	HS
20MAC21	Multivariable Calculus and Complex Analysis	3	1*	2*	4	50	50	100	BS
20PHT23	Physics for Communication and Computer Science Engineering	3	0	0	3	50	50	100	BS
20CYT23	Chemistry of Electronic Materials	3	0	0	3	50	50	100	BS
20MEC11	Engineering Graphics	2	0	2	3	50	50	100	ES
20ITT21	Programming and Linear Data Structures	3	0	2	4	50	50	100	PC
	Practical								
20PHL28	Physical Sciences Laboratory II	0	0	2	1	50	50	100	BS
20MEL11	Engineering Practices Laboratory	0	0	2	1	50	50	100	ES
20VEC11	Yoga Values for Holistic Development	1	0	1	1	100	0	100	HS
					Total	**23**			

SEMESTER – III	B.TECH. INFORMATION TECHNOLOGY CURRICULUM – R2020								
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
20MAT34	Discrete Mathematical Structures	3	1	0	4	50	50	100	BS
20ITC31	Digital Logic and Microprocessors	3	0	2	4	50	50	100	ES
20ITT31	Data Structures	3	0	0	3	50	50	100	PC
20ITT32	Object Oriented Programming	3	0	0	3	50	50	100	PC
20ITT33	Computer Organization	3	1	0	4	50	50	100	PC
Practical / Employability Enhancement									
20ITL31	Data Structures Laboratory	0	0	2	1	50	50	100	PC
20ITL32	Object Oriented Programming Laboratory	0	0	2	1	50	50	100	PC
20EGL31	English for Workplace Communication Laboratory	0	0	2	1	50	50	100	HS
20GET31	Universal Human Values	2	0	0	2	100	0	100	HS
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									
20MAT42	Probability and Statistics	3	1	0	4	50	50	100	BS
20ITT41	Principles of Communication	3	1	0	4	50	50	100	ES
20ITT42	Database Management Systems	3	0	0	3	50	50	100	PC
20ITT43	Design and Analysis of Algorithms	3	1	0	4	50	50	100	PC
20ITT44	Web Technology	3	0	0	3	50	50	100	PC
	Open Elective I	3	1/0	0/2	4	50	50	100	OE
Practical / Employability Enhancement									
20ITL41	Database Management Systems Laboratory	0	0	2	1	50	50	100	PC
20ITL42	Web Technology Laboratory	0	0	2	1	50	50	100	PC
20MNT31	Environmental Science	2	0	0	0	100	0	100	MC
Total Credits to be earned					**24**				

SEMESTER – V	B.TECH. INFORMATION TECHNOLOGY CURRICULUM – R2020								
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
20ITT51	Computer Networks	3	0/1	0	3*/4#	50	50	100	PC
20ITT52	Operating Systems	3	0	0	3	50	50	100	PC
20ITT53	Software Engineering	3	0	0	3	50	50	100	PC
	Professional Elective I	3	0	0	3	50	50	100	PE
	Open Elective II	3	1/0	0/2	4	50	50	100	OE
Practical / Employability Enhancement									
20ITL51	Network Laboratory	0	0	2	1	100	0	100	PC
20ITL52	Operating Systems Laboratory	0	0	2	1	100	0	100	PC
20ITL53	CASE Tools Laboratory	0	0	2	1	100	0	100	PC
20GEL51/ 20GEI51	Professional Skills Training I / Industrial Training I $	--	--	--	2	100	0	100	EC
Total Credits to be earned					**21*/22#**				

*2020-21 #2021-22

SEMESTER – VI									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
20ITT61	Internet of Things and its Applications	3	0	0	3	50	50	100	ES
20ITT62	Machine Learning	3	0	0	3	50	50	100	PC
20ITT63	Cloud Computing	3	0	0	3	50	50	100	PC
	Open Elective III	3	0	0	3	50	50	100	OE
Practical / Employability Enhancement									
20ITL61	Internet of Things Laboratory	0	0	2	1	100	0	100	ES
20ITL62	Machine Learning Laboratory	0	0	2	1	100	0	100	PC
20ITL63	Cloud Computing Laboratory	0	0	2	1	100	0	100	PC
20GEL61/ 20GEI61	Professional Skills Training II / Industrial Training II @	---	---	---	2	100	0	100	EC
20GEP61	Comprehensive Test / Viva	---	---	---	2	100	0	100	EC
20ITP61	Project Work 1 #	0	0	4	2	100	0	100	EC
Total Credits to be earned					**23*/21#**				

*2020-21 #2021-22

SEMESTER – VII	B.TECH. INFORMATION TECHNOLOGY CURRICULUM – R2020								
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
20GET71	Engineering Economics and Management	3	0	0	3	50	50	100	HS
20ITT71	Blockchain Technology	3	0	0	3	50	50	100	PC
	Professional Elective II	3	0	0	3	50	50	100	PE
	Professional Elective III	3	0	0	3	50	50	100	PE
	Professional Elective IV	3	0	0	3	50	50	100	PE
	Professional Elective V	3	0	0	3	50	50	100	PE
Practical / Employability Enhancement									
20ITP71	Project Work 2 Phase 1 $	0	0	8*/6#	4*/3#	100	0	100	EC
Total Credits to be earned					**21**				

*2020-21 #2021-22

SEMESTER – VIII									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
	Open Elective IV	3	0	0	3	50	50	100	OE
	Professional Elective VI	3	0	0	3	50	50	100	PE
Practical / Employability Enhancement									
20ITP81	Project Work 2 Phase 2 #	---	---	12*/14#	6*/7#	50	50	100	EC
Total Credits to be earned					**12*/13#**				

*2020-21 #2021-22

LIST OF PROFESSIONAL ELECTIVE COURSES (PE)							
Course Code	**Course Name**	**L**	**T**	**P**	**C**	**Sem**	**Domain/ Stream**
	Elective 1						
20ITE01	Computer Graphics	3	0	0	3	V	
20ITE02	Advanced Java Programming	3	0	0	3	V	
20ITE03	User Interface Design	3	0	0	3	V	
20ITE04	Search Methods for Problem Solving	3	0	0	3	V	
20ITE05	Information Theory and Coding	3	0	0	3	V	
	Elective 2						
20GEE01	Fundamentals of Research	3	0	0	3	V	
20ITE06	Native Application Development using Android	3	0	0	3	VII	
20ITE07	3D Modelling and Mixed Reality Applications	3	0	0	3	VII	
20ITE08	Network Communication Protocols and Standards	3	0	0	3	VII	
20ITE09	Big Data Analytics	3	0	0	3	VII	
20ITE10	Cryptography and Network Security	3	0	0	3	VII	
	Elective 3						
20ITE11	Digital Image Processing	3	0	0	3	VII	
20ITE12	Software Testing	3	0	0	3	VII	
20ITE13	Mobile Communication	3	0	0	3	VII	
20ITE14	Embedded Linux Basics	3	0	0	3	VII	
20ITE15	Deep Learning	3	0	0	3	VII	
	Elective 4						
20ITE16	Ethical Hacking	3	0	0	3	VII	
20ITE17	Information Retrieval	3	0	0	3	VII	
20ITE18	Software Defined Networks	3	0	0	3	VII	
20ITE19	Game Theory and its Applications	3	0	0	3	VII	
20ITE20	Software Quality Assurance	3	0	0	3	VII	
	Elective 5						
20ITE21	Cyber Forensics	3	0	0	3	VII	
20ITE22	Multicore Architecture	3	0	0	3	VII	
20ITE23	Business Intelligence and its Applications	3	0	0	3	VII	
20ITE24	Pattern Recognition	3	0	0	3	VII	
20ITE25	Software Project Management	3	0	0	3	VII	

	Elective 6						
20ITE26	Building Enterprise Applications	3	0	0	3	VIII	
20ITE27	Web Application Security	3	0	0	3	VIII	
20ITE28	Wireless Sensor Networks	3	0	0	3	VIII	
20ITE29	Realtime Programming for Embedded Systems	3	0	0	3	VIII	
20ITE30	Information Storage and Management	3	0	0	3	VIII	
20ITE31	Total Quality Management	3	0	0	3	VIII	
	Total credits to be earned				**18**		

OPEN ELECTIVE COURSES OFFERED TO OTHER DEPARTMENTS (OE)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	20ITO01	Artificial Intelligence	3	1	0	4	IV
2.	20ITO02	Web Technologies	3	1	0	4	IV
3.	20ITO03	Introduction to Operating Systems	3	1	0	4	IV
4.	20ITO04	Programming in Python	3	1	0	4	IV
5.	20ITO05	Computer Vision	3	1	0	4	V
6.	20ITO06	Data Science	3	1	0	4	V
7.	20ITO07	Advanced Java Programming	3	1	0	4	V
8.	20ITO08	NCC Studies (Air Wing) - I	3	0	2	4	V/VI
9.	20ITO09	Bio Natural Language Processing	3	0	0	3	VI
10.	20ITO10	Disaster Management for Information Technology	3	0	0	3	VI
11.	20ITO11	Modern Application Development	3	0	0	3	VIII
12.	20ITO12	Object Oriented System Development using UML	3	0	0	3	VIII
13.	20ITO13	Reinforcement Learning	3	0	0	3	VIII
Total Credits to be earned						**14**	

20EGT11 ENGLISH LANGUAGE SKILLS

(Common to all Engineering and Technology Branches)

Programme & Branch	All BE/BTech branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	HS	3	0	0	3

Preamble	This course is designed to impart required levels of fluency in using the English Language at A2/B1 Level in the Common European Framework (CEFR).	
Unit - I	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – I**	**9**
Listening - Talking about past experiences - listening to descriptions - Speaking - Exchanging personal information - Talking about cities and transportation - Reading - Life and achievements of a famous personality - Global transport systems - Writing - Childhood experiences - Process Description – Grammar & Vocabulary – Past tense – Expressions of quantity – Indirect questions.		
Unit - II	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – II**	**9**
Listening - Information about hotels and accommodation - Recipes and food items - Speaking - Life style changes and making comparisons - Talking about food - Reading - Habit formation and changing habits - International cuisine - Writing - Personal email - emails about food and recipes – Grammar & Vocabulary – Evaluations and Comparisons with adjectives – Simple past and present perfect tenses.		
Unit - III	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – III**	**9**
Listening - Information about travel - descriptions / conversations about family life - Speaking - Vacations and Holidays - Requests, complaints and offering explanations - Reading - Tourist places and travel experiences - Group behaviour and politeness - Writing - Personal letter about travelling - Writing guidelines and checklists – Grammar & Vocabulary – Future tense – Modals – Two-part verbs.		
Unit - IV	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – IV**	**9**
Listening - Descriptions about festivals - Presentations on technology - Speaking - About technology - festivals, special events and traditions - Reading - Sports, hobbies and past time - About different cultures - Writing - Product Description - Writing web content – Grammar & Vocabulary – Infinitives and Gerunds for uses and purposes – Imperatives for giving suggestions – Relative clauses of time.		
Unit - V	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – V**	**9**
Listening - Talking about changes - Job preferences - Speaking - Comparing different periods or phases in life – Changes that happen - Skills and abilities, Personality Development - Employability Skills – Reading - Reading about life experiences - Emotions and feelings – Job preferences – Jobs and Personality – Writing - Writing about one's past, present and future – Researching job options – Choosing the right job – Grammar & Vocabulary – Time contrasts – Conditional sentences with "if clauses" – Gerunds – short responses.		

Total: 45

TEXT BOOK:

1. Jack C. Richards, Jonathan Hull, and Susan Proctor, "Interchange - Student's Book 2", 4th Edition, Cambridge University Press, New York, 2017.

REFERENCES:

1. Sanjay Kumar and Pushp Lata, "Communication Skills", 2nd Edition, Oxford University Press, New Delhi, 2015.
2. Pamela Hartmann and Brenda Wegmann, "New Interactions English Language Learning and Assessment Platform (Level Intro - Level IV)", McGraw Hill India, 2020.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	use language effectively and accurately acquiring vocabulary from real-life context	Applying (K3)
CO2	listen/view and comprehend different spoken discourses / excerpts in different accents	Applying (K3)
CO3	read different genres of texts adopting various reading strategies	Analyzing (K4)
CO4	write cohesively, coherently and flawlessly avoiding grammatical errors, using a wide range of vocabulary, organizing their ideas logically on a topic	Creating (K6)
CO5	speak clearly, confidently, comprehensibly and communicate with others using appropriate communicative strategies	Creating (K6)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2			2	3	2	2		
CO2									2	3		1		
CO3						1				3	1	1		
CO4										3		1		
CO5									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		16	30	37		17	100
CAT2		17	30	37		16	100
CAT3		13	33	37		17	100
ESE		7	21	37		35	100

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

20MAC11 MATRICES AND 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 differential equations.	
Unit - I	**Matrices:**	**9**
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.		
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.		
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^nsinax and x^ncosax – 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** & **Inverse 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) – Solution of linear ODE of second order with constant coefficients.		

List of Exercises / Experiments:

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

***Alternate week**

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

TEXT BOOK:

1. Ravish R. Singh, Mukul Bhatt "Engineering Mathematics", 1st Edition, McGraw Hill Education, New Delhi, 2016.

REFERENCES:

1. Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley Sons, 2011.
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. MATLAB 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)
CO2	identify the appropriate method for solving first order ordinary differential equations.	Applying (K3)
CO3	solve higher order linear differential equations with constant and variable coefficients.	Applying (K3)
CO4	apply the concept of ordinary differential equations for modeling and finding solutions to engineering problems.	Applying (K3)
CO5	apply Laplace Transform to find solutions of Linear Ordinary Differential Equations	Applying (K3)
CO6	know the basics of MATLAB and computing eigen values and eigen vectors of real matrix by MATLAB.	Understanding (K2), Manipulation (S2)
CO7	solve ordinary differential equations with constant and variable coefficients and simultaneous first order ordinary differential equations using MATLAB.	Applying (K3), Manipulation (S2)
CO8	compute Laplace and inverse Laplace Transform of basic functions and solve Second Order ODE by using Laplace Transform with MATLAB.	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	1										
CO2	3	3	2	1										
CO3	3	3	2	1										
CO4	3	3	2											
CO5	3	3	2	1										
CO6					3									
CO7					3									
CO8					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)**

20PHT11 APPLIED PHYSICS

(Common to All Engineering and Technology Branches)

Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	BS	3	0	0	3

Preamble	This course aims to impart the essential concepts of propagation of elastic waves, acoustics, ultrasonics, laser and fiber optics, quantum physics, crystal structure and crystal defects. It also describes the physical phenomena related to the aforementioned concepts and their applications in engineering and provides motivation towards innovations	
Unit - I	**Propagation of Elastic Waves:**	**9**
Oscillatory Motion: Introduction to simple harmonic motion - Damping velocity - Damping coefficient - Differential equation of simple harmonic motion - Velocity and acceleration - Restoring force - Vibration of a spring and mass system - Frequency response - Phase response - Resonance - Wave motion: Definition of a plane progressive wave - Attenuation of waves - Differential equation of a plane progressive wave - Phase velocity - Phase and phase difference - Solution of the differential equation of a plane progressive wave.		
Unit - II	**Acoustics and Ultrasonics:**	**9**
Acoustics: Introduction - Reverberation and reverberation time - Growth and decay of sound - Sabine's formula for reverberation time – Determination of sound absorption coefficient – Design of an auditorium: Factors affecting acoustics of buildings and the remedies. Ultrasonics: Introduction – Properties of ultrasonic waves – Generation of ultrasonic waves: Magnetostrictive generator and Piezoelectric generator - Determination of velocity of ultrasonics in a liquid: Acoustic grating – Industrial application: Non-destructive testing - Other applications of ultrasonic waves (qualitative).		
Unit - III	**Laser and Fiber Optics:**	**9**
Laser and Applications: Introduction – Interaction of light with matter - Three quantum process: Stimulated absorption, spontaneous emission and stimulated emission - Population inversion - Einstein's coefficients and their relations - Pumping methods - Nd:YAG laser - CO_2 laser - Holography. Fiber Optics and Applications: Introduction - Numerical aperture and acceptance angle - Classification of optical fibers based on refractive index, modes and materials - Fiber optics communication system (qualitative) - Fiber optic sensors: Temperature and displacement sensors.		
Unit - IV	**Quantum Physics:**	**9**
Introduction - Blackbody radiation - Planck's quantum hypothesis - Compton scattering (qualitative) - de Broglie's hypothesis - Properties of matter waves - Application of Heisenberg uncertainty principle - Schrodinger's time independent and time dependent wave equations - Physical significance of wave function - The free particle - Potential energy step - Infinite potential well (one - dimensional).		
Unit - V	**Crystal Physics:**	**9**
Introduction - Classification of solids - Space lattice - Crystal structure - Unit cell - Bravais lattice - Single and polycrystalline materials - Lattice planes - Miller indices - Indices of crystal direction - Interplanar spacing in cubic system - Hexagonal close packed crystal structure and c/a ratio - Symmetry -Symmetry elements in cubic crystal - Crystal imperfections: line, surface and volume imperfections - Features of crystal imperfections (qualitative).		

Total: 45

TEXT BOOK:

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

REFERENCES:

1. Purnima Khare and Swarup A.,"Engineering Physics: Fundamentals and Modern Applications", 1st Edition, Jones and Bartlett Publishers, Sudbury, Massachusetts, 2009.
2. Gaur R.K. and Gupta S.L., "Engineering Physics", 8th Edition, Dhanpat Rai and Sons, New Delhi, 2009.
3. Tamilarasan K. and Prabu K., "Engineering Physics – I", 3rd Edition, McGraw Hill Education Pvt. Ltd., 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 concepts of oscillatory and wave motion to comprehend the phenomena related to the propagation of elastic waves.	Applying (K3)
CO2	apply the concepts of growth and decay of sound energy in a hall to compute Sabine's formula to recognize the requirements of acoustically good buildings, and to describe the production of ultrasonic wave, working of acoustic grating & non-destructive testing using ultrasonic waves.	Applying (K3)
CO3	apply the concepts of stimulated emission to explain the working and the applications of laser in engineering and technology, and to apply the principle of propagation of light through optical fiber to compute acceptance angle and numerical aperture to comprehend the loss in optical fiber, fiber optic communication system and working of fiber optic sensors.	Applying (K3)
CO4	use the concepts of quantum mechanics to describe the behavior of electrons in a metal by solving Schrodinger's wave equation for particle motion in infinite potential well.	Applying (K3)
CO5	utilize the concepts of the seven crystal systems to obtain interplanar spacing in cubic lattice and c/a ratio of HCP crystal structure, and to comprehend symmetry elements, reciprocal lattice and the types of crystal imperfections and their impacts.	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

20CYT11 APPLIED CHEMISTRY

(Common to All Engineering and Technology Branches)

Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	BS	3	0	0	3

Preamble	Applied Chemistry course explores the basic principles and advancements of chemistry in the field of engineering and technology. It aims to impart the fundamentals of chemistry towards innovations in science and technology and also for societal applications.	
Unit - I	**Water Technology:**	**9**
Introduction - sources of water - impurities in water - types of water - hardness of water- expression of hardness (simple problems) - units of hardness –estimation of hardness of water by EDTA method – determination of alkalinity - disadvantages of using hard water in Industries - boiler troubles - scale and sludge, boiler corrosion, caustic embrittlement, priming and foaming - softening of water: i) Internal treatment process - carbonate and calgon conditioning ii) External treatment method - demineralization process iii) Treatment of water for municipal water supply (Removal of suspended particles and disinfection methods, Break-point of chlorination).		
Unit - II	**Electrochemistry:**	**9**
Introduction – electrochemical cells - applications of electrochemical series - reference electrode - standard calomel electrode - ion selective electrode - glass electrode - concentration cells - electrode and electrolyte concentration cells (simple problems) - applications- potentiometric titrations - acid-base, redox, precipitation titrations - advantages- conductometric titrations - strong acid vs strong base, weak acid vs strong base, mixture of weak and strong acid vs strong base- advantages of conductometric titrations.		
Unit - III	**Corrosion and its Control:**	**9**
Introduction – causes and effects of corrosion - types of corrosion - chemical corrosion – Pilling Bed-worth rule - electrochemical corrosion –types **-** galvanic corrosion, concentration cell corrosion – other types of corrosion -stress, intergranular and microbiological corrosion- galvanic series - factors influencing rate of corrosion – corrosion control methods - design and material selection, anodic protection, corrosion inhibitors, protective coatings - i) metallic coatings : hot dipping (tinning and galvanizing) ii) non-metallic coating : anodizing iii) organic coating : paints – constituents and their functions.		
Unit - IV	**Fuels and Combustion:**	**9**
Introduction – classification of fuels - characteristics of a good fuel - combustion - calorific values – gross and net calorific values - Dulong's formula (simple problems) - Flue gas analysis by Orsat's method - ignition temperature - spontaneous ignition temperature - explosive range - solid fuels - coal and its varieties – proximate and ultimate analysis – significance – metallurgical coke - Otto-Hoffman byproduct method - liquid fuel - refining of petroleum – manufacture of synthetic petrol - hydrogenation of coal - Bergius process - knocking - octane number – cetane number - gaseous fuel - water gas.		
Unit - V	**Polymers:**	**9**
Introduction – terminology - classification - polymerization - types of polymerization (definition only)- polymerisation techniques-bulk, solution, suspension and emulsion polymerisation - plastics- difference between thermoplastics and thermosetting plastics - compounding of plastics- plastic moulding methods - compression, injection, extrusion and blow moulding methods - industrial polymers: preparation, properties and applications of PVC, PAN, polyurethane, polyesters –biodegradable polymers-classification and applications.		

Total: 45

TEXT BOOK:

1. Wiley Editorial Board, "Wiley Engineering Chemistry", 2nd Edition, Wiley India Pvt. Ltd, New Delhi, Reprint 2019.

REFERENCES:

1. Palanisamy P.N., Manikandan P., Geetha A.& Manjula Rani K., "Applied Chemistry", 6th Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2019.
2. Payal B. Joshi, Shashank Deep, "Engineering Chemistry", Oxford University Press, New Delhi, 2019.
3. Palanna O., "Engineering Chemistry", McGraw Hill Education, New Delhi, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply the suitable water softening methods to avoid boiler troubles.	Applying (K3)
CO2	apply the principle of electrochemistry for various applications.	Applying (K3)
CO3	make use of corrosion control methods to solve corrosion related problems.	Applying (K3)
CO4	illustrate the quality of fuels from its characteristics.	Understanding (K2)
CO5	explain the types of polymers, plastics and fabrication methods.	Understanding (K2)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

20ITC11 PROBLEM SOLVING AND PROGRAMMING

Programme & Branch	BTech – Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	PC	3	0	2	4

Preamble	Problem solving skill is the most important skill to be possessed by any student. Most of the time, the emphasis is on learning a programming language rather than on inculcating the problem solving skills. This course is designed for use by freshmen students taking their first course in programming. It deals with the techniques needed to practice computational thinking, the art of using computers to solve problems and the ways the computers can be used to solve problems. This course also focuses on developing programming skills using C language.

Unit - I	**Introduction to Computer and Problem Solving:**	**9**

Overview of computers : Types, Generations, Characteristics, Basic computer Organization –Programming methodologies – Structured programming Problem solving techniques: Algorithms – Flowcharts – Pseudo codes – Structuring the logic: Sequential, selection and repetitive structure.

Unit - II	**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 - III	**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 - IV	**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 - V	**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

List of Exercises / Experiments :

1.	Writing algorithms and drawing flowcharts using Raptor Tool for problems involving sequential structures
2.	Writing algorithms and drawing flowcharts using Raptor Tool for problems involving selective structures
3.	Writing algorithms and Drawing flowcharts using Raptor Tool for problems involving repetitive structures
4.	Programs for demonstrating the use of different types of operators like arithmetic, logical, relational and ternary operators (Sequential structures)
5.	Programs to Illustrate the different formatting options for input and output
6.	Programs using decision making statements like ‘if’, ‘else if’, ‘switch’, conditional and unconditional ‘goto’ (Selective structures)
7.	Programs for demonstrating repetitive control statements like ‘for’, ‘while’ and ‘do-while’ (Iterative structures)
8.	Programs for demonstrating one-dimensional and two-dimensional numeric array
9.	Programs to demonstrate modular programming concepts using functions (Using built-in and user-defined functions)
10.	Programs to implement various character and string operations with and without built-in library functions.
11.	Programs to demonstrate the use of pointers
12.	Programs to illustrate the use of user-defined data types

Lecture:45, Practical:30, Total: 75

TEXT BOOK:

1.	Sumitabha Das, "Computer Fundamentals and C Programming", 1st Edition, McGraw Hill, 2018.

REFERENCES:

1.	YashavantKanetkar,"Let us C", 16th Edition, BPB Publications, 2018.
2.	Reema Thareja, "Programming in C ", 2nd Edition, Oxford University Press, New Delhi, 2018.
3.	Balagurusamy E., "Programming in ANSI C", 7th Edition, McGraw Hill Education, 2017.
4.	Raptor and C Compiler

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	outline the basics of computers and apply problem solving techniques to express the solution for the given problem	Applying (K3)
CO2	identify the appropriate looping and control statements in C and develop applications using these statements	Applying (K3)
CO3	develop simple C programs using the concepts of arrays and modular programming	Applying (K3)
CO4	recall the basic concepts of pointers and develop C programs using strings and pointers	Applying (K3)
CO5	make use of user defined data types to solve given problems	Applying (K3)
CO6	demonstrate the execution of flowchart for the given problem using Raptor	Applying (K3), Precision (S3)
CO7	demonstrate the application of sequential, selective and repetitive control structures	Applying (K3), Precision (S3)
CO8	implement solutions to the given problem using derived and user defined data types and functions	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
CO2	3	2	2										2	1
CO3	3	2	2										2	1
CO4	3	2	2										2	1
CO5	3	2	2										2	1
CO6	3	2	1	1	1					1			2	1
CO7	3	2	1	1	1					1			2	1
CO8	3	2	1	1	1					1			2	1

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

ASSESSMENT PATTERN - THEORY

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

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

20ITT11 FOUNDATIONS OF IT

Programme & Branch	BTech - Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	ES	3	0	0	3

Preamble	This course is intended to introduce the fundamental concepts of computers and foundations of Information Technology	
Unit - I	**Data and Information, Acquisition of Numbers and Textual Data:**	**9**
Data and Information: Introduction -Types of Data - Simple Model of a Computer -Data Processing Using a Computer -Desktop Computer. Acquisition of Numbers and Textual Data: Introduction - Input Units - Internal Representation of Numeric Data - Representation of Characters in Computers -Error-Detecting Codes.		
Unit - II	**Acquiring Image Data, Acquiring Audio and Video Data:**	**9**
Acquiring Image Data: Introduction - Acquisition of Textual Data - Acquisition of Pictures -Storage Formats for Pictures - Image Compression Fundamentals - Image Acquisition with a Digital Camera. Acquiring Audio and Video Data: Introduction - Basics of Audio Signals -Acquiring and Storing Audio Signals -Compression of Audio Signals-Acquisition of Video – Introduction-Capturing a Moving Scene with a Video Camera - Compression of Video Data-MPEG Compression Standard.		
Unit - III	**Data Storage and Central Processing Unit:**	**9**
Data Storage: Introduction - Storage Cell - Physical Devices Used as Storage Cells - Random Access Memory - Read Only Memory - Secondary Storage - Compact Disk Read Only Memory (CDROM) - Archival Store.Central Processing Unit: Introduction- Structure of a Central Processing Unit-Specifications of a CPU- Interconnection of CPU with Memory and I/O Units - Embedded Processors		
Unit - IV	**Output Devices, Computer Software and Computer Networks:**	**9**
Output Devices and Computer Software: Introduction -Video Display Devices -Touch Screen Display - E-Ink Display -Printers - Audio Output -Computer Software- Introduction - Operating System -Programming Languages- Classification of Programming Languages Based on Applications.Computer Networks: Introduction - Local Area Network (LAN) - Applications of LAN - Wide Area Network (WAN) -Internet - Naming Computers Connected to Internet- Future of Internet Technology.		
Unit - V	**Data Organization, Processing Numerical Data and Displaying Textual Data:**	**9**
Data Organization: Introduction- Organizing a Database - Structure of a Database - Database Management System -Example of Database Design - Non-Text Databases - Archiving Databases. Processing Numerical Data and Displaying Textual Data: Introduction - Use of Spreadsheets -Numerical Computation -Processing and Displaying Textual Data -Introduction -Word Processor-Desktop Publishing - Page Description Language - Markup Languages. Some Internet Applications – Introduction-Email - World Wide Web - Information Retrieval from the World Wide Web - Other Facilities Provided by Browsers.		

Total: 45

TEXT BOOK:

1. Rajaraman V., “Introduction to Information Technology”, 3rd Edition, PHI Publications, India, 2018.

REFERENCES:

1. Pearson Team, “Introduction to Computers and Information Technology”, 2nd Edition, Pearson, 2015

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	differentiate between data and information	Remembering (K1)
CO2	summarize the ways of acquiring various types of data	Understanding (K2)
CO3	illustrate the importance of data storage and Central Processing Unit	Understanding (K2)
CO4	discuss the functions of output devices and system software	Understanding (K2)
CO5	apply appropriate tools for organizing the data	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	13	87					100
CAT2	40	60					100
CAT3	30	50	20				100
ESE	20	60	20				100

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

20PHL11 PHYSICAL SCIENCES LABORATORY I

(Common to All Engineering and Technology Branches)

Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	1	BS	0	0	2	1

Preamble	This course aims to impart hands on training in the determination of the physical parameters such as Young's modulus, rigidity modulus, frequency of vibration, velocity of ultrasonic waves, compressibility of water, wavelength of laser, acceptance angle and the numerical aperture of an optical fiber, and to develop the skills in handling different basic instruments and also aims to impart the basic concepts of volumetric, conductometric and pH meter experiments and thereby, to improve the analytical capability.

List of Exercises / Experiments:

1.	Determination of the Young's modulus of the material of a given beam using uniform bending method.
2.	Determination of the rigidity modulus of the material of a given wire using torsional pendulum.
3.	Determination of frequency of electrically vibrating rod by forming standing waves using Melde's apparatus.
4.	Determination of the velocity of ultrasonic waves in a liquid and the compressibility of a liquid using ultrasonic interferometer.
5.	Determination of (i) the wavelength of a semiconductor laser and (ii) the acceptance angle and the numerical aperture of a given optical fiber.
6.	Estimation of total, temporary and permanent hardness of water by EDTA method.
7.	Estimation of $Ca^{2+}$and Mg^{2+}hardness separately by EDTA method.
8.	Estimation of alkalinity of the given water sample.
9.	Conductometric titration -Mixture of acids.
10.	Estimation of hydrochloric acid using pH meter.

Total: 30

REFERENCES:

1.	Tamilarasan K. and Prabu K.,"Physics Laboratory Manual', 1st Edition, SCM Publishers, Erode, 2020.
2.	Palanisamy P.N., Manikandan P., Geetha A. and Manjula Rani K., "Chemistry Laboratory Manual", 1st Edition, Rajaganapathy Publishers, Erode, 2020.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	determine the Young's modulus of a material using the concepts of elasticity and bending moment of a beam and to determine the rigidity modulus of a wire using the concepts of twisting couple and to compute the frequency of electrically vibrating rod using the concept of standing waves formed in fixed vibrating string.	Applying (K3), Precision (S3)
CO2	determine the wavelength of a semiconductor laser beam using the concept of diffraction of light, and to compute the acceptance angle and the numerical aperture of an optical fiber using the concepts of total internal reflection and divergence of light in air and estimate the amount of hardness for the given water sample by EDTA method, and the amount of alkalinity for the given water sample.	Applying (K3), Precision (S3)
CO3	demonstrate the conductivity meter and pH meter to estimate the amount of the given solution.	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										
CO2				3										
CO3				3										

Mapping of COs with POs and PSOs
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

20ITL11 IT ESSENTIALS LABORATORY

Programme & Branch	BTech - Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	ES	0	0	2	1

Preamble	To Assemble and upgrade personal computer systems and to Troubleshoot system, software, and hardware problems

List of Exercises / Experiments:

1.	Study the function of the following components i) Input devices ii) Central Processing Unit (CPU) iii) Output devices iv) Memory v) Networking components (Network Interface Card (NIC), switch, hub, router, and modem)
2.	Install and configure Windows and Linux Operating System.
3.	Customize Operating System and maintenance of system application software.
4.	Perform the following operations in word processing: i) Modifying Layout of a Paragraph ii) Managing Headers iii) Managing Footers iv) Managing Styles v) Insert Graphical Objects and Illustrations vii) Text Wrapping viii) Inserting Objects ix) Insert Shapes, Symbols and Special Characters x) Insert tables – insert/delete rows and columns, merge andsplit cells.
5.	Perform the following operations using Presentation tool: i) Inserting a Movie Clip ii) Inserting an Audio Clip iii) Working with Tables iv) Working with Charts v) Inserting Transitions vi) Inserting Animations vii) Grouping Objects ix) Reviewing Content x) Preparing to Deliver a Presentation
6.	Perform the following operations in Spreadsheets: i) Use Auto sum in Cells ii) Conditional Formatting iii) Hide / Unhide / Freeze Rows and Columns iv) Set Page Breaks v) Set Page Layout vi) Manage Workbook Views vii) Apply Cell and Range Names viii) Create Modify and Format Charts ix) Sort and Filter Data x) Calculate Data across Worksheets
7.	Install Printer, Scanner and troubleshoot their faults.
8.	Perform the following operations in Email Messaging: i) Working with Calendar ii) Schedule an Appointment iii) Categorize an Appointment iv) Share a Calendar v) Creating a Meeting Request vi) Respond to a Meeting Request vii) Create and Edit a Task viii) Create and Edit a Note ix) Create and Edit a Journal Entry
9.	Perform any one online transaction: i) Ticket Booking (Train Ticket, Bus Ticket, Flight Ticket, Cinema Ticket) ii) Bill Payment (EB Bill, Mobile Recharge, Insurance Premium, EMI) iii) Online Purchase (Flipkart, Amazon)

Total: 30

REFERENCE BOOKS:

1.	MS-Office suite
2.	Installation and Configurations notes.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	organize the functional parts of computers and network components	Applying (K3), Manipulation (S2)
CO2	utilize various tools like word processing, spreadsheets, presentation and database	Applying (K3), Precision (S3)
CO3	experiment with computer hardware and software configurations.	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

Mapping of COs with POs and PSOs
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

20EGT21 ADVANCED COMMUNICATION SKILLS

(Common to all Engineering and Technology Branches)

Programme & Branch	All BE/BTech branches	Sem.	Category	L	T	P	Credit
Prerequisites	20EGT11 – English Language Skills	2	HS	3	0	0	3

Preamble	This course is designed to impart required levels of fluency in using the English Language at B1Level in the Common European Framework (CEFR).	
Unit - I	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – VI**	**9**
Listening – Job and career related descriptions and conversations – requests of different kinds and the responses – **Speaking -** Career choices and professional skills – making requests and responding to requests – **Reading** – Using texts about jobs and careers – about different societies and cultural differences – **Writing** – Resumes, CVs and job oriented advertisements – business and career related emails – **Grammar &Vocabulary** – Gerunds and elements of comparison – requests and indirect requests.		
Unit - II	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – VII**	**9**
Listening – Expository and narrative descriptions – information about different cultures, nations and societies. **Speaking** – Narrating and describing – talking about other countries and other cultures – **Reading** – Using texts about media and information technology – living abroad and experiencing different cultures – **Writing** – Blog writing – brochures and tourist pamphlets – **Grammar & Vocabulary** – The past tense forms - noun phrases and relative clauses.		
Unit - III	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – VIII**	**9**
Listening – Consumerism – product description – complaints and redressal – environmental issues – ecology – saving the planet – **Speaking** – Talking about problems, issues, complaints – solutions and redressal – talking about environmental issues – **Reading** – Using texts on segregating wastes – recycling and reusing – texts on environmental issues – **Writing** – Online reviews, articles and writing web content – **Grammar & Vocabulary** – Phrases and sentences used for describing problems – passives – prepositions and infinitives.		
Unit - IV	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – IX**	**9**
Listening – Education, learning and the choice of courses – various services needed in daily life – self-improvement for success in life – **Speaking** - Discussions about educational and career oriented issues – talking about everyday services – giving advice and self improvement – **Reading** – Reading about learning strategies and learning styles – using texts about personality development – **Writing** – Writing about hobbies – pastime and individual skills – writing short articles on everyday life and personality development – **Grammar & Vocabulary** – Using of "would" and certain gerund forms – use of modals, verbs, gerunds, negative questions and infinitives.		
Unit - V	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – X**	**9**
Listening – Historical narratives – biographies and learning about the future – important life events, milestones and happenings of the past – **Speaking** – Talking about the past, present and the future – talking about important events in life – **Reading** – Texts about new technologies and future science – using texts about social organization, culture and social practices – **Writing** – Biographical sketches – historical events – famous personalities, stages of life and getting along with people – **Grammar & Vocabulary** – Future tense forms – time clauses and certain "if clauses".		

Total: 45

TEXT BOOK:

1. Jack C. Richards, Jonathan Hull, and Susan Proctor, "Interchange - Student's Book 3", 4th Edition, Cambridge University Press, New York, 2017.

REFERENCES:

1. Sanjay Kumar and Pushp Lata, "Communication Skills: A Workbook based on AICTE Syllabus", Oxford University Press, 2018.
2. Board of Editors, "Skills Annexe: Functional English for Success", Orient BlackSwan, Hyderabad, 2013.

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 spoken excerpts critically and infer Unspoken and implied meanings.	Applying (K3)
CO3	read different genres of texts, infer implied meanings and critically analyze and evaluate them for ideas as well as for method of presentation.	Analyzing (K4)
CO4	write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.	Creating (K6)
CO5	speak effectively, to express opinions clearly, initiate and sustain a discussion and also negotiate using appropriate communicative strategies.	Creating (K6)

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	1	1		
CO2									2	3		1		
CO3						1				3	1	1		
CO4										3		2		
CO5									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		13	30	33	-	17	100
CAT2		13	33	37	-	17	100
CAT3		20	30	33	-	17	100
ESE		6	40	36	-	18	100

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

20MAC21 MULTIVARIABLE CALCULUS AND COMPLEX ANALYSIS

(Common to All Engineering and Technology Branches)

Programme & Branch	All BE/BTech branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	BS	3	1*	2*	4

Preamble	To impart the knowledge of partial derivatives, evaluation of real and complex integrals, vector calculus and analytic functions to the students for solving the problems related to various engineering disciplines.	
Unit - I	**Functions of Several Variables:**	**9**
Functions of two or more variables – Partial derivatives – Total differential – Taylor's series for functions of two variables – Maxima and minima – Constrained maxima and minima – Lagrange's multiplier method		
Unit - II	**Multiple Integrals:**	**9**
Double integration in cartesian coordinates – Change of order of integration – Application: Area between two curves – Triple integration in cartesian coordinates –Volume as triple integrals		
Unit - III	**Vector Calculus:**	**9**
Directional derivative – Gradient of a scalar point function – Divergence of a vector point function – Curl of a vector – Solenoidal and Irrotational vectors – Green's, Stoke's and Gauss divergence theorems (without proof) – Verification of the above theorems and evaluation of integrals using them**.**		
Unit - IV	**Analytic Functions:**	**9**
Functions of a complex variable – Analytic functions – Necessary and sufficient conditions (excluding proof) – Cauchy–Riemann equations (Statement only) – Properties of analytic function (Statement only) – Harmonic function – Construction of analytic function – Conformal mapping: w = z + a, az, 1/z – Bilinear transformation.		
Unit - V	**Complex Integration:**	**9**
Introduction – Cauchy's theorem (without proof) – Cauchy's integral formula – Taylor's and Laurent series – Singularities – Classification – Cauchy's residue theorem (without proof) – Applications: Evaluation of definite integrals involving sine and cosine functions over the circular contour.		

List of Exercises / Experiments:

1.	Finding ordinary and partial derivatives
2.	Computing extremes of a single variable function
3.	Evaluating double and triple integrals
4.	Finding the area between two curves
5.	Computing gradient, divergence and curl of point functions
6.	Applying Milne-Thomson method for constructing analytic function
7.	Determination of Mobius transformation for the given set of points
8.	Finding poles and residues of an analytic function

***Alternate week**

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

TEXT BOOK:

1. Ravish R. Singh, Mukul Bhatt "Engineering Mathematics", 1st Edition, McGraw Hill Education, New Delhi, 2016.

REFERENCES:

1. Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley Sons, 2011.
2. Dass H K, "Higher Engineering Mathematics", 3rd Revised Edition, S.Chand and Co., New Delhi, 2014.
3. Duraisamy C., Vengataasalam S., Arun Prakash K. and Suresh M., "Engineering Mathematics – I", 2nd Edition, Pearson India Education, New Delhi, 2018.

4.	MATLAB Manual.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	compute extremal values which arise in function of several variables.	Applying (K3)
CO2	solve Problems involving Double and Triple integrals.	Understanding (K2)
CO3	apply the concept of vectors in engineering problems.	Applying (K3)
CO4	identify, construct and apply analytic functions in electrostatics and fluid flow problems.	Applying (K3)
CO5	evaluate complex integrals which are extensively applied in engineering.	Applying (K3)
CO6	compute maxima and minima of a single variable function, gradient, curl and divergence of a vector function using MATLAB.	Understanding (K2), Manipulation (S2)
CO7	evaluate Double, Triple integrals and determine area between two curves using MATLAB	Applying (K3), Manipulation (S2)
CO8	construct analytic function, find bilinear transformation and compute poles and residues using MATLAB.	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												
CO2	3	3	2											
CO3	3	3												
CO4	3	3												
CO5	3	3	2											
CO6					3									
CO7					3									
CO8					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)**

20PHT23 PHYSICS FOR COMMUNICATION AND COMPUTER SCIENCE ENGINEERING

(Common to Electronics and Communication Engineering, Computer Science and Engineering and Information Technology branches)

Programme & Branch	BE, Electronics and Communication Engineering, BE-Computer Science and Engineering, BTech-Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Applied Physics	2	BS	3	0	0	3

Preamble	This course aims to impart the knowledge on the physics of conductors, superconductors, semiconductors, magnetic materials, dielectrics, optoelectronic materials and nano materials. It also describes the working of the select solid state and optoelectronic devices and the applications of aforementioned materials in Communication Engineering and Computer Science and Engineering and Information Technology and provides motivation towards innovations.	
Unit - I	**Conducting and Superconducting Materials:**	**9**
Conducting Materials: Introduction - Classical free electron theory of metals - Electrical conductivity - Drawbacks of classical free electron theory - Quantum free electron theory - Quantum statistics: Fermi distribution function and Effect of temperature on Fermi function - Superconducting Materials: Introduction - Properties of superconductors - Type I and Type II superconductors - Applications: Cryotron - Superconducting quantum interference device (SQUID).		
Unit - II	**Semiconducting Materials and Devices:**	**9**
Introduction - Intrinsic semiconductor: Carrier concentration, Fermi level in intrinsic semiconductor, Variation of intrinsic conductivity with temperature and Determination of band gap - Extrinsic semiconductor: Carrier concentration in N-type and P-type semiconductors, Fermi level in Extrinsic semiconductors, Variation of Fermi level with temperature and impurity concentration - Hall effect: Determination of Hall coefficient and its applications - Uni-junction Transistor: Construction and characteristics – Junction field Effect Transistor: Construction and characteristics.		
Unit - III	**Magnetic and Dielectric Materials:**	**9**
Magnetic materials: Introduction - Classification of magnetic materials based on magnetic moment - Ferromagnetism: Domain theory of ferromagnetism, Hysteresis loss, Soft and hard magnetic materials and Application: Transformer core. Dielectrics Materials: Introduction - Dielectric constant - Types of polarization (qualitative) - Temperature dependence of polarization - Frequency dependence of total polarization - Dielectric loss (qualitative) - Dielectric breakdown – Ferroelectricity and its applications.		
Unit - IV	**Optoelectronic Materials and Devices:**	**9**
Introduction - Photodetectors: p-i-n photo diode - Avalanche photo diode – Effect of Anisotropic crystals in light propagation: Index ellipsoid of uniaxial and biaxial crystals -Electro-Optic effect: Pockel's effect and Kerr effect - Light modulators - Types of light modulators - Electro refractive modulators: Electro-optic amplitude and Phase modulators - Electro absorptive modulators: Franz - Keldysh and Stark effect modulators.		
Unit - V	**Nano Materials:**	**9**
Introduction - Properties of nano-materials - Low dimensional structures: Quantum dot, quantum wire and quantum well - Production techniques: Ball Milling, lithographic method, physical vapor deposition method, chemical vapor deposition method and sol gel method - Applications of nano-materials – Carbon nanotubes: Structures, properties, synthesis by laser ablation method - Applications of carbon nanotubes.		

Total:45

TEXT BOOK:

1. Avadhanulu M.N., Kshirsagar P.G. and Arun Murthy T.V.S., "A Textbook of Engineering Physics", 11th Edition, S. Chand & Company Pvt. Ltd., New Delhi, 2019 for Unit I, II, III and Unit V.
2. Palanisamy P.K., "Semiconductor Physics and Opto electronics", 2nd Edition, Sci Tech Publications, Chennai, 2010, for Unit IV.

REFERENCES:

1. Kachhava C.M., "Solid State Physics, Solid State Device and Electronics", 1st Edition, New Age International, New Delhi, 2003.
2. Charles Kittel, "Introduction to Solid State Physics", 8th Edition, John Wiley& Sons, New Jersey, 2004.
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	apply the concepts of classical and quantum free electron theory of metals to compute the electrical conductivity of metals and to comprehend the effect of temperature on Fermi function and to summarize the types, properties and applications of superconductors (Cryotron and Superconducting quantum interference device).	Applying (K3)
CO2	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 phenomenon related to Hall Effect and the working of UJT and JFET.	Applying (K3)
CO3	apply the domain theory of ferromagnetism to explain hysteresis and to apply the concept of electric dipole moment and electric polarization to comprehend the select polarization mechanisms in dielectrics and to describe the related phenomenon.	Applying (K3)
CO4	apply the theory of photoconductivity and p-n junction to describe the materials, construction, working and applications of the select optoelectronic devices and to apply the concept of index ellipsoid of uniaxial and biaxial crystals to explain the principle, working and application of opto-electric modulators.	Applying (K3)
CO5	utilize appropriate methods to prepare nano-materials and carbon nano-tubes, and to comprehend their properties, types 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	1											
CO2	3	2	1											
CO3	3	2	1											
CO4	3	2	1											
CO5	3	2	1											

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

ASSESSMENT PATTERN - THEORY

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

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

20CYT23 CHEMISTRY OF ELECTRONIC MATERIALS

Programme & Branch	B.E – ECE, CSE, EEE, EIE & B.TECH- IT branches	Sem.	Category	L	T	P	Credit
Prerequisites	Applied Chemistry	2	BS	3	0	0	3

Preamble	Chemistry of electronic materials aims to equip the engineering students to realize the importance of chemistry in polymeric materials, metal finishing, organic electronic materials, fuel cells, renewable energy and e-waste management.	
Unit - I	**Chemistry of Polymeric and Composite Materials :**	**9**
Introduction - structure and property relationship of polymers - plastics - properties and uses of plastics as engineering materials - rubbers (elastomers) - natural rubber- processing of latex- vulcanization of rubber - synthetic rubbers- preparation, properties and uses of thiokol and butyl rubber- polymer blends and alloys - fibres-physical properties-types-spinning processes- composites - classification of composites - fibre reinforced plastics- processing , properties and uses of fiber reinforced plastics		
Unit - II	**Industrial Metal Finishing :**	**9**
Introduction – technological importance of metal finishing- methods of metal finishing - manufacturing of electronic component- PCB fabrication- essential of metal finishing: polarization, decomposition potential and overpotential - surface preparation - Electroplating – Process - effect of plating variables on the nature of electrodeposit - electroplating of chromium and silver. Electroless plating - electroless copper plating on printed circuit board - electroless nickel plating process -Distinction between electroplating and electroless plating- advantages of electroless plating.		
Unit - III	**Chemistry of Organic Electronic Materials and Fuel Cells:**	**9**
Introduction-Organic semiconducting materials – principle and applications - advantages over inorganic semiconducting materials - P-type and N-type organic semiconducting materials (definition and examples) - conducting polymers and its applications - organic dielectrics (principle and example) - organic light emitting diodes - working and applications. Fuel Cells: Importance and classification of fuel cells - description, principle, components, applications and environmental aspects of fuel cells: alkaline fuel cells, phosphoric acid, molten carbonate and direct methanol fuel cells.		
Unit - IV	**Renewable Energy Resources:**	**9**
Introduction – global energy consumption scenario- types of energy resources - nuclear energy - nuclear power reactor - breeder reactors - applications and disadvantages of nuclear energy - design, working, advantages and disadvantages of solar energy, hydropower, wind energy, geothermal energy, tidal and wave power, ocean thermal energy - biomass and biofuels - hydrogen as an alternate fuel - hydrogen production - advantages ,disadvantages and applications - nanotechnology for energy sector.		
Unit - V	**E-Waste and its Management:**	**9**
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 – 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 Units I,II,IV.
2. Palanisamy P.N., Manikandan P., Geetha A., Manjula Rani K.& Kowshalya V.N., “Environmental Science”, Revised Edition, Pearson Education, New Delhi, 2019 for Units I, III, IV, V.

REFERENCES:

1. Palanna O., "Engineering Chemistry" , McGraw Hill Education, New Delhi, 2017 for Units II,III.
2. B.Joshi & Shashank Deep, “Engineering Chemistry”, Oxford University Press, New Delhi, 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	utilize the polymeric and composite materials for various applications	Applying (K3)
CO2	employ the concept of coating techniques in industrial metal finishing	Applying (K3)
CO3	apply the concepts of fuel cells, organic electronic materials and its applications	Applying (K3)
CO4	explain the role of renewable energy resources to attain sustainability	Understanding (K2)
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	1												
CO4	3	2	1	1										
CO5	3	2	1	1										

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

ASSESSMENT PATTERN - THEORY

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

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

20MEC11 ENGINEERING GRAPHICS

(Common to Civil, Mechanical, Mechatronics, Automobile Engineering, Chemical & Food Technology Branches)

Programme & Branch	BE(Civil, Mech, MTS, Auto) &BTech(Chem, FT)	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	ES	2	0	2	3

Preamble	To impart knowledge on orthographic, isometric projections, sectional views and development of surfaces by solving different application oriented problems.	
Unit - I	**General Principles of Orthographic Projection:**	**9**
Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications - Size, layout and folding of drawing sheets - Lettering and dimensioning - Projections of Points, Lines and Planes - General principles of orthographic projection - First angle projection - Layout of views - Projection of points located in all quadrant and straight lines located in the first quadrant - Determination of true lengths and true inclinations and location of traces - Projection of polygonal surface and circular lamina inclined to both reference planes.		
Unit - II	**Projections of Solid:**	**9**
Projections of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.		
Unit - III	**Sectioning of Solids:**	**9**
Sectioning of solids - prisms, pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other - Obtaining true shape of section.		
Unit - IV	**Development of Surfaces:**	**9**
Development of lateral surfaces of simple solids like prisms, pyramids, cylinders and cones – development of simple truncated solids involving prisms, pyramids, cylinders and cones.		
Unit - V	**Isometric Projection and Introduction to AutoCAD:**	**9**
Principles of isometric projection - Isometric scale - Isometric projections of simple and truncated solids like prisms, pyramids, cylinders and cones - Conversion of isometric projection into orthographic projection - Introduction to AutoCAD.		

Lecture:30, Practical:30, Total:60

TEXT BOOK:

1. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, 15th Edition, New Age International Pvt. Ltd., New Delhi, 2018.

REFERENCES:

1. Basant Agrawal, Agrawal C.M., “Engineering Drawing”, 2nd Edition, McGraw Hill Education, 2019.
2. Gopalakrishnana K.R. “Engineering Drawing”, Volume. I & II, Subhas Publications, Bengaluru, 2014.
3. Parthasarathy N.S., Vela Murali. “Engineering Drawing”, 1st Edition, Oxford University Press, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	interpret international standards of drawings and sketch the projections of points, lines and planes.	Understanding (K2)
CO2	draw the projections of 3D primitive objects like prisms, pyramids, cylinders and cones.	Applying (K3)
CO3	construct the various sectional views of solids like prisms, pyramids, cylinders and cones.	Applying (K3)
CO4	develop the lateral surfaces of simple and truncated solids.	Applying (K3)
CO5	sketch the isometric projections of simple and truncated solids and convert isometric drawing in to orthographic projection.	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	2	2	2	3
CO2	3	2	1	1						3	2	3	2	3
CO3	3	2	1	1						3	2	3	2	3
CO4	3	2	1	1						3	2	3	2	3
CO5	3	2	1	1						3	2	3	2	3

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

ASSESSMENT PATTERN - THEORY

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

20ITT21 PROGRAMMING AND LINEAR DATA STRUCTURES

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

List of Exercises:

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

Lecture: 45, Practical: 30, Total: 75

TEXT BOOK:

1.	Sumitabha Das, “Computer Fundamentals &C Programming”, McGraw Hill Education(India) Private Limited, 1st Edition, 2018, for Units I,II,III,IV.
2.	PradipDey, Manas Ghosh, “Programming in C”, Oxford Higher education, 2nd Edition, 2016, for Unit V.

REFERENCES:

1.	Yashavant Kanetkar, “Pointers in C”, BPP Publications, 4th Edition, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	make use of pointers to perform array and string operations	Applying (K3)
CO2	implement functions and structures with pointers	Applying (K3)
CO3	demonstrate file operations and preprocessor directives	Applying (K3)
CO4	describe the different operations on singly linked list and make use of it for developing simple applications	Applying (K3)
CO5	manipulate the operations on stacks and queues	Applying (K3)
CO6	implement programs to solve problems using pointers to arrays and structures	Applying (K3), Precision (S3)
CO7	develop programs using files and preprocessor directives	Applying (K3), Precision (S3)
CO8	use appropriate linear data structure for solving given 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									2	1
CO2	3	2	1	1									2	1
CO3	3	2	1	1									2	1
CO4	3	2	1										2	1
CO5	3	2	1	1									2	1
CO6	3	2	1	1									2	1
CO7	3	2	1	1									2	1
CO8	3	2	1	1									2	1

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	10	80				100
CAT2	10	10	80				100
CAT3	10	20	70				100
ESE	10	30	60				100

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

20PHL28 PHYSICAL SCIENCES LABORATORY II

Prog. & Branch	BTech - Information Technology	Sem.	Category	L	T	P	Credit
Pre requisite	Nil	2	BS	0	0	2	1

Preamble	This course aims to impart hands on training in the determination of physical parameters such as specific resistance, band gap, hysteresis loss and thickness of a nano-structured material and also the working UJT, and to develop the skills in handling different basic instruments. This course also aims to impart the significance of Cl^-, Cr^{6+}, DO, Fe^{2+} and Cu^{2+} and thereby, to improve the analytical capability.

List of Exercises / Experiments:

1.	Determination of the specific resistance of the material of a wire using Carey-Foster's bridge.
2.	Determination of the band gap of a semiconductor using post office box.
3.	Observation of the I-V characteristics of a uni junction transistor.
4.	Determination of hysteresis loss in a ferromagnetic material.
5.	Determination of the thickness of a nano-structured material using air-wedge arrangement.
6.	Estimation of chloride ion in the given water sample using Argentometric method.
7.	Estimation of chromium (Cr^{6+}) in wastewater sample.
8.	Determination of dissolved oxygen in the given wastewater sample.
9.	Estimation of iron using permanganometry.
10.	Estimation of copper in the given solution by Iodometric method.

Total: 30

REFERENCES:

1.	Tamilarasan K. and Prabu K., "Physics Laboratory Manual", 1st Edition, SCM Publishers, Erode, 2020.
2.	Palanisamy P.N., Manikandan P., Geetha A. and Manjula Rani K., "Chemistry Laboratory Manual", 1st Edition, Kalaikathir Publishers, Coimbatore, 2020.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	determine the specific resistance of conducting materials and the band gap of semiconducting materials using the concept of electrical conductivity and to obtain the V-I characteristics of a UJT using the concept of creation of a region with negative resistance.	Applying (K3), Precision (S3)
CO2	determine the hysteresis loss in ferromagnetic materials using the concept of domain theory of ferromagnetism and to determine the thickness of nano-crystalline thin films using the concept of interference of light. Estimation of Chloride and Chromium (Cr^{6+}) in the given water sample and also to determine the dissolved oxygen in the given wastewater sample.	Applying (K3), Precision (S3)
CO3	estimation of iron and copper in the given solution.	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											
CO2			3											
CO3			3											

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

20MEL11 ENGINEERING PRACTICES LABORATORY

(Common to Civil, Mechanical, Mechatronics, Automobile Engineering, Chemical & Food Technology Branches)

Programme & Branch	BE (Civil, Mech, MTS, Auto) & BTech (Chem, FT)	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	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 Exercises / Experiments:

	PART A – MECHANICAL ENGINEERING
1.	To prepare square or rectangular shaped MS plates using power tools for cutting, polishing and shaping to the required dimensions.
2.	To carryout drilling, tapping and assembly on the given MS plates.
3.	To carryout thread forming on a GI/PVC pipes and prepare water leak proof water line from overhead tank.
4.	To prepare a wood or plywood box/tray/any innovative models using modern power tools like cutting machine, router, jigsaw, power screw driver etc.
5.	Welding practice through arc welding / simulator
	PART B – ELECTRICAL AND ELECTRONICS ENGINEERING
1.	Safety Aspects of Electrical Engineering, Electrical Symbols, Components Identification, Fuse selection and installation, Circuit Breakers selection
2.	Wiring circuit for fluorescent lamp and Stair case wiring
3.	Measurement of Earth resistance
4.	Soldering of Simple Circuits and trouble shooting
5.	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), Precision (S3)
CO2	identify and use appropriate modern power tools and complete the exercises/models accurately	Applying (K3), Precision (S3)
CO3	select fuses and Circuit breakers	Understanding (K2), Manipulation (S2)
CO4	perform house wiring and realize the importance of earthing	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	2		3	3	2	1			3	3		3		
CO2	2		3	3	2				3	3		3		
CO3	3		3	3	1				2	2		3		
CO4	3		3	3	1				2	3		3		
CO5	3		3	3	1				2	2		3		

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

20VEC11 YOGA VALUES FOR HOLISTIC DEVELOPMENT
(Common to all Engineering and Technology branches)

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

Preamble	Providing Value Education to improve the Students' character - understanding yogic life and physical health - maintaining youthfulness - Measure and method in five aspects of life	
Unit - I	**Physical Health:**	**4**
Manavalakalai (SKY) Yoga: Introduction - Education as a means for youth empowerment - Greatness of Education - Yoga for youth Empowerment. **Simplified Physical Exercises:** Need and Objectives of Simplified Physical Exercise - Hand, Leg, Breathing, Eye exercises - Kapalabathi, Makarasana Part I, Makarasana Part II, Body Massage, Acu pressure, Relaxation exercises - Benefits. **Yogasanas:** Pranamasana - Hastha Uttanasana - Pada Hasthasana - Aswa Sanjalana Asana - Thuvipatha asva Sanjalana asana - Astanga Namaskara - Bhujangasana - Atha Muktha Savasana - Aswa Sanjalana Asana - Pada Hasthasana - Hastha Uttanasana - Pranamasana. **Pranayama:** Naddi suddi - Clearance Practice - Benefits.		
Unit - II	**Life Force:**	**4**
Reasons for Diseases: Body Function - Reason for Diseases and Prevention - Natural reasons (Genetic / imprints, Planetary Position, Natural calamities and climatic changes) - Unnatural reasons (Food habits, Thoughts, Deeds). **Philosophy of Kaya kalpa:** Enriching Bio-Magnetism - Physical body - Sexual vital fluid - Life force - Bio-Magnetism - Mind. **Maintaining youthfulness:** Postponing old age - Transformation of food into seven components - Importance of sexual vital fluid - Measure and method in five aspects of life - Controlling undue Passion. **Kayakalpa practice:** Aswini Mudra - Ojas breath - Benefits of Kaya Kalpa.		
Unit - III	**Mental Health:**	**4**
Mental Frequencies: Beta, Apha, Theta and Delta wave - Agna Meditation explanation - benefits. **Shanti meditation:** Shanthi Meditation explanation – benefits. **Thuriya Meditation:** Thuriya Meditation explanation – benefits. **Benefits of Blessing:** Self blessing (Auto suggestion) - Family blessing - Blessing the others - World blessing - Divine protection.		
Unit - IV	**Values:**	**4**
Human Values: Self control - Self confidence - Honesty Contentment - Humility – Modesty - Tolerance - Adjustment - Sacrifice – Forgiveness - Purity (Body, Dress, Environment) - Physical purity - Mental purity - Spiritual purity. **Social Values:** Non violence – Service. Patriotism – Equality. Respect for parents and elders - care and protection - Respect for teacher. Punctuality - Time Management.		
Unit - V	**Morality (Virtues):**	**4**
Importance of Introspection: I - Mine (Ego, Possessiveness). Six Evil Temperaments - Greed - Anger - Miserliness - Immoral sexual passion - Inferiority and superiority Complex – Vengeance. Maneuvering of Six Temperaments: Contentment - Tolerance - Charity - Chastity - Equality - Pardon (Forgiveness). Five essential Qualities acquired through Meditation: Perspicacity - Magnanimity - Receptivity - Adaptability - Creativity (Improved Memory Power).		

Total:20

TEXT BOOK:

1. Thathuvagnani Vethathiri Maharishi, "Yoga for Youth Empowerment", Vethathiri Publications, 2019.

REFERENCES:

1. Thathuvagnani Vethathiri Maharishi, "Yoga for Modern Age", Vethathiri Publications, 2019.
2. Thathuvagnani Vethathiri Maharishi, "Simplified Physical Exercises", Vethathiri Publications, 2019.
3. Neelam Sharma, "Holistic Education and Yoga", Shipra Publications, 2017.
4. Dr. Joseph Murphy, "The Power of Your Subconscious Mind", Pushpak Publication, 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand the importance of physical health and practice simplified physical yoga exercise.	Applying (K3)
CO2	understand the importance of Kayakalpa exercise to enrich Bio-Magnetism and practice it.	Applying (K3)
CO3	understand the significance of meditation and do meditation to get sound mind.	Applying (K3)
CO4	understand the human and social values to provide service to society.	Applying (K3)
CO5	understand the evil temperaments and five essential qualities acquired through meditation	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		
CO3						3		3				1		
CO4						3		2	1			1		
CO5						3		3				1		

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

ASSESSMENT PATTERN

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

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

20MAT34 DISCRETE MATHEMATICAL STRUCTURES

(Common to Computer Science and Engineering & Information Technology branches)

Programme & Branch	BE – Computer Science and Engineering & BTech – Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	3	BS	3	1	0	4

Preamble	To impart knowledge in mathematical logic, partial ordering and lattices, investigate various category of functions and develop skills to apply graph theoretic concepts in networking and 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", 7th Edition, Tata McGraw Hill Publishing Company, 2012.
3. Susanna S. Epp, "Discrete Mathematics with Applications", Metric Edition, Cengage Learning, USA, 2019.
4. Alan Doerr, Kenneth Levasseur, "Applied Discrete Structures", 3rd Edition, 2018.

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	1										1	
CO2	3	2	1										1	
CO3	3	2	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	15	20	65				100
CAT2	10	20	70				100
CAT3	10	40	60				100
ESE	10	30	60				100

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

20ITC31 DIGITAL LOGIC AND MICROPROCESSORS

Programme & Branch	B.Tech. & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	3	ES	3	0	2	4

Preamble	This course enables the students to understand the basic principles of combinational logic and sequential logic circuits and how to design different types of counters. And it also throws light on the functional architecture of 8086 and its interfaces.	
Unit - I	**Combinational Logic:**	**9**
Logic Gates - Realization of functions using Logic gates-Canonical and Standard Forms of Boolean functions – Minimization of functions using Karnaugh Map – Don't Care Conditions – NAND and NOR Implementation -Half Adder – Full Adder - Half Subtractor – Full Subtractor – 4 bit Binary Adder-Subtractor – Code Converters - Decoders – Encoders – Multiplexers – Demultiplexers		
Unit - II	**Sequential Logic:**	**9**
Flip-flops SR,JK,T and D – Characteristic table and equation - Triggering – Realization of one flip-flop using other flip-flops - Shift Registers: SISO– SIPO– PISO–PIPO–Universal Shift register		
Unit - III	**Design of Synchronous Sequential Circuits:**	**9**
State diagram - State table – State minimization – State assignment. Counters: Synchronous Counters: Binary Counter – up-down Binary Counter – BCD Counter – modulo-N Counter – Ring Counter – Johnson Counter		
Unit - IV	**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 Programming		
Unit - V	**8086 Interfacing and Stack:**	**9**
Introduction to stack - Interrupt and interrupt service routines- Interfacing Memory- 8255 (PPI), 8254 (Timer), 8251 (USART), 8279(Key Board Display Interface)		
List of Exercises / Experiments :		
1	Simplify and Implement boolean functions using Combinational Circuits	
2	Implement Adder and Subtractor	
3	Implement Code converters	
4	Implement Decoder and Encoder	
5	Implement Multiplexer and Demultiplexer	
6	Design Counters and Shift Registers	
7	Write simple programs for performing the following operations: addition, subtraction, multiplication and division using 8086.	
8	Write a program to find the maximum and minimum value in the given list using 8086.	
9	Write a program to arrange the given list in ascending/descending order using 8086.	
10	Generate a square ware and rectangular wave by interfacing 8255 with 8086.	

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1. Morris Mano M., Micheal D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL and System Verilog", 6th Edition, Pearson Education, 2019, for Units I, II, III.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay and Lyla B. Da, "Microprocessors and Microcontrollers", 1st Edition, Pearson Education, 2013, for Units IV, V.

REFERENCES:

1. Charles H. Roth, "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	design Combinational logic circuits	Applying (K3)
CO2	design Sequential logic circuits	Applying (K3)
CO3	implement synchronous counters	Applying (K3)
CO4	comprehend the concepts of 16-bit microprocessor and apply their programming for simple problems	Applying (K3)
CO5	apply assembly language programming to interface peripheral devices with 16-bit microprocessor	Applying (K3)
CO6	design and implement combinational logic circuits	Applying (K3), Precision (S3)
CO7	implement Sequential logic circuits using flip-flops	Applying (K3), Precision (S3)
CO8	write assembly language programs for problem solving and to 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	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
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**	**50**	**40**				**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)**

20ITT31 DATA STRUCTURES

Programme & Branch	B. Tech & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	3	PC	3	0	0	3

Preamble	This course introduces the basic concepts of nonlinear data structures and applications of linear data structures.	
Unit - I	**Linear Data Structures and its Applications:**	**9**
Linked List – Doubly Linked List – Circular Linked List– Applications of List: Polynomial Addition – Representing Sparse matrices – Reversing a Linked List – Cloning a Linked List – Sorting of Linked List – Applications of Stack: Towers of Hanoi – Balancing Parenthesis – String Reversal– Applications of Queue: Reversing the Queue using Stack.		
Unit - II	**Trees:**	**9**
Preliminaries: Implementation of trees – Tree Traversals with an Application – Binary trees:Implementation – Expression trees – The Search Tree ADT– Binary Search Trees: Construction – Searching – Insertion – Deletion – Find Min – Find Max– AVL trees: Rotation – Insertion – Deletion.		
Unit - III	**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.		
Unit - IV	**Advanced Trees:**	**9**
Splay Trees: Splaying – B tree– Red-Black Trees: Rotation – Insertion – Deletion – Priority Queues (Heaps) – Binary heap – Applications of Priority Queues: Selection problem – Event Simulation – d-heaps.		
Unit - V	**Searching, Sorting and Hashing:**	**9**
Searching: Linear search – Binary Search – Sorting: Internal sorting: Bubble sort – Shell sort – Bucket sort – External sorting: Multiway Merge – Polyphase Merge – Replacement Selection – Hashing: Hash Functions – Separate Chaining – Open Addressing: Linear Probing – Quadratic Probing – Double Hashing – Rehashing – Extendible Hashing.		

Total: 45

TEXT BOOK:

1. Weiss M. A., “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, London, 2016.

REFERENCES:

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	solve the problems involving lists using linear data structures.	Applying (K3)
CO2	build trees and perform its various operations.	Applying (K3)
CO3	choose appropriate graph algorithm for solving problems.	Applying (K3)
CO4	identify suitable advanced trees and perform operations on them	Applying (K3)
CO5	demonstrate the concept of sorting, searching and hashing 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	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**	**25**	**65**				**100**
CAT2	**10**	**20**	**70**				**100**
CAT3	**10**	**15**	**75**				**100**
ESE	**10**	**20**	**70**				**100**

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

20ITT32 OBJECT ORIENTED PROGRAMMING

Programme & Branch	B. Tech & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	3	PC	3	0	0	3

Preamble	This course provides an overview of object oriented programming concepts with a comprehensive introduction to Java programming. Topics include class definitions, polymorphism by overloading functions, inheritance, packages, interfaces, virtual functions, abstract classes, exception handling, multithreading, string handling and generics. This course also focuses on GUI programming concepts.	
Unit - I	**Introduction to OOP, Java, Classes and Objects:**	**9**
Software Development and object-oriented programming paradigms - History and Evolution of Java – Overview – Data Types - Variables - Arrays – Operators - Control Statements – Classes – Fundamentals – Declaring Objects - Assigning Object Reference Variables - Methods –Constructors - this keyword - Garbage collection - finalize method.		
Unit - II	**Reusability, Packages and Interfaces:**	**9**
Overloading Methods -Objects as Parameters -Argument Passing -Returning Objects – Recursion - Access Control – Static – Nested and Inner Classes – Command - Line Arguments – Variable Length Arguments. Inheritance – Basics – Super keyword - Multilevel Hierarchy - Method Overriding - Dynamic Method Dispatch - Abstract Classes - final with Inheritance. Packages - Access Protection - Importing Packages - Interfaces.		
Unit - III	**Exception Handling, Multithreading and I/O:**	**9**
Exception Handling basics – Multiple catch Clauses- Nested try Statements – Java's Built-in Exceptions – User defined Exception – Chained exceptions. Java Thread Model - Creating a Thread - Priorities – Synchronization – Interthread Communication – Multithreading. I/O Basics - Reading and Writing Console I/O – PrintWriter Class - Reading and Writing Files		
Unit - IV	**String Handling, Generics and Collection:**	**9**
String Class – methods. Wrappers – Auto boxing- Generics – Example – Parameters - General Form- Generic class, Method and Interfaces - Collection: Overview – Interface- List – Set – Map - Classes – ArrayList – LinkedList – Map–Stack – Queue		
Unit - V	**AWT and Event Handling:**	**9**
AWT Classes - Window Fundamentals - Frame Windows - Frame Window in an Applet. AWT Controls - Layout Managers - Event Handling – Mechanisms -Delegation Event Model - Event Classes -ActionEvent -ItemEvent- Sources of Events - Event Listener Interfaces – ActionListener - Mouse and Keyboard events. Handling Events by Extending AWT Components		

Total: 45

TEXT BOOK:

1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, New Delhi, 2019.

REFERENCES:

1. Buyya Rajkumar, 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, 2017.
3. Cay S. Horstmann, "Core Java Fundamentals", 11th Edition, Prentice Hall of India, New Delhi, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply the concepts of classes and objects to solve simple problems	Applying (K3)
CO2	develop applications using inheritance, packages and interfaces	Applying (K3)
CO3	build applications with exception handling mechanisms, multithreaded model and Stream classes	Applying (K3)
CO4	make use of string classes, generics and collection concepts to solve real world problems	Applying (K3)
CO5	develop event-based GUI applications using AWT classes and controls	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	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	40	50	-	-	-	100
CAT3	10	40	50	-	-	-	100
ESE	15	40	45	-	-	-	100

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

20ITT33 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 organization and its sub-components like ALU, CU, and data-path. It also analyzes performance of processor, memory and I/O of a digital computer.	
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, 2012.

REFERENCES:

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

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 determine the addressing modes for the 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 to determine and handle the hazards	Applying (K3)
CO4	distinguish between different types of memory and apply the mapping functions between main memory and cache	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	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	50	30				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)**

20ITL31 DATA STRUCTURES LABORATORY

Programme & Branch	B.Tech. & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Programming and Linear Data structures	3	PC	0	0	2	1
Preamble	This course provides practical exposure to develop applications using the concepts of Linear and Non-linear Data Structures.						

List of Exercises / Experiments :

1.	Perform the polynomial operations using linked list: i) Add $10x^5+2x^3-1$ to $8x^4-x^3+16x^2$ ii) Subtract $100x^4-19x^2-7x$ from $150x^3+8x-14$
2.	Implement a music player using appropriate data structure. The songs in music player are linked to previous and next song and the songs can be played either from starting or ending of the list.
3.	When multiple applications are running on a PC, it is common for the operating system to put the running applications on a list and then to cycle through them, giving each of them a slice of time to execute and then making them wait while the CPU is given to another application. When the operating system reaches the end of the list it can cycle around to the front of the list. Assist the operating system to perform the above operations using the appropriate data structure.

4.	a. Consider that you are given the following C program:
	void main()
	{
	printf("KONGU";
	if((a>b)&&(a>c)
	printf(" a is greater than b and c");
	}
	When the program is executed, the compiler reports an error "Missing parenthesis". Show how the compiler detects the error.
	b. Implement a Stack and Queue using Deque.

5.	a. Write a program to reverse the first k elements of a Queue. Example: Given Q = [10, 20, 30, 40, 50, 60, 70, 80, 90, 100] and k = 5. The output should be Q = [50, 40, 30, 20, 10, 60, 70, 80, 90, 100] b. Implement a program to check if the elements of a queue are pairwise consecutive.
6.	Implement a program with the criteria, every descendant node's value in the left subtree of n is less than the value of n and every descendant node's value in the right subtree is greater than the value n
7.	Consider that the height of the student has to be maintained in a tree. The tree height must be balanced at all the time. Implement it with a suitable data structure.
8.	Given a File of N employee records with a set K of Keys(4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table(HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers. Design a program that uses Hash function H: K →L as H(K)=K mod m (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision using linear probing.
9.	A person wants to visit some places. He starts from a vertex and then wants to visit every place connected to this vertex and so on. What traversal methodology suits best for him? Implement it using C.
10.	A person wants to visit some places. He starts from a vertex and then wants to visit every vertex till it finishes from one vertex, backtracks and then explore other vertex from same vertex. What traversal methodology suits best for him? Implement it using C.

Total: 30

REFERENCES/MANUAL/SOFTWARE:

1.	Linux / GCC Compiler

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	identify and apply the appropriate data structure for solving the given problem	Applying (K3), Manipulation (S2)
CO2	implement various operations on non-linear data structures	Applying (K3), Manipulation (S2)
CO3	perform searching and traversing on various data structures	Applying (K3), Manipulation (S2)

Mapping of COs with POs and PSOs														
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	1									3	2
CO2	3	2	1	1									3	2
CO3	3	2	1	1									3	2
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

20ITL32 OBJECT ORIENTED PROGRAMMING LABORATORY

Programme & Branch	B.Tech. & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	3	PC	0	0	2	1
Preamble	This course provides practical knowledge to develop applications using object oriented programming concepts.						

List of Exercises / Experiments :

1.	Simple java programs using operators, control statements and arrays • Calculate Simple interest, Area of rectangle and triangle • Generate Electricity bill using control statements • Calculate factorial of given numbers • Finding the prime numbers between 1 to n • Multiplication of two matrices
2.	Develop bank application using class and object.
3.	Program to demonstrate inheritance & polymorphism. • Create one base class for student personal details and inherit those details into the sub class of student educational details to display complete student information. • Create an abstract class named shape that contains two integers and an empty method named printArea(). Provide two classes named Rectangle and Triangle such that each one of the classes extends the class shape. Each one of the class contains only the method printArea() that print the area of the given shape.
4.	Develop the Employee payroll application using packages and interfaces.
5.	Program to illustrate exception handling in java and creation of user defined exception.
6.	Program to demonstrate multithread concepts like synchronisation and inter-thread communication.
7.	Program to copy the contents of one file into another file, count the number of characters and print the file size in bytes
8.	Program to demonstrate the features of generics and collection classes and interfaces. • Implement sorting algorithm for integer, character, float and double data types • Demonstrate simple application using collection classes and interfaces • Create simple application using String class and methods
9.	Design and develop a bio-data application using AWT layer and components
10.	Program to capture and experiment with various keyboard and mouse events

Total: 30

REFERENCES/MANUAL/SOFTWARE:

1.	Operating System : Windows/Linux
2.	Software : Eclipse/Netbeans IDE, Java SE
3.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	implement programs using basic concepts of Java to solve the given problems	Applying (K3), Manipulation (S2)
CO2	develop application using inheritances, packages, exception handling, multithreading, string handling, generics and collection classes.	Applying (K3), Manipulation (S2)
CO3	design and develop applications with GUIs and event driven programming.	Applying (K3), Manipulation (S2)

Mapping of COs with POs and PSOs

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

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

20EGL31 ENGLISH FOR WORKPLACE COMMUNICATION LABORATORY

(Common to all BE/BTech Engineering and Technology branches)

Programme & Branch	All BE/BTech Engineering & Technology branches	Sem.	Category	L	T	P	Credit
Prerequisite	Nil	3 / 4	HS	0	0	2	1

Preamble:	This course is designed to impart required levels of fluency in using the English Language at B1/B2 level in the CEFR through activities, hands-on training and application.	
Unit -I	**Listening:**	**6**
Techniques for effective listening and note taking; listening to audio scripts, podcasts and TED talks; listening to discourse samples of native speakers and imitating; improving pronunciation; introduction to the basics of phonetics and understanding different accents.		
Unit -II	**Reading:**	**6**
Speed reading skills; reading to gain knowledge; reading newspaper articles to improve writing; academic journals to enrich vocabulary and word power; reading aloud with proper stress and intonation; reading to draw inferences.		
Unit -III	**Soft Skills:**	**6**
Importance of soft skills at workplace - understanding soft skills through case studies - developing positive attitude; goal setting; time management; team work; telephone etiquette; developing professionalism, interpersonal skills and work ethics.		
Unit -IV	**Writing:**	**6**
Introduction to pre-writing, style and mechanics of writing; mind mapping; creating content from an outline; paragraph and resume writing; nuances of academic writing; writing Statement of Purpose (SOP), editing, revising and proof reading for clarity and readability; structural and grammatical accuracy.		
Unit -V	**Speaking:**	**6**
Verbal and non-verbal communication; fluency and spoken English; introducing oneself and others; making presentations on topics using prepared material; mock interviews; dynamics of Group Discussion.		

List of Exercises / Experiments :

1.	Mock Interview
2.	Presentation
3.	Reading Aloud
4.	Group Discussion
5.	Soft Skills through Case Studies
6.	Listening Test

Total: 30

REFERENCES/MANUAL/SOFTWARE:

1.	Jeff Butterfield, “Soft Skills for Everyone”, 1st Edition, Cengage Learning, New Delhi, 2011.
2.	Bob Dignen, Steve Flinders and Simon Sweeney, “Professional English for Work and Life, English 365, Student’s Book 2”, 1st Edition, Cambridge University Press, New Delhi, 2004.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	acquire effective listening and reading skills	Understanding (K2), Imitation (S1)
CO2:	acquire and demonstrate appropriate professional skills for the workplace	Applying (K3), Naturalization (S5)
CO3:	speak fluently and write meaningfully in English in the given context	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	PSO1	PSO2
CO1									2	3		2		
CO2									2	3		2		
CO3									3	3		3		

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

20GET31 UNIVERSAL HUMAN VALUES
(Common to All BE/BTech branches)

Programme & Branch	All BE/BTech Engineeirng & Technology branches	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	3 / 4	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	3	3	3	3				
CO2						3	3	3	3	3				
CO3						3	3	3	3	3				
CO4						3	3	3	3	3				
CO5						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	25	75					100
CAT2	25	75					100
CAT3	NA						
ESE	NA						

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

20MAT42 PROBABILITY AND STATISTICS
(Common to Computer Science and Engineering & Information Technology branches)

Programme & Branch	BE - Computer Science Engineering & BTech – Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	4	BS	3	1	0	4

Preamble	To provide an in-depth knowledge about 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+3**
Introduction to Probability – Random VariableS – Discrete and Continuous random variables – Probability Mass and Probability density functions – Mathematical expectation and Variance – Moments – Moment generating function – Functions of random variable.		
Unit - II	**Standard Probability Distributions:**	**9+3**
Discrete Distributions: Binomial distribution – Poisson distribution – Geometric distribution – Continuous Distributions: Uniform distribution – Exponential distribution – Normal distribution.		
Unit - III	**Two Dimensional Random Variables:**	**9+3**
Introduction – Joint probability distributions – Marginal and conditional distributions – Covariance – Correlation and regression – Transformation of random variables.		
Unit - IV	**Testing of Hypothesis:**	**9+3**
Introduction – Critical region and level of significance – Types of Errors – Large sample tests: Z-test for single proportion and difference of two sample proportions – 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+3**
Analysis of variance – One way classification: Completely Randomized Design – Two way classification: Randomized Block Design – Three way classification: Latin Square Design.		

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

1. Veerarajan, T, "Probability, Statistics, Random Processes and Queuing Theory", 1st Edition, Tata McGraw-Hill, New Delhi, 2019.

REFERENCES:

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. Walpole R.E., Myers R.H., Myers S.L. and Ye K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2016.
4. Douglas C. Montgomery & George C. Runger, "Applied Statistics and Probability for Engineers ", 7th Edition, John Wiley and Sons, USA, 2018.

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)
CO2	apply different types of distributions in engineering problems.	Applying (K3)
CO3	understand the concepts of two dimensional random variables and regression.	Applying (K3)
CO4	apply statistical tests for solving engineering problems involving small and large samples.	Applying (K3)
CO5	apply the concepts of analysis of variance to experimental data.	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	70				100
CAT2	10	20	70				100
CAT3	10	30	60				100
ESE	10	25	65				100

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

20ITT41 PRINCIPLES OF COMMUNICATION

Programme & Branch	B.Tech. & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	4	ES	3	1	0	4

Preamble	This course explains the concepts of Analog and Digital communication systems that are used for the transmission of information from source to destination. A detailed quantitative framework for analog and digital transmission techniques is addressed.	
Unit - I	**Amplitude Modulation:**	**9+3**
Principles of amplitude modulation – AM envelope - Frequency spectrum and bandwidth - Modulation index and percentage modulation - AM power distribution - AM modulator circuits – Low level AM modulator - AM transmitters – Low level transmitter - AM receivers – Super heterodyne receivers		
Unit - II	**Angle Modulation:**	**9+3**
Angle Modulation – FM and PM waveforms - Phase deviation and modulation index - Frequency deviation - Direct FM and PM demodulators - Frequency spectrum of angle modulated waves - Bandwidth requirement - Narrowband FM and Broadband FM - Average power - FM and PM modulators, Direct FM transmitter - Angle modulation Vs. Amplitude modulation –Indirect FM transmitter.		
Unit - III	**Digital Modulation:**	**9+3**
Sampling - Time Division Multiplexing - Digital T-carrier System – Pulse code modulation – Amplitude shift keying - Frequency and phase shift keying – Modulator and demodulator - bit error rate calculation.		
Unit - IV	**Data Communication:**	**9+3**
Data communication codes: ASCII - BAR codes - Error Control - Error Detection - Redundancy checking - Error Correction - Hamming – Line coding: AMI – NRZ - RZ - Serial interfaces : RS232 - RS485 - Data communication circuits - Data communication modems - Public Switched Telephone Network(PSTN) – ISDN.		
Unit - V	**Spread Spectrum:**	**9+3**
PN sequence code and its properties- Direct sequence spread spectrum system - Processing gain- Frequency hopping spread spectrum.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Wayne Tomasi, “Electronic Communications Systems: Fundamentals through Advanced”, 5th Edition, Pearson Education, 2008.

REFERENCES:

1. Michael Moher and Simon Haykin, “Communication System”, 5th Edition, Wiley India Pvt. Ltd., New Delhi, 2011.
2. Frenzel and Louis E., “Principles of Electronic Communication Systems”, 3rd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2008.
3. Anokh Singh, “Principles of Communication Engineering”, S. Chand & Co., New Delhi, 2006.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	illustrate amplitude modulation techniques	Applying (K3)
CO2	use the different angle modulation schemes	Applying (K3)
CO3	apply the concepts of digital modulation techniques	Applying (K3)
CO4	detect and correct the errors introduced in the channel using error control coding schemes	Applying (K3)
CO5	illustrate the spread spectrum techniques for modern communication	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	30	40	30				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)**

20ITT42 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	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**	**30**	**60**				**100**
ESE	**10**	**30**	**60**				**100**

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

20ITT43 DESIGN AND ANALYSIS OF ALGORITHMS

Programme & Branch	B.Tech. & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Data Structures, Problem Solving and Programming	4	PC	3	1	0	4

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+3**
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+3**
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+3**
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+3**
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+3**
n-Queens problem - Hamiltonian Circuit Problem - Subset Sum Problem - Branch and Bound: Assignment problem - Knapsack Problem - Traveling Salesman Problem - Overview of P, NP and NP-Complete Problems.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, New Delhi, 2012.

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, MIT Press, London, 2009.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, New Delhi, 2006.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	examine various frameworks for algorithmic design	Analyzing (K4)
CO2	apply brute force and divide-and-conquer techniques to various problems and analyze their efficiency.	Analyzing (K4)
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	1								3	3
CO2	3	3	2	2	1								3	3
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	30	40	20			100
CAT2	10	30	50	10			100
CAT3	10	40	50				100
ESE	10	20	50	20			100

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

20ITT44 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 Server Side 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.		
Unit - II	**JavaScript ES6:**	**9**
Introduction – Variables – Operators - Control structures -Functions - Scope - Objects - Array, Date - Math – RegExp – HTML DOM – Collections - Event Handling.		
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 - Connect to NoSQL Database using Node JS – Implementation of CRUD operations.		
Unit - IV	**TypeScript and Angular 6.0:**	**9**
TypeScript: Introduction – Features – Variables – Data types – Enum – Array – Tuples – Functions – OOP concepts – Interfaces. Angular 6.0: Introduction - Needs - Evolution – Features – Setup and Configuration – Components and Modules – Templates – Change Detection – Directives – Data Binding - Pipes – Nested Components.		
Unit - V	**Client-side JS Framework:**	**9**
Services - HTTP - Routing -Template Driven Forms - Model Driven Forms - Reactive Forms - Custom Validators - dependency Injection.		

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	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	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)**

20ITL41 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 Exercises / Experiments :

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 queries using concepts of embedded query languages	Applying (K3), 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	2
CO2	3	2	1	1									3	2
CO3	3	2	1	1									3	2

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

20ITL42 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 Exercises / Experiments :

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 page and perform form validation using JavaScript.
4.	Design an webpage to create simple interactive CGPA calculator using DOM.
5.	Develop simple login page by performing event handling using GET and POST method.
6.	Design a webpage to maintain personal information using CRUD operations in MongoDB.
7.	Create an Angular service for an eCart application.
8.	Design a web application using components, modules and router in Angular.
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.	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

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

20MNT31 ENVIRONMENTAL SCIENCE

Programme & Branch	All BE/BTech Engineering & Technology branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	3 / 4	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.
2. Lodish. H., Berk A., Zipurursky S.L., Matsudaria P., Baltimore D. and Darnell J., “Molecular Cell Biology”, 4th Edition, Freeman Press, 2000.

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. Satyanarayan, U.,& Chakrapani, U., “Textbook of Biochemistry”,1999 Ed. June 2017

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
CAT3	NA						100
ESE	NA						100

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

20ITT51 COMPUTER NETWORKS

Programme & Branch	B. Tech & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	PC	3	1	0	4

Preamble	This course deals with the fundamental concepts of computer networks. It presents bottom up approach of different layers along with their concepts and protocols.	
Unit - I	**Network Models and Physical Layer**	**9**
Data Communications – Networks – Networks Types. Network Models: TCP/IP Protocol model - 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 Protocols: Random Access Protocols – 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 – 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 -Techniques to improve QoS.		
Unit - V	**Application Layer**	**9**
WWW - HTTP- FTP - Electronic mail –Telnet - SSH, DNS. Network Management: Introduction - SNMP.		

Lecture: 45, 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	explain the basic fundamentals of networks for data communication and apply the different line coding schemes for digital-to-digital conversion	Applying (K3)
CO2	demonstrate the knowledge of error detection and correction methods and protocols at data link layer	Applying (K3)
CO3	interpret 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	generalize the 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	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	30	50	20				100
CAT2	20	50	30				100
CAT3	30	50	20				100
ESE	20	50	30				100

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

20ITT52 OPERATING SYSTEMS

Programme & Branch	B. Tech & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	PC	3	0	0	3

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**
Introduction – Computer System Organization – Computer System Architecture – Operations – Resource Management – Security and Protection – Virtualization – Computing Environments. Operating Systems Structures: Services – User and OS Interface – System Calls – Linkers and Loaders – Operating system Structure – Building and Booting OS.		
Unit - II	**Process Management**:	**9**
Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication – IPC in Shared Memory and Message Passing Systems. Threads: Overview - Multicore Programming - Multithreading Models. CPU Scheduling: Scheduling Criteria – Scheduling Algorithms.		
Unit - III	**Process Synchronization**	**9**
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**
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**
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, Total: 45

TEXT BOOK:

1. Silberschatz A, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th 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	outline 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 algorithms	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	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	25	25	50				100
CAT2	20	20	60				100
CAT3	20	20	60				100
ESE	15	25	60				100

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

20ITT53 SOFTWARE ENGINEERING

Programme & Branch	B. Tech & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	PC	3	0	0	3

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 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 - Agile development: Agile process - Extreme programming – Scrum.		
Unit - II	**Requirement Gathering and Analysis**	**9**
Requirements engineering – Eliciting requirements, Developing use cases – Building the analysis model – Negotiating requirements – Requirements monitoring – Validating requirements – Requirements analysis.		
Unit - III	**UML Modeling**	**9**
Introduction – Unified Modeling Language – Static model – Dynamic model – UML diagrams– UML class diagram– Use case diagram – UML dynamic modeling – UML interaction diagrams –UML state chart diagram – UML activity diagram – Implementation Diagrams –Component diagram –Deployment diagram.		
Unit - IV	**Software Design**	**9**
Design concepts and model – Architectural design: Software architecture, Architectural styles – Architectural design – Component level design: Designing class-based components, Conducting component level design – User interface design: User interface analysis and design – Interface analysis –Interface design steps – Design patterns.		
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.		

Lecture: 45, Total: 45

TEXT BOOK:

1. Roger S. Pressman, Bruce R. Maxim, "Software Engineering: A Practitioner's Approach", 8th Edition, McGraw-Hill Education, India, 2019.

REFERENCES:

1. Ali Bahrami, "Object Oriented Systems Development", 1st Edition, Tata McGraw-Hill, New Delhi, 2008.
2. Jalote Pankaj, "An Integrated Approach to Software Engineering", 3rd Edition, Narosa Publishing House, New Delhi, 2000.

	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)
CO2	apply the requirement engineering tasks to identify the requirements for a given scenario	Applying (K3)
CO3	use different methods for modeling and design of a software system	Applying (K3)
CO4	apply the different design principles for a software system	Applying (K3)
CO5	make use of various software testing techniques to test the software 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	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	30	30	40				100
CAT3	20	30	50				100
ESE	10	40	50				100

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

20ITL51 NETWORK 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 packet Tracer. It also enables the students to configure routing protocols using tools like GNS3 and Packet Tracer.						

List of Exercises / Experiments :

1.	Simulate the network topologies (Bus, Ring, Star and Mesh) using Cisco Packet Tracer
2.	Simulate and identify the difference in working operation of Hub and Switch using Cisco Packet Tracer
3.	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.
4.	Simulate a network that performs Network address Translation to share a single public IP to the entire host connected in the network.
5.	Implement bit stuffing and byte stuffing using C program.
6.	Implement the functionality of FTP server using Cisco packet tracer.
7.	Simulate the TCP and UDP communications using Cisco packet tracer.
8.	Study of Packet Analyzer wireshark Tool.
9.	Emulate the working operation of Address Resolution Protocol using GNS3 Emulator and capture the packets using wireshark tool.
10.	Configure Routing Information Protocol and OSPF Protocol in a network to route packets using Cisco packet Tracer

Practical : 30,Total: 30

REFERENCES/MANUAL/SOFTWARE:

1.	Cisco Packet Tracer/C Language/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 of supporting protocols of each layer through Packet Tracer	Applying (K3), Precision (S3)
CO3	experiment with network layer and transport 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	2
CO2	3	2	1	1									3	2
CO3	3	2	1	1									3	2

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

20ITL52 OPERATING SYSTEMS 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 practical knowledge in basic Linux commands, shell script, process creation, system calls and synchronization.						

List of Exercises / Experiments :

1.	Basic Linux Commands (Process / File / Directory/ Memory / Disk / User / Filters / Pipes)
2.	Simple Shell programs - Arithmetic operations and String operations
3.	Shell program using loops and conditional statements
4.	Write a CPU bound C program and a I/O bound C program (e.g. use a number of printf statements within a while (1) loop). Compile and execute both of them. Observe the effect of their CPU share using the top display and comment.
5.	Write a C program to simulate UNIX commands like cp, ls, grep
6.	Implementation of system calls - fork, exec, getpid, exit, wait, close, stat, opendir, readdir.
7.	Implementation of I/O system calls (open, read, write, close, etc)
8.	Write a C-program to implement the producer – consumer problem using semaphores
9.	Write a C Program to implement IPC using Pipe
10.	Write a C program perform Round Robin CPU scheduling algorithm by reading all the necessary data from file.

Practical : 30,Total: 30

REFERENCES/MANUAL/SOFTWARE:

1.	Linux Operating System
2.	C Language

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	Demonstrate the Linux commands and shell script	Applying (K3), Manipulation (S2)
CO2	Implement different system calls in Linux and thread management	Applying (K3), Precision (S3)
CO3	Implement process synchronization and inter process communication.	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

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

20ITL53 CASE TOOLS 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 hands-on experience in designing and developing software systems using object oriented concepts.						

List of Exercises / Experiments :

1.	Define problem statement, develop business and domain models with UML diagrams, implement the interfaces and do testing for the Passport Automation system
2.	Define problem statement, develop business and domain models with UML diagrams, implement the interface and do testing for the Library Management system
3.	Define problem statement, develop business and domain models with UML diagrams, implement the interface and do testing for the Exam Registration System
4.	Define problem statement, develop business and domain models with UML diagrams, implement the interface and do testing for the Stock Maintenance system
5.	Define problem statement, develop business and domain models with UML diagrams, implement the interface and do testing for the Online Course Registration system
6.	Define problem statement, develop business and domain models with UML diagrams, implement the interface and do testing for the E-ticketing system
7.	Define problem statement, develop business and domain models with UML diagrams, implement the interface and do testing for the Insurance management system
8.	Define problem statement, develop business and domain models with UML diagrams, implement the interface and do testing for the Credit card processing system
9.	Define problem statement, develop business and domain models with UML diagrams, implement the interface and do testing for the Employee Recruitment system
10.	Define problem statement, develop business and domain models with UML diagrams, implement the interface and do testing for the Bank Management system

Practical : 30,Total: 30

REFERENCES/MANUAL/SOFTWARE:

1.	IBM Rational Suite

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	design and implement projects using Object oriented concepts	Applying (K3), Precision (S3)
CO2	use UML analysis and design diagrams in various applications	Applying (K3), Precision (S3)
CO3	apply appropriate design patterns for the given scenarios	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

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

20GEL51 PROFESSIONAL SKILLS TRAINING I
(Common to all BE/ BTech / MSc / MCA /BSc Branches)

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	EC	0	0	0	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 & 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 – Writing a fresher's CV / Résumés – 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: 80

TEXT BOOK:

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

REFERENCES:

1	Bailey Stephen, "Academic Writing: A practical guide for students", Routledge, New York, 2011.
2	Raman, Meenakshi and Sharma, Sangeeta**,** "Technical Communication - Principles and Practice", 3rd Edition, Oxford University Press, New Delhi, 2015.

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 individual and 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**						**NA**

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

20ITT61 INTERNET OF THINGS AND ITS APPLICATIONS

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

Preamble	This course provides an introduction to Internet of Things and its technologies that enables the students to develop real world applications using it.	
Unit - I	**Introduction to Internet of Things**	**9**
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	**IoT Design Methodology**	**9**
M2M – Difference between M2M &IoT – Software defined networks – Network function Virtualization – IoT Platform design Methodologies – Domain Specific IoT – Home Automation – Smart Agriculture.		
Unit - III	**Python packages**	**9**
HTTPLib- URLLib-SMTPLib. **IoT Physical Devices and Endpoints:** Introduction to Raspberry PI – Interfaces: serial- SPI- 12C- Programming – Python program with Raspberry PI with focus of interfacing external gadgets – controlling output – reading input from pins		
Unit - IV	**IoT Cloud Storage**	**9**
Introduction to cloud storage models - Amazon Web Services for IoT- MQTT- Storing data in database. **Data Analytics for IoT:** Apache Hadoop – Using Hadoop, MapReduce for Batch Data Analysis – Apache Spark – Apache Storm – Using Apache Storm for Real-time Data Analysis		
Unit - V	**Tools for IoT**	**9**
Introduction – Chef – Puppet –NETCONF-YANG – Case Studies – IoT Code Generator- Case Studies.		

Lecture: 45, Total: 45

TEXT BOOK:

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things – A Hands-on Approach", 1st Edition, University Press, 2015

REFERENCES:

1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", 1st Edition, CRC Press, 2012
2. https://aws.amazon.com/

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply IoT architecture, infrastructure and constraints	Applying (K3)
CO2	utilize the design methodologies for IoT applications	Applying (K3)
CO3	experiment with simple applications using python and Raspberry Pi	Applying (K3)
CO4	develop IoT product with the use of cloud storage and data analytics	Applying (K3)
CO5	make use of different IoT tools for implementing real time 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	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	40	50	10				100
CAT2	30	50	20				100
CAT3	30	30	40				100
ESE	25	35	40				100

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

20ITT62 MACHINE LEARNING

Programme & Branch	B. Tech & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Design and Analysis of Algorithms	6	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	**Machine Learning**	**9**
Introduction- Types - Applications - Tools in machine learning - Types of data - Exploring structure of data - Data Quality – Remediation - Data preprocessing. Design and Analysis of Machine Learning experiments**:** Factors - Guidelines - Cross Validation and Resampling methods- Measuring classifier performance-Assessing classifier algorithm's performance.		
Unit - II	**Modeling and Evaluation**	**9**
Introduction to model – Model Selection: Predictive Model-Descriptive Model-Training a Model - Model representation, Interpretation – Evaluating performance of Model – Improving performance of a Model. Feature Engineering: 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. Regression: Examples – Regression algorithm: simple linear regression - Multiple linear regression - polynomial regression model - Logistic regression.		
Unit - IV	**Neural Networks**	**9**
Introduction to biological and artificial neuron – 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.		
Unit - V	**Other Types of Learning**	**9**
Reinforcement learning - Elements of Reinforce learning - Types of Reinforcement Learning. Representation Learning-Active learning –Instance based Learning – Ensemble Learning Algorithm - Regularization Algorithm.		

Lecture: 45, 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	perform data preprocessing and choose appropriate machine learning algorithm	Applying (K3)
CO2	utilize model selection and 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 for various domains	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	30	50	20				100
CAT2	30	40	30				100
CAT3	30	40	30				100
ESE	30	30	40				100

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

20ITT63 CLOUD COMPUTING

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

Preamble	This course provides understanding of cloud computing and its services in order to design and develop various cloud based applications.	
Unit - I	**Distributed System Models**	**9**
Scalable computing – Network Based Systems – System Models – Software Environment for Distributed and Cloud computing – Performance – Security – Energy Efficiency.		
Unit - II	**Virtualization**	**9**
Implementation levels of Virtualization – Virtualization Structures – Tools and Mechanisms – CPU, Memory, I/O devices Virtualization – Virtual Clusters and Resource Management – Virtualization for Data-Center Automation.		
Unit - III	**Cloud Platform Architecture over Virtualized Data Centers**	**9**
Cloud computing Service models – Data-Center Design and Interconnection Networks – Architectural Design of Compute and Storage Clouds.Public Cloud Platforms : Google App Engine – AWS – Azure – Inter-cloud Resource Management – Cloud Security – Trust Management.		
Unit - IV	**Cloud Programming and Software Environments**	**9**
Cloud and Grid Platforms – Parallel and Distributed Programming Paradigms – Programming Support : Google App Engine – Amazon AWS – Microsoft Azure – Cloud Frameworks : Eucalyptus – Nimbus – OpenNebula – Sector – Sphere – OpenStack – Manjrasoft Aneka Cloud and Appliances.		
Unit - V	**Ubiquitous Clouds and the Internet of Things**	**9**
Cloud Trends in supporting Ubiquitous Computing Performance of Distributed Systems and the Cloud – Enabling technologies forthe Internet of Things – Innovative Applications of the Internet of Things – Online Social and Professional Networking.		

Total: 45

TEXT BOOK:

1. Kai Hwang, Geoffrey C Fox and Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", 1st Edition, Morgan Kauffmann, USA, 2017

REFERENCES:

1. Thomas Erl, ZaighamMahood and Richard Puttini, "Cloud Computing, Concept, Technology and Architecture", First Edition, Prentice Hall, 2013
2. Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", First Edition, John Wiley & Sons, 2013

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	utilize the concepts, characteristics, and benefits of cloud enabling technologies to build cloud models	Applying (K3)
CO2	apply virtualization tools for virtual resource management	Applying (K3)
CO3	use and evaluate various cloud computing services	Applying (K3)
CO4	illustrate the elements of cloud programming and software environments	Applying (K3)
CO5	develop strategies for ubiquitous clouds and 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	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	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)**

20ITL61 INTERNET OF THINGS LABORATORY

Programme & Branch	B.Tech. & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	6	ES	0	0	2	1
Preamble	This course provides practical knowledge on IoT tools and technologies to develop real world applications.						

List of Exercises / Experiments :

1.	Design a simple LED bargraph using Arduino
2.	Find the obstacle distance using Arduino
3.	Create simple security alarm system using Arduino
4.	Interface and control an LED with NODEMCU in online
5.	Control and monitor the temperature of the elements using temperature sensor with NODEMCU
6.	Create a smart light using Raspberry pi
7.	Monitor pollution levels using SMTP in Raspberry pi.
8.	Control an electrical appliance via webpage using Raspberry pi/Arduino
9.	Push IoT sensor data for cloud storage and analyze the data.
10.	Develop a mini-project using Raspberry pi/Arduino

Total: 30

REFERENCES/MANUAL/SOFTWARE:

1.	Raspberry pi , Arduino, NODEMCU, GSM Module and Sensors
2.	Linux ,Python and C

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	design and develop smart objects	Applying (K3), Precision (S3)
CO2	control and monitor smart objects via web application	Applying (K3), Precision (S3)
CO3	build solutions for 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	2
CO2	3	2	1	1									3	2
CO3	3	2	1	1									3	2

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

20ITL62 MACHINE LEARNING LABORATORY

Programme & Branch	B.Tech. & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Design and Analysis of Algorithms, Object oriented programming	6	PC	0	0	2	1
Preamble	This course provides implementation of various machine learning algorithms for designing solutions for real life problems						

List of Exercises / Experiments :

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	preprocess the dataset by data cleaning and dimensionality reduction	Applying (K3), Precision (S3)
CO2	perform classification using various supervised learning methods	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	2
CO2	3	2	1	1									3	2
CO3	3	2	1	1									3	2

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

20ITL63 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 Exercises / Experiments :

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	configure various virtualization tools such as Virtual Box and VMware workstation.	Applying (K3), Manipulation (S2)
CO2	create EC2-AWS buckets, instances and web applications	Applying (K3), Precision (S3)
CO3	manipulate 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	2
CO2	3	2	1	1									3	2
CO3	3	2	1	1									3	2

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

20GEL61 PROFESSIONAL SKILLS TRAINING II
(Common to all BE/ BTech / MSc/ MCA /BSc Branches)

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	6	EC	0	0	0	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 & Logical Reasoning - II**	**30**
Problem solving level II: Money related problems-Mixtures-Symbol base problem-Clocks and calendars-Simple-linear-quadratic and polynomial equations-Special, equations-Inequalities-Sequence and series-Set theory-Permutations and combinations-Probability-Statistics-Data sufficiency- Geometry-Trigonometry-Heights and distances-Co-ordinate geometry-Mensuration. Logical reasoning: Conditionality and grouping-Sequencing and scheduling- Selections-Networks:-Codes; Cubes-Venn diagram in logical reasoning- Quant based reasoning-Flaw detection- Puzzles-Cryptarithms.		
Unit - III	**Reading & Speaking Skills**	**30**
Reading: Reading comprehension– Effective Reading strategies – Descriptive, Inferential, & Argumentative reading passages – Identifying and locating factual information within a text – global reading/skimming for general understanding – selective comprehension / scanning for specific information – detailed comprehension / intensive reading – understanding the development of an argument – identifying the writer's attitude and opinions – Reading news articles in business magazines, newspapers – Reading notices and book reviews –Interpreting graphic data & Advertisements. Speaking: Mock Interviews –Self-Introduction – Sharing of Real Time Experience; Conversational Practices –Role Play – Short Talks / TED Talks –Extempore; Giving a Presentation on Various Topics – Technical / Non-Technical Topics – Project Review Presentation – Oratory and Effective Public Speaking; Pair Discussion – Group Discussion – The process of Group Discussion – Strategies to be adopted – Skills Assessed – Telephonic Conversations & Skills – Negotiating Skills.		

Total: 80

TEXT BOOK:

1	Thorpe, Showick and Edgar 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, 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 individual and as a team	Applying (K3), Precision (S3)
CO2	Solve real time problems using numerical ability and logical reasoning	Applying (K3), Precision (S3)
CO3	Apply reading and speaking skills effectively for various academic and professional purposes	Applying (K3), Precision (S3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	0	0	0	3	3	0	3	0	3	2		
CO2	3	2	0	0	0	3	3	0	3	0	3	2		
CO3	0	2	0	0	0	3	3	0	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	40	40				100
CAT2		50	50				100
CAT3		50	50				100
ESE							

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

20GET71 ENGINEERING ECONOMICS AND MANAGEMENT

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

Preamble	This course provides fundamental knowledge on management by introducing concepts like economics, national income, marketing, operations management and accounting principles	
Unit - I	**Introduction to Economics**	**9**
Basics Concepts and Principles – Demand and Supply – Law of demand – Determinants - Law of Supply – Determinants - Market Equilibrium.		
Unit - II	**National Income & Management Functions**	**9**
Circular flow of income - National Income and its measurement techniques. Inflation - Causes of Inflation – Controlling Inflation – Business Cycle. Management Functions: Planning – Organizing – Staffing – Leading and Controlling - Managerial Skills - Levels of Management.		
Unit - III	**Marketing**	**9**
Core Concepts of Marketing - Four P_s of Marketing - New product development - 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 Accounting**	**9**
Accounting Principles – Financial Statements and its uses – Depreciation: Straight Line and Diminishing Balance Method – Break Even Analysis – Capital Budgeting: Meaning – Methods of capital Budgeting.		

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 & Purba Roy Choudhury, "Managerial Economics", 3rd Edition, McGraw Hill Education, Noida, 2017.
2. William J. Stevenson, "Operations Management Paperback", 12th Edition, McGraw Hill Education, Noida, 2018.
3. Jain S.P, Narang K.L, Simmi Agrawal & Monika Sehgal, "Financial Accounting for Management", 1st Edition, Kalyani Publishers, New Delhi, 2018

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand demand and supply functions and estimate market equilibrium between demand and supply	Applying (K3)
CO2	analyse the impact of macro economic variables in business organisations	Applying (K3)
CO3	interpret marketing decisions taken by organisations	Applying (K3)
CO4	assess suitable operation management concepts in business situations	Applying (K3)
CO5	apply accounting and financial concepts in decision making	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	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)**

20ITT71 BLOCK CHAIN TECHNOLOGY

Programme & Branch	B. Tech & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Cryptography and Network Security	7	PC	3	0	0	3

Preamble	This course provides comprehensive introduction to the theoretical and practical aspects of block chain technologies and its applications.	
Unit - I	**Blockchain 101**	**9**
Distributed systems - The history of blockchain - Introduction to blockchain – definitions - elements - Features - Applications of blockchain technology - Tiers - Types of blockchain - Consensus in blockchain - CAP theorem - Benefits and limitations of blockchain		
Unit - II	**Decentralization and Cryptography and Technical Foundations**	**9**
Decentralization using blockchain – Methods – Routes - Blockchain and full ecosystem decentralization -.Smart contract - Decentralized applications - Platforms for decentralization. Cryptography and Technical Foundations – Introduction - Cryptography - Confidentiality - Integrity – Authentication - Cryptographic primitives - Asymmetric cryptography - Public and private keys – RSA - Discrete logarithm problem - Hash functions - Elliptic Curve Digital signature algorithm		
Unit - III	**Bitcoin**	**9**
Bitcoin – Transactions – Blockchain - Bitcoin payments - Alternative Coins - Theoretical foundations - Bitcoin limitations – Namecoin - Litecoin – Primecoin – Zcash - Smart Contracts		
Unit - IV	**Ethereum 101**	**9**
Introduction - Ethereum blockchain - Elements of the Ethereum blockchain - Precompiled contracts – Accounts – Block – Block header – Messages – Mining - Clients and wallets - The Ethereum network - Ethereum Development		
Unit - V	**Hyperledger**	**9**
Projects – protocol - Hyperledger Fabric - Sawtooth lake – Corda - Blockchain-Outside of Currencies: Internet of Things – Government – Health – Finance		

Lecture: 45, Total: 45

TEXT BOOK:

1. Imran Bashir, "Mastering Blockchain Distributed ledgers, decentralization and smart contracts Explained", 2 Edition, Packt Publishing, 2018.

REFERENCES:

1. Brenn Hill, Samanyu Chopra, Paul Valencourt, "Blockchain Quick Reference: A guide to exploring decentralized blockchain application development", 1 Edition, Packt publishing, 2018.
2. Andreas Antonopoulos, "Mastering Bitcoin: Programming the open blockchain", 2 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 blockchain, and choose appropriate consensus in blockchain	Applying (K3)
CO2	make use of practical aspect of cryptography in decentralization of blockchain	Applying (K3)
CO3	use bitcoins, identify alternative coins and smart contracts for your application	Applying (K3)
CO4	develop a distributed application using Ethereum	Applying (K3)
CO5	implement 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	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	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)**

20ITE01 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.		

Lecture: 45, 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	manipulate 2D objects by applying transformation, clipping, and viewing operations	Applying (K3)
CO3	apply 3D concepts and 3D object representations	Applying (K3)
CO4	perform 3D transformations, viewing, projection and volume	Applying (K3)
CO5	make use of color models and computer 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	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	20	55	25				100
CAT3	20	50	30				100
ESE	20	35	45				100

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

20ITE02 ADVANCED JAVA PROGRAMMING

Programme & Branch	B. Tech & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Object oriented programming	5	PE	3	0	0	3

Preamble	This course deals with Spring and Spring Boot frameworks to build web applications quickly with less code.	
Unit - I	**Software Architectures**	**9**
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 - Need of Spring and Spring Boot frameworks		
Unit - II	**Spring Framework**	**9**
Basics of Spring framework - Basics of Spring Boot Framework - Differences between Spring & Spring Boot. Spring Boot: Building Spring Boot Application - Normal Spring - Manual Approach - Maven - Gradle - Overview - Spring Initializer - STS - Understanding the Spring Boot autoconfiguration		
Unit - III	**Configuration of Spring Framework**	**9**
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 - IV	**Database access using Spring Boot**	**9**
Working with JPA - POJO classes - MYSQL - Working with Hibernate - Data JPA with crud Repositories - Data JPA with custom methods - Data JPA with custom queries		
Unit - V	**Restful Microservice and Database Connectivity**	**9**
Add view all posts functionality - Add view specific post functionality - REST client - Postman - Add post functionality - Update - Delete operation		

Lecture: 45, Total: 45

TEXT BOOK:

1. Mark Heckler, “Spring Boot: Up and Running: Building Cloud Native Java and Kotlin Applications”, 1st Edition, O'Reilly Media Inc., USA, 2021

REFERENCES:

1. Claudio Eduardo de Oliveira, Greg L. Turnquist, Alex Antonov, “Developing Java Applications with Spring and Spring Boot”, Packt publishing, Mumbai, 2018
2. Craig Walls, “Spring in Action”, 5th Edition, Manning Publications, Dream Tech Press, New Delhi, 2018

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	use the micro services architecture and its concepts	Applying (K3)
CO2	experiment the spring boot installation and its auto configuration	Applying (K3)
CO3	interpret and configure annotations, dev tools in Spring Boot Framework	Applying (K3)
CO4	implement a Web Application using JPA/Hibernate with Spring Boot	Applying (K3)
CO5	design and develop Restful micro web services using Spring Boot	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	40	40	20				100
CAT2	40	30	30				100
CAT3	40	30	30				100
ESE	30	40	30				100

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

20ITE03 USER INTERFACE DESIGN

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

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		

Lecture: 45, Total: 45

TEXT BOOK:

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

REFERENCES:

1. Banks, Alex, and Porcello, Eve, “Learning React: Functional Web Development with React and Redux”, United States, O'Reilly Media, 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 applications using react and its basic elements	Applying (K3)
CO2	apply the fundamental concepts of components in react	Applying (K3)
CO3	demonstrate properties and state of UI Components in react	Applying (K3)
CO4	implement simple applications using react events	Applying (K3)
CO5	design web applications using React	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	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)**

20ITE04 SEARCH METHODS FOR PROBLEM SOLVING

(Offered by Department of Information Technology)

Programme & Branch	**All Engineering and Technology Branches**	**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 and itsimplementation strategy towards solving real world problems.	
Unit - I	**Solving problems by Searching**:	**9+3**
Problem-Solving agents-Examples 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+3**
Greedy best-first search-A* search-Optimality of A*-Memory-bounded heuristic search-learning to search better-Heuristic Functions.		
Unit - III	**Search in Complex Environments:**	**9+3**
Local Search and Optimization Problems-Local Search in Continuous Spaces-Search with Nondeterministic Actions-Search in Partially Observable Environments-Online Search Agents and Unknown Environments.		
Unit - IV	**Adversarial Search and Games:**	**9+3**
Game Theory-Optimal Decisions in Games-Heuristic Alpha–Beta Tree Search-Monte Carlo Tree Search-StochasticGame-Partially Observable Game-Limitations of Game Search Algorithm.		
Unit - V	**Constraint Satisfaction Problems:**	**9+3**
Defining Constraint Satisfaction Problems-Constraint Propagation: Inference in CSPs-Backtracking Search forCSPs-Local Search for CSPs-The Structure of Problems.		

Lecture :45, Tutorial:15, Total:60

TEXT BOOK:

1	Stuart Russell and Peter Norvig, —Artificial Intelligence – A Modern Approach", 4th Edition, Pearson EducationPress, 2020.

REFERENCES:

1	George F. Luger, —Artificial Intelligence", 1st Edition, Pearson Education, 2001.

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	apply search strategies in complex environments	Applying (K3)
CO4	apply appropriate solution techniques for game applications	Applying (K3)
CO5	design and implement appropriate solutions for search 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										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

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

ASSESSMENT PATTERN - THEORY

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

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

20ITE05 INFORMATION THEORY AND CODING

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

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**
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**
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**
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**
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**
Principles: Frame types-Motion estimation and compensation-Implementation issues – H.261- H.263- MPEG :MPEG-1 - MPEG-2 - MPEG-3 - MPEG-4 video standard**s.**		

Lecture: 45, Total: 45

TEXT BOOK:

1. Simon Haykins, "Communication Systems", 4th Edition, John Wiley and Sons, New York, 2012.
2. Fred Halsall, "Multimedia Communications, Applications, Networks, Protocols and Standards", 4th Edition, Pearson Education, New Delhi, 2009.

REFERENCES:

1. Ranjan Bose, "Information Theory, Coding and Cryptography", 2nd Edition, Tata McGraw-Hill, India, 2008.
2. Mark S. Drew, Ze-Nian Li, "Fundamentals of Multimedia", 1st Edition, Pearson Education, New Delhi, 2003.
3. Mark Nelson, "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	apply various 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	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	40	50	10				100
CAT2	30	30	40				100
CAT3	30	60	10				100
ESE	20	55	25				100

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

20ITE06 FUNDAMENTALS OF RESEARCH

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

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

Lecture: 45, Total: 45

TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	list the various stages in research and categorize the quality of journals.	Analyzing (K4)
CO2	formulate a research problem from published literature/journal papers	Evaluating K5)
CO3	write, present a journal paper/ project report in proper format	Creating (K6)
CO4	select suitable journal and submit a research paper.	Applying (K3)
CO5	compile a research report and the presentation	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

20ITE07 NATIVE APPLICATION DEVELOPMENT USING ANDROID

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

Preamble	This course enables the students to gain knowledge in application development using android.	
Unit - I	**Introduction**	**9**
History – Android architecture –Setup Android studio – New project basics – Android Folder structure - Application components - Android Manifest file - Creating an Android Virtual Device - Run the app in the emulator- Debugging -activity_main.xml elements - strings.xml file - Adding components with the design editor -Activity - Activity life cycle.		
Unit - II		**9**
Lifecycle methods- button call a method - Building the custom Java class- Intent - putExtra() - Send Message button - intent filter - Layout – Types of layout - relative, linear, and grid - Basic UI components- Event Handling - OnClickListener - TextView – EditText – Toast – Case Study Programs: Message sending - Addition of two numbers – Biggest among two numbers- Factorial.		
Unit - III		**9**
Resources –Dimensions – Colors –drawable - Adding action items - Menu - resource file - showAsAction attribute- t OrderActivity- List view – Adapters - clicks with a Listener-array adapter-Fragments – lifecycle- Nested Fragments – getFragmentManager() – OnClickListener- Action Bars – Navigation drawers – Case study : Pizza app		
Unit - IV		**9**
Sqlite database introduction - persist data - SQLite classes - SQL functions in queries - create tables - insert() - update()– delete()-- cursor –onPreExecute() method-doInBackgound() method -onProgressUpdate() method -onPostExecute() method-AsyncTask class– threads overview–Services overview -Case Study : student database		
Unit - V		**9**
WebView class -Animation - Property animation- View animations- Activity transitions- Location Information –LocationListener - Broadcast receivers – Sensors - Jetpack - Introduction to Kotlin – variables- function - Basic android application using kotlin.		

Total: 45

TEXT BOOK:

1. Dawn Griffiths , David Griffiths “Head First Android Development”. 2th Edition, O'Reilly Media Inc., USA, 2017.

REFERENCES:

1. https://developer.android.com/
2. www.javapoint.com

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	experiment with a simple android application	Applying (K3)
CO2	design an application using UI and Layouts	Applying (K3)
CO3	build application using resources, fragments and navigations	Applying (K3)
CO4	develop applications using database and services	Applying (K3)
CO5	develop applications using location, jetpack and kotlin	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	40	40	20				100
CAT2	30	30	40				100
CAT3	30	30	40				100
ESE	20	30	50				100

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

20ITE08 3D MODELING AND MIXED REALITY APPLICATIONS

Programme & Branch	B. Tech & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Mathematics I	7	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. (Unit-I,II)
2. Allen Paul Mealy, "Virtual & Augmented Reality For Dummies", 1st Edition, John Wiley & Sons, 2018.(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", 3rd Edition, 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	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	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)**

20ITE09 NETWORK COMMUNICATION PROTOCOLS AND STANDARDS

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

Preamble	This course covers protocols involved in computer networks which help in establishing communication between two end systems.	
Unit - I	**Introduction and Link layer Protocols**	**9**
Introduction – The Architecture and Protocols of the TCP/IP Suite - Standardization Process – Link Layer – Introduction - Ethernet and the IEEE 802 LAN/MAN Standards - Bridges and Switches: Spanning Tree Protocol - Multiple registration protocol – Point to point protocol – Address Resolution Protocol		
Unit - II	Internet Protocol and DHCP	**9**
Internet Protocol – Introduction - IPv4 and IPv6 Headers - IPv6 Extension Headers - IP Forwarding – Dynamic Host Configuration Protocol - Stateless Address Autoconfiguration - DHCP and DNS Interaction		
Unit - III	NAT and ICMP	**9**
Firewalls and Network Address Translation – Introduction – Firewalls - Network Address Translation (NAT) - NAT Traversal - Configuring Packet-Filtering Firewalls and NATs - ICMPv4 and ICMPv6: Internet Control Message Protocol – Introduction - ICMP Messages - ICMP Error Messages - ICMP Query/Informational Messages - Neighbor Discovery in IPv6 - Translating ICMPv4 and ICMPv6		
Unit - IV	IGMP and UDP	**9**
Broadcasting and Local Multicasting – Introduction – Broadcasting – Multicasting - The Internet Group Management Protocol (IGMP) and Multicast Listener Discovery Protocol (MLD) - User Datagram Protocol (UDP) and IP Fragmentation – Introduction – Header – Check sum - Path MTU Discovery with UDP - Maximum UDP Datagram Size - UDP Server Design - Translating UDP/IPv4 and UDP/IPv6 Datagrams - UDP in the Internet		
Unit - V	DNS and TCP	**9**
Name Resolution and the Domain Name System – Introduction – Domain Name Space – DNS Protocol - Open DNS Servers and DynDNS - Translating DNS from IPv4 to IPv6 - TCP: The Transmission Control Protocol – Introduction – Connection Management – Establishment and Termination – TCP Options – TCP Server Operation - TCP Timeout and Retransmission - TCP Data Flow and Window Management		

Total:45

TEXT BOOK:

1. Kevin R. Fall, W. Richard Stevens, "TCP/IP Illustrated volume1", 2 Edition, Pearson Education, 2012.

REFERENCES:

1. Behrouz A. Forouzan, "TCP/IP Protocol Suite", 4 Edition, McGraw-Hill Education , 2011.
2. "Network Protocols Handbook", 2 Edition, Javvin Technologies Inc, 2005.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	Identify the link layer protocols in a TCP/IP communication	Understanding (K2)
CO2	Summarize Internet Protocol and use DHCP in address autoconfiguration	Applying (K3)
CO3	Choose appropriate protocol to be used for network translation and inform error using ICMP	Applying (K3)
CO4	Utilize the role of IGMP and unacknowledged transport layer protocols in taking the data from one device to another device	Understanding (K2)
CO5	Identify the role of DNS, and re-transmission and flow control techniques of TCP	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	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	50	30				100
CAT2	25	50	25				100
CAT3	20	40	40				100
ESE	30	40	30				100

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

20ITE10 BIG DATA ANALYTICS

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 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	**MONGO DB 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.		

Lecture: 45, Total: 45

TEXT BOOK:

1. Seema Acharya and Subhashini Chellappan, "Big Data and Analytics", 2nd Edition, Wiley, 2019.
2. Dr.Anil Maheshwari, “Big Data”, 1st Edition, McGraw Hill Education, New Delhi, 2017

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	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	25	50	25				100
CAT2	20	20	60				100
CAT3	25	50	25				100
ESE	25	30	45				100

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

20ITE11 CRYPTOGRAPHY AND NETWORK SECURITY

Programme & Branch	B. Tech & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Computer Networks	7	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 the 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	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	20	60				100
CAT2	20	20	60				100
CAT3	30	50	20				100
ESE	20	20	60				100

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

20ITE12 DIGITAL IMAGE PROCESSING

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

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”, PHI, India, 2011

2. Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image processing analysis and machine vision”, 4th edition, Cengage India, India, 2017

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 using Fourier Transforms	Applying (K3)
CO4:	manipulate color images and make use of Wavelet transforms	Applying (K3)
CO5:	implement 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	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	40	30	30				100
CAT2	40	30	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)**

20ITE13 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		

Lecture: 45, Total: 45

TEXT BOOK:

1. Limaye M.G., —Software Testing -Principles, Techniques and Tools, 1stReprint, Tata McGraw-Hill, 2009.
2. Perry William, —Effective Methods for Software Testing, 3rdEdition, Wiley India, Reprint 2013.

REFERENCES:

1. David Burns, “Selenium 2 Testing Tools – Beginners Guide”, 2nd Edition, Packt Publishing, UK, 2012
2. Rajani Renu 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 process.	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	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	30	50	20				100
CAT2	20	30	50				100
CAT3	20	30	50				100
ESE	20	40	40				100

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

20ITE14 MOBILE COMMUNICATION

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

Preamble	This course enables the students to understand the concepts of wireless communication, telecommunication systems, different mobile networks and various operating systems that support mobile devices.	
Unit - I	**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 Systems**	**9**
Telecommunications –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 Networks**	**9**
Wireless LAN -Infrared Vs Radio Transmission –Infrastructure Networks and Adhoc Networks -IEEE 802.11 –HIPERLAN: HIPERLAN1 –Bluetooth-User scenarios-Architecture.		
Unit - IV	**Mobile Network and Transport Layer**	**9**
Mobile IP –Dynamic Host Configuration Protocol-Mobile ad-hoc Networks –Improvement on TCP for mobile and wireless network		
Unit - V	**Mobile Platforms and Application Layer**	**9**
WAP-Architecture-Wireless application environment–Mobile Device Operating Systems: Special constraints and Requirements-Commercial mobile Operating System: Windows Mobile, Palm OS, iOS, Android, BlackBerry		

Lecture: 45, Total: 45

TEXT BOOK:

1. Schiller J., —Mobile Communication, 2nd Edition,Pearson Education, New Delhi, 2020, I, II, III, IV
2. Prasant Kumar Pattnaik, Rajib Mall, —Fundamentals of Mobile Computing‖, PHI Learning Pvt. Ltd., 1st Edition, New Delhi, 2016, V

REFERENCES:

1. Raj Kamal - Mobile Computing, 3rd edition, oxford university press Inc. New Delhi, 2019
2. Asoke K Talukder,Hasan Ahmed,Roopa R Yavagal–Mobile Computing Technology, applications and Service Creation ,Second Edition , McGraw Hill Education Private Ltd, New Delhi, 2018
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	illustrate the fundamental concepts of wireless transmission and make use of MAC mechanisms for multiplexing schemes.	Applying (K3)
CO2	utilize the concepts and features of GSM, satellite systems	Applying (K3)
CO3	identify the concepts of Wireless LAN and explain the principles of IEEE 802.11, HIPERLAN and Bluetooth	Applying (K3)
CO4	apply the routing algorithms and transport layer techniques to support mobility for MANET	Applying (K3)
CO5	make use of WAP architecture, commercial mobile operating systems and their features	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	40	40	20				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)**

20ITE15 EMBEDDED LINUX BASICS

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 fundamentals of Embedded Linux, various distributions and basics of GNU cross platform tool chain along with kernel configuration.	
Unit - I	**Basic Concepts and Host-Target Setup**	**9**
Definitions-Real Life Embedded Linux Systems – Design and Implementation Methodology**.** Basic Concepts: Types of Hosts – Host/Target Development Setups – Host/Target Debug Setups – Generic Architecture of an Embedded Linux System– System Startup – Types of Boot Configuration – System memory Layout –Processor Architectures - Buses and Interfaces - I/O – Storage.		
Unit - II	**Kernel Configurations**	**9**
Development Tools - A Practical Project Workspace - GNU Cross-Platform Development Toolchain - C Library Alternatives- Other Programming Languages - Eclipse: An Integrated Development Environment - Terminal Emulators. **Kernel Considerations:** Selecting a Kernel - Configuring the Kernel - Compiling the Kernel - Installing the Kernel.		
Unit - III	**Root File Systems**	**9**
Basic Root Filesystem Structure - Libraries - Kernel Modules and Kernel Images - Device Files – MainSystem Applications - System Initialization. Storage Device Manipulation: MTD supported devices – Disk Devices – swap decisions. Root File system Setup: File system types for Embedded Devices – Writing a File system to Flash using an NFS – Placing a Disk File system on a RAM Disk – Rootfs and Initramfs – Choosing a File system Type and Layout – Handling software upgrades.		
Unit - IV	**Setting up the Bootloader and Networking Services**	**9**
Embedded Bootloaders – Server Setup for Network Boot – Using the U-Boot Bootloader. Setting up Networking Services: Network Settings – Busy box – Dynamic Configuration – The Internet Super Server – Remote Administration with SNMP – Network Login through Telnet – Secure Communication with SSH – Serving Web Content through HTTP – Provisioning.		
Unit - V	**Debugging Tools and Real Time Linux Systems**	**9**
Eclipse – Debugging Application with gdb – Tracing – Performance Analysis – Memory Debugging – Hardware Tools. Real-Time Linux: Real-Time Processing – Real Time Kernel Requirements –Users of Real-Time Linux Computing. The Xenomai Real-Time System: Porting traditional RTOS applications to Linux –The Xenomai Architecture and Working – The real time Driver Model. RT Patch: Configuring the Kernel with the RT Patch.		

Lecture: 45, Total: 45

TEXT BOOK:

1. Karim Yaghmour, Jon Masters, Gilad Ben-Yossef and Philippe Gerum, “Building Embedded Linux Systems”, 2nd Edition, SPD -O’Reilly Publications, 2009.

REFERENCES:

1. P.Raghavan,Amol Lad and SriramNeelakandan, “EmbeddedLinux System Design & Development”,Auerbach Publications, 2012.
2. Jonathan Corbet, Alessandro Rubini and Greg Kroah-Hartman, “Linux Device Drivers”, 3rd Edition, SPD -O’Reilly Publications, 2011.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	use Linux desktop and GNU tool chain with Eclipse IDE.	Applying (K3)
CO2	perform cross compilation of Linux kernel and port it to target board.	Applying (K3)
CO3	make use of the kernel modules and Images and setup a File System using Embedded Devices.	Applying (K3)
CO4	interpret the configuration of embedded Boot loaders and Networking services and build the communication using protocols.	Applying (K3)
CO5	perform debugging of hardware tools and develop the real time Driver model using real-Time Linux 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	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	30	40	30				100
CAT2	20	50	30				100
CAT3	20	40	40				100
ESE	30	40	30				100

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

20ITE16 DEEP LEARNING

Programme & Branch	B. Tech & Information Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Machine Learning	7	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 – Hyper parameters 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**
Development Tools - A Practical Project Workspace - GNU Cross-Platform Development Toolchain - C Library Alternatives- Other Programming Languages - Eclipse: An Integrated Development Environment - Terminal Emulators. Kernel Considerations: Selecting a Kernel - Configuring the Kernel - Compiling the Kernel - Installing the Kernel.		
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.		

Lecture: 45, 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	utilize the concepts 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 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	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)**

20ITE17 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 Mode - 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,Airodump-ng- Wireless Adapter in Monitor Mode - Determining the Target - Cracking a WPA/WPA2 Wireless Network Using Aircrack-ng- 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.		

Lecture: 45, Total: 45

TEXT BOOK:

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

REFERENCES:

1. Sean-Philip Oriyano, CEH v9: Certified Ethical Hacker Version 9, Wiley publication, 3rd Edition, 2016.
2. Stuart McClure, Joel Scambray and Goerge Kurtz, “Hacking Exposed 7 : Network Security” Secrets & Solutions”, Tata Mcgrawhill Publishers, Seventh 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	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	30	30	40				100
CAT2	20	30	50				100
CAT3	20	30	50				100
ESE	20	30	50				100

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

20ITE18 INFORMATION RETRIEVAL

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 solid grasp of the fundamental ideas of information retrieval strategies and an idea to apply modeling techniques to various applications. It also deals with the development of retrieval algorithms for web search tasks and analysis of their performance for massive data sets.	
Unit - I	**Introduction and Modeling**	**9**
Information Retrieval –The IR Problem –The IR System –Modeling: Classic Information Retrieval –Set Theoretic, Algebraic and Probabilistic Models –Retrieval Evaluation.		
Unit - II	**Relevance Feedback and Documents**	**9**
A Framework for feedback methods-Explicit feedback-Implicit feedback through local analysis-Global analysis- Documents: Metadata-Document Formats-Text Properties-Document Preprocessing-Organizing documents-Text Compression.		
Unit - III	**Queries, Indexing and Searching**	**9**
Query Languages-Query Properties-Indexing and Searching: Introduction-Inverted Indexes –Signature Files –Suffix Trees and Suffix Arrays-Sequential Searching –Multidimensional Indexing.		
Unit - IV	**Web Retrieval and Web Crawling**	**9**
Introduction-The Web-Search Engine Architectures-Ranking-User Interaction-Browsing-Web Crawling.		
Unit - V	**Structure Text and Multimedia Information Retrieval**	**9**
Structured Text Retrieval-Multimedia Information Retrieval-Enterprise Search-Tasks-Architecture-Evaluation.		

Lecture: 45, Total: 45

TEXT BOOK:

1.	Ricardo Baeza-Yate, Berthier Ribeiro-Neto, "Modern Information Retrieval", 2nd Edition, Pearson Education, 2011.

REFERENCES:

1.	Chowdhury G.G, "Introduction to Modern Information Retrieval", 2nd Edition, Neal-Schuman Publishers, 2003.
2.	Daniel Jurafsky and James H. Martin, "Speech and Language Processing", 2nd Edition, Prentice Hall, 2008.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply the basic concepts of information retrieval	Applying (K3)
CO2	utilize the principles of relevance feed back and perform preprocessing on documents	Applying (K3)
CO3	make use of different indexing and searching mechanisms	Applying (K3)
CO4	perform web crawling for web information retrieval	Applying (K3)
CO5	develop and evaluate search engines	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	30	50	20				100
CAT2	30	40	30				100
CAT3	30	40	30				100
ESE	30	30	40				100

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

20ITE19 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**
Introduction to SDN: 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**
SDN and OpenFlow: 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 Additions – OpenFlow 1.2 Additions – OpenFlow 1.3 Additions – OpenFlow Limitations.		
Unit - III	**SDN Interfaces**	**9**
SDN Interfaces: Alternative definitions of SDN: Potential drawbacks of open SDN – SDN via APIs – SDN via hypervisor based overlays – SDN via opening up the device – Network Functions virtualization – Alternatives overlap and ranking. SDN open source: Open source licensing issues – OpenFlow source code – Switch implementation – Controller implementations – Orchestration and Network virtualization – Simulation, Testing and Tools – OpenStack – Applying SDN open source.		
Unit - IV	**SDN in Data Center**	**9**
SDN in data center: 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 environments and applications: SDN in other environment: Wide area networks – Service provider and carrier networks – Campus networks – Hospitality networks – Mobile networks – In-Line network functions – Optical networks. SDN Applications: Reactive versus Proactive applications – A simple reactive Java application – Creating network virtualization tunnels – offloading flows in the data center – Access control for the campus – Traffic engineering for the service providers.		

Lecture: 45, Total: 45

TEXT BOOK:

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

REFERENCES:

1. SiamakAzodolmolky, "Software Defined Networking with OpenFlow", 1st Edition, Packt Publishing, 2013
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	outline the difference between 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	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	35	45				100
CAT2	20	40	40				100
CAT3	10	30	60				100
ESE	20	30	50				100

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

20ITE20 GAME THEORY AND ITS APPLICATIONS

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

Preamble	This course on game theory deals with mathematical modeling of strategic interaction among rational and irrational agents. It also describes how game theory is applied in economics, computer science, auction and negotiation.	
Unit - I	**Games**	**9**
Reasoning about Behavior in Game Best responses and Dominant Strategies Nash Equilibrium Mixed Strategies-Pareto Optimality Dominated strategies and dynamic strategies.		
Unit - II	**Non-cooperative Games**	**9**
Discrete static games Continuous static games Relation to other Mathematical Problems: Nonlinear optimization Fixed point-problems.		
Unit - III	**Equlibria and Dynamic Games**	**9**
Existence of Equilibria Computation of Equilibria Special matrix games Uniqueness of Equilibria Repeated and Dynamic-games Games under uncertainty.		
Unit - IV	**Cooperative Games**	**9**
Solutions based on characteristic function-Conflict Resolution-Multi objective optimization-Social choice.		
Unit - V	**Case studies and Applications**	**9**
A salesman's Dilemma- Oligopoly in water management A forestry management problem International fishing Water-distribution problem**.**		

Lecture: 45, Total: 45

TEXT BOOK:

1. David Easley and jon Kleinberg, "Networks, Crowds and Markets: Reasoning about a highmy Connected World", Cambridge University, USA, 2010
2. Matsumoto A., Szidarovszky F, "Game Theory and Applications", Springer, 2016

REFERENCES:

1. E.M.Barron, "Game Theory: An Introduction", Wiley, 2009.
2. Leon Petrosjan, ValdimirV.Mazalov, "Game Theory &Applications", Nova Science Publishers Inc, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply the strategies of game theory and Nash Equilibria to the real world problems	Applying (K3)
CO2	solve the problems of non-cooperative static games and find their optimized solutions	Applying (K3)
CO3	apply the concept of equilibria and dynamic games to identify the certainty	Applying (K3)
CO4	solve problems in cooperative games and relate them to multi objective optimization	Applying (K3)
CO5	model some real world problems using the principles of game theory and its 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	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	60	20				100
CAT2	30	60	10				100
CAT3	30	50	20				100
ESE	20	50	30				100

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

20ITE21 SOFTWARE QUALITY ASSURANCE

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

Preamble	This course presents methods, tools and procedures that enable to control the quality of software products and provides the student with a foundation for building quality software	
Unit - I	**Software Quality in Business Context**	**9**
Defining Quality – Need for Quality – Quality Control Vs Quality assurance – Quality assurance at each phase of SDLC. Managing software Quality in an Organization: QMS – Need for SQA group in an Organization. Planning for SQA : Software Quality assurance plans – Organizational level initiatives		
Unit - II	**Product Quality and Process Quality**	**9**
Introduction – Software systems evolution – Product quality – Models for software product Quality – Process Quality. Software Measurement and Metrics : Introduction – Measurement during software life cycle context – Defect metrics – Metrics for software maintenance – Classification of software metrics – Requirements related metrics – Measurements and process improvement – Measurement principles.		
Unit - III	**Walkthroughs and Inspections**	**9**
Introduction – Structured walkthroughs – Inspections – Various roles and responsibilities involved in Reviews / Inspections – Some psychological aspects of reviews. Software Configuration Management : Need for SCM – Software configuration management activities – Personnel in SCM activities		
Unit - IV	**Software Quality Assurance Standardization**	**9**
ISO 9000 – Origin of ISO 9000 – Work of ISO – ISO standards development process. ISO 9001 : 2000 – ISO Certification – Assessment / Audit preparation – Assessment process – ISO consulting services and consultants. Software CMM and other Process Improvement Models : The Capability Maturity Model for software – An overview – Practices followed at mature organizations – Types of CMMs Model		
Unit - V	**Software Testing**	**9**
Purpose of testing – Differences between inspection and testing – Testing Vs debugging – Testing life cycle – Roles and responsibilities in testing – Test artifacts – The test plan – The V- Model for testing phases – Testing techniques – Test metrics – Risk-based testing – Human issues and challenges in testing.		

Lecture: 45, Total: 45

TEXT BOOK:

1. Nina S. Godbole, —Software Quality Assurance Principles and Practice, Narosa Publishing House, Second Edition, 2017

REFERENCES:

1. Mordechai Ben-Menachem, Garry S. Marliss, —Software Quality, 2nd Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2014
2. 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	utilize the concepts, metrics, and models of software quality assurance in business context	Applying (K3)
CO2	apply various product and process quality metrics in SQA	Applying (K3)
CO3	illustrate the significance of walkthroughs, inspections and SCM	Applying (K3)
CO4	apply ISO and CMM practices in SQA	Applying (K3)
CO5	choose the appropriate software testing techniques to cater the need of a project	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	30	50	20				100
CAT2	30	30	40				100
CAT3	20	30	50				100
ESE	10	40	50				100

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

20ITE22 CYBER FORENSICS

Programme & Branch	IT	Sem.	Category	L	T	P	Credit
Prerequisite	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		**9**
Computer Investigations: Computer Investigations: Preparing a Computer investigation – Taking a systematic approach – Assessing the case – Planning Investigation – Securing evidence– Procedures for Corporate High – Tech investigations – Conducting an Investigation – Completing the case.		
Unit - II		**9**
Data Acquisition: Understanding storage formats for digital evidence – Determining the best acquisition method - Contingency planning for image acquisitions – Using Acquisition tools: Windows XP Write-protection with USB Devices – Validating Data Acquisitions: Windows Validation Methods – Performing RAID Data Acquisitions – Using Remote Network Acquisition tools – Using other Forensics Acquisition tools.		
Unit – III		**9**
Processing Crime and Incident Scenes: Identifying Digital Evidence – Collecting Evidence in Private Sector Incident Scenes – Processing Law Enforcement Crime Scenes – Preparing for a Search –Securing a Computer Incident or Crime Scene –Seizing Digital Evidence at the Scene –Storing Digital Evidence –Obtaining a Digital Hash –Reviewing a Case.		
Unit - IV		**9**
Computer Forensic Tools, Analysis and Validation: Evaluating Computer Forensics Tool Needs -Computer Forensics Software Tools – Computer Forensics Hardware Tools –Validating and Testing Forensic Software - Computer Forensics Analysis and Validation: Determining Data Collection and Analysis –Validating Forensic Data –Addressing Data-Hiding Techniques – Performing Remote Acquisitions.		
Unit - V		**9**
Recovering Graph Files, Email Investigations: Recognizing Graph File- Understanding Data Compression- Locating And Recovering Graphic Files- Identifying Un known File Formats- Understanding Copyright Issues- Investigating Email Crimes And Violations- Understanding Email Servers- Using Specialized Email Forensic Tools.		

Lecture: 45, Total: 45 Hours

TEXT BOOK:

1. Nelson Bill, Phillips Amelia and Steuart Christopher, "Guide to Computer Forensics and Investigations", 4th Edition, Cengage Learning, USA, 2017.

REFERENCES:

1. Marie-Helen Mara, "Computer Forensics", 2nd Edition, Jones and Bartlett Learning, 2015.
2. Albert Marcella Jr, "Cyber Forensics", 2nd Edition, Auerbach Publications, 2007.

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	illustrate 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	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	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)**

20ITE23 MULTICORE ARCHITECTURE

Programme & Branch	B.E. – Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Computer Organization	7	PE	3	0	0	3

Preamble	This course focuses on performance improvement 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		

Lecture: 45, Total:45

TEXT BOOK:

1. John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", 6th Edition, Morgan Kaufmann, Elsevier, 2019. (Units 1-5)
2. Richard Y. Kain, "Advanced Computer Architecture: A Systems Design Approach", 1st Edition, Prentice Hall, 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	Analyzing (K4)
CO2	analyze the importance of memory hierarchy and benefits of cache memory	Analyzing (K4)
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	Analyzing (K4)
CO5	inspect the architectures of GPUs, warehouse scale computers and choose an appropriate model for a given problem	Analyzing (K4)

		Mapping of COs with POs and PSOs												
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2										3	2
CO2	3	3	2										3	2
CO3	3	2	1										3	2
CO4	3	3	2										3	2
CO5	3	3	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	30	30	20			100
CAT2	20	40	40				100
CAT3	20	30	30	20			100
ESE	10	30	30	30			100

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

20ITE24 BUSINESS INTELLIGENCE AND ITS APPLICATIONS

Programme& Branch	IT	Sem.	Category	L	T	P	Credit
Prerequisite	Database management systems	7	PE	3	0	0	3

Preamble	This course enables the students to apply BI concepts and techniques to various applications for making better decisions.	
Unit – I		**9**
Introduction and Business View of Information Technology Applications: 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		**9**
Business Intelligence and Data Integration: 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		**9**
OLTP, OLAP and Multidimensional Data Modeling: 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		**9**
Performance Management and Enterprise Reporting: 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		**9**
BI Applications: 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.		

Lecture: 45, Total: 45Hours

TEXT BOOK:

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

REFERENCES:

1. Ramesh Sharda, DursunDelen, 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 BI 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 BI to mobile, cloud, ERP and social CRM systems	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	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	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)**

20ITE25 PATTERN RECOGNITION

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

UNIT – I	**ESTIMATION**	**9**

Statistical pattern recognition –Stages in pattern recognition problem – Issues – Supervised vs. unsupervised – Approaches to statistical pattern recognition. Estimation – Normal based models – Normal mixture models – Bayesian estimates. Density estimation – Histogram methods – K-NN method – Expansion by basis function - Kernel methods.

UNIT – II	**LINEAR and NON-LINEAR DISCRIMINANT ANALYSIS**	**9**

Introduction – two class algorithm – multiclass algorithm – logistic discrimination – Nonlinear discriminant analysis (Neural Networks) – introduction – optimization criteria – Radial basis functions –multilayer perceptron – Bayesian approaches.

UNIT – III	**CLASSIFICATION TREES AND FEATURE SELECTION AND EXTRACTION**	**9**

Introduction – Classification tree construction – Other issues – Feature Selection and Extraction - Introduction – feature selection – Linear feature extraction – multidimensional scaling

UNIT – IV	**CLUSTERING**	**9**

Introduction – Hierarchical methods – Quick partitions – Mixture Models – Sum of Squares methods – Cluster validity. Additional topics - Performance Assessment – Comparing classifier performance – Model selection – Learning with unreliable classifiers – Missing Data – Outlier detection and robust procedures – Discrete Discriminant Analysis – Combining classifiers

UNIT – V	**HMMs and SVM**	**9**

State machines - Hidden Markov Models: Maximum Likelihood for the HMM, The Forward and Backward algorithm, Sum-Product Algorithm for the HMM, Scaling factors, The Viterbi algorithm, Extensions of the Hidden Markov Model - Support Vector Machines: Maximum Margin Classifiers, Relevance Vector Machines

Total: 45

TEXT BOOK:

1. Andrew Webb, “Statistical Pattern Recognition”, 2nd Edition, Wiley-Blackwell, London, 2002

REFERENCES:

1. Richard O. Duda, Peter E. Hart and David G. Stork, “Pattern Classification”, 2nd Edition, Wiley, London, 2007
2. M. Narashimha Murthy, V. Susheela Devi, “Pattern Recognition”, Springer, 2011

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	Paraphrase pattern classifier algorithms and model estimation procedures.	Applying (K3)
CO2:	Illustrate the difference between linear and non-linear discriminant analysis	Applying (K3)
CO3:	Utilize classification trees and outline feature extraction and selection	Applying (K3)
CO4:	model clustering algorithmsand paraphrase performance issues	Applying (K3)
CO5:	apply Support Vector Machines and Hidden Markov Model algorithms for real time 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	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	40	30	30				100
CAT2	40	30	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)**

20ITE26 SOFTWARE PROJECT MANAGEMENT

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 knowledge about project management activities which include project evaluation, planning, estimation, monitoring and control especially for software projects.	
Unit - I	**Introduction to Software Project Management:**	**9**
Introduction to Software Project Management: 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, project infrastructure – Analyse project characteristics – Identify project products and activities – Estimate effort for activity – Identify activity risks - Allocate Resources – Review plan – Execute plan. Software Effort Estimation : Introduction – Estimates – Problems with over and under estimates – Basis –Techniques – Bottom-up Estimating – Top down approach and parametric models – Expert Judgement – Estimating by analogy – Albrecht Function Point analysis – Function Points Mark II - COSMIC FFP – COCOMO II.		
Unit - III	**Activity Planning**	**9**
Activity Planning: Objectives – Project Schedule – Projects and Activities - Sequencing and Scheduling Activities –Network Planning Models – Formulation - 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", 5th Edition, Tata McGraw Hill, New Delhi, 2011.

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 control the risks involved.	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	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	40	40				100
CAT2	20	40	40				100
CAT3	20	60	20				100
ESE	20	40	40				100

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

20ITE27 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 on 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		

Lecture: 45, Total: 45

TEXT BOOK:

1. Anubhav Pradhan, Satheesha B. Nanjappa, Senthil K. Nallasamy, Veerakumar Esakimuthu, "Raising Enterprise Applications", 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	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	40	40				100
CAT2	20	40	40				100
CAT3	20	50	30				100
ESE	20	45	35				100

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

20ITE28 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		
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 permission-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 Applications Testing Fundamentals - Basic Observation HTML Page Source -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 LibWWW-Perl, 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		

Lecture: 45, Total: 45

TEXT BOOK:

1. Bryan Sullivan, Vincent Liu, "Web Application Security- A Beginner's Guide", 1st Edition, McGrawHill Education, New Delhi, 2011.

REFERENCES:

1. Paco Hope, Ben Walther, "Web Security Testing Cookbook", 1st Edition, O'Reilly Media, 2008.
'2. Georgia Weidman, "Penetration Testing: A Hands-On Introduction to Hacking", 1st Edition, No Starch Press, 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	implement file security and secure development methodologies	Applying (K3)
CO4	demonstrate various testing techniques for web application	Applying (K3)
CO5	carry out 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	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	30	30	40				100
CAT2	20	30	50				100
CAT3	20	30	50				100
ESE	20	30	50				100

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

20ITE29 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 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, 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 network 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	develop software and hardware components required for a sensor network 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	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	30	50	20				100
CAT2	30	50	20				100
CAT3	30	30	40				100
ESE	25	35	40				100

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

20ITE30 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.		

Lecture: 45, 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 application developments	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	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)**

20ITE31 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 Storage Systems**	**9**
Introduction to evolution of storage architecture, key data center elements, virtualization, and cloud computing. Key data center elements – Host (or computer), connectivity, storage, and application in both classic and virtual environments. RAID implementations, techniques and levels along with the impact of RAID on application performance. Components of intelligent storage provisioning and intelligent storage implementations.		
Unit - II	**Storage Networking Technologies**	**9**
Fibre channel SAN components, connectivity options, and topologies including access protection mechanism “Zoning”, FC protocol stack, addressing operations, SAN-based virtualization and VSAN technology, iSCS and FCIP protocols for storage access over IP network, Converged protocol FCoE and its components Network Attached Storage (NAS) – components, protocol and operations, File level storage virtualization. Object based storage and unified storage platform.		
Unit - III	**Backup, Archive and Replication**	**9**
Business continuity terminologies, planning and solutions, clustering and multipathing architecture to avoid single points of failure, Backup and recovery – methods, targets and topologies, Data duplication and backup in virtualized environment, Fixed content and data archive, Local replication in classic virtual environments, Remote replication in classic and virtual environment services and deployment models		
Unit - IV	**Cloud Computing**	**9**
Cloud Computing: Business drivers for Cloud computing, Definition of Cloud computing, Characteristics of cloud computing, Steps involved in transitioning from Classic data center to Cloud computing environment services and deployment models, Cloud infrastructure components, Cloud migration considerations.		
Unit - V	**Securing and Managing Storage Infrastructure**	**9**
Securing the Storage Infrastructure: Information security Framework – Risk Triad – Security Implementations in Storage Networking: FC SAN – NAS – IP SAN - Managing the storage Infrastructure: Monitoring storage infrastructure – Storage Infrastructure Management Activities - Information lifecycle management - Storage tiering		

Lecture: 45, 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	demonstrate 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	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	40	50	10				100
CAT2	30	50	20				100
CAT3	30	30	40				100
ESE	25	35	40				100

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

20ITE32 TOTAL QUALITY MANAGEMENT

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

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

Total: 45

TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	demonstrate the need, history and principles of quality and TQM	Applying (K3)
CO2	illustrate the principles and strategies of TQM	Applying (K3)
CO3	make use of various tools and techniques of quality management	Analyzing (K4)
CO4	apply various quality tools and techniques in both manufacturing and service industry	Applying (K3)
CO5	explain the concepts of quality management system and ISO.	Applying (K3)

Mapping of COs with POs and PSOs														
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	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	30	30	20			100
CAT3	25	45	30				100
ESE	20	30	35	15			100

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

20ITO01 ARTIFICIAL INTELLIGENCE							
Prog. & Branch	**All Engineering and Technology Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Pre requisite	**Nil**	**4**	**OE**	**3**	**1**	**0**	**4**

Preamble	The course focuses on the methodology of how to translate a datadrivenbusiness problem into an effective solution by using the powerful AI technologies andMachine Learning paradigm.	
Unit - I	**Introduction to Artificial Intelligence**	**9**
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**
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**
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**
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**
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, Total:45

TEXT BOOK:

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

REFERENCE BOOK:

1. RajendraAkerkar, “Introduction to Artificial Intelligence”, PHI Learning Pvt Ltd, Second Edition August,2014.
2. GopinathRebala, Ajay Ravi, Sanjay Churiwala, “An Introduction to Machine Learning”, Springer Nature,Switzerland, 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 keycompetitive advantages and issues.	Applying (K3)
CO2	relatemachine learning basics and the importance of mathematics towards machine learning technologies.	Applying (K3)
CO3	use toolbox for basic methods for differentai-based applications	Applying (K3)
CO4	perform pre-processing on data 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	1
CO2	3	2	1	1									3	1
CO3	3	2	1	1									3	1
CO4	3	2	1	1									3	1
CO5	3	2	1	1									3	1

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	60	15				100
CAT2	25	55	20				100
CAT3	20	40	40				100
ESE	20	50	30				100

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

20ITO02 WEB TECHNOLOGIES

Programme & Branch	B.E. – Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Object Oriented Programming	4	OE	3	1	0	4

Preamble	This course provides an introduction to HTML, CSS, Bootstrap, Client Side JS and Server Side JS Framework. The course also addresses the application of ReactJS for developing web applications.	
Unit - I	**HTML UI Design**	**9**
Introduction – Basic tags – HTML Forms Element – Page Structured Elements – Media Tags. Cascading Style Sheet: Types of CSS – Positioning Elements – Backgrounds – Box Model – Dropdown Menus. Responsive Web Design: Introduction – Bootstrap – Grid basics – Nav – Nav Bar – List – Drop down – Tables – Button –Images – Forms-Input – Input Groups.		
Unit - II	**JavaScript**	**9**
Introduction – Operators – Control Structures: Selection: if – if-else – switch. Repetition: while – do-while – for – break and continue. Functions: Function Definition – Scope Rules – Recursion. Array: Declaration – Initialization – Growing Arrays – Passing Arrays to Function. Event Handling.		
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 – Modules – Connect to NoSQL Database using Node JS – Implementation of CRUD operations.		
Unit - IV	**ReactJS Basics**	**9**
React: Introduction – Installation – create React app – components – state – props - props validation – state vs props – constructor – Component API – Component Life cycle – Forms – controlled and uncontrolled component – Events – conditional rendering.		
Unit - V	**ReactJS Animation and API**	**9**
ReactJS: list – keys – refs – Fragments - Router – CSS – Animation – Map – Table – Code splitting – hooks – API Integration.		

Lecture: 45, Total: 45

TEXT BOOK:

1.	Paul Deitel, Harvey M.Deitel and Abbey Deitel, “Internet and World Wide Web - How To Program”, 5th Edition, Prentice Hall, 2011. (Unit 1[first half], 2)
2.	Infosys campus connect material (Unit 1[Second Half] ,3)
3.	https://www.javatpoint.com (Unit 4, 5)

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 javascript	Applying (K3)
CO3	develop a web application using node JS with database connectivity	Applying (K3)
CO4	apply the features of React to develop web applications.	Applying (K3)
CO5	utilize client side JS framework to develop 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										3	2
CO2	3	2	1										3	2
CO3	3	2	1										3	2
CO4	3	2	1										3	2
CO5	3	2	1										3	2
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

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

20ITO03 INTRODUCTION TO OPERATING SYSTEMS

Programme & Branch	All Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	4	OE	3	1	0	4

Preamble	This course provides the fundamentals of various operating system services and enables the students to learn about how those services are implemented in an operating system.	
Unit - I	**Introduction to Operating Systems**	**9**
Introduction – Computer System Organization - A Real-Time Control Application - An Operational Overview - Processes and Tools. Linux Environment - Linux File System - Linux Commands.		
Unit - II	**File System and Process Management**	**9**
Files – File Access Rights – File Access and Security Concerns - File Storage Management - The Root File System. Process – Process Management – Process States – Scheduling - Choosing a Scheduling Policy – Context Switch.		
Unit - III	**Memory Management**	**9**
Main Memory Management - Memory Relocation Concept - Linking and Loading Concepts - Process and Main Memory Management – Memory Allocation – Virtual Memory – Paging - Segmentation.		
Unit - IV	**Input Output (IO) Management**	**9**
Issues in IO Management **–** IO Organisation - HW/SW Interface - Management of Buffers - Motivation for Disk Scheduling - Disk Scheduling Policies – USB – PCI bus – Bluetooth Interface.		
Unit - V	**Resource Sharing and Management**	**9**
Need for Scheduling - Mutual Exclusion – Deadlocks - Deadlock Prevention Method - Deadlock Detection and Prevention Algorithms. Case Study: Linux: Introduction - Linux Kernel Architecture.		

Lecture :45, Total:45

TEXT BOOK:

1	Oliver Theobald, “Machine Learning for Absolute Beginners”, Independently Published, Second Edition, 2017. (Unit-3,4,5)

REFERENCES:

1	RajendraAkerkar, “**Introduction to Artificial Intelligence**”, PHI Learning Pvt Ltd, Second Edition August,2014. (Unit-1)
2	GopinathRebala, Ajay Ravi, Sanjay Churiwala, “**An Introduction to Machine Learning**”, Springer Nature,Switzerland, 1st edition, 2019. (Unit-2)

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	outline operating system structure, services and demonstrate the various Linux commands	Applying (K3)
CO2	demonstrate various process scheduling algorithms and describe file system management	Applying (K3)
CO3	illustrate memory management strategies and the need for virtual memory	Applying (K3)
CO4	summarize the functions of IO management and apply various disk scheduling policies	Applying (K3)
CO5	apply different methods for handling deadlocks and discuss about Linux operating system	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

20ITO04 PROGRAMMING IN PYTHON

Programme & Branch	B.Tech. Food Technology	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	4	OE	3	1	0	4

Preamble	This course introduces the core python programming. It emphasizes on developing python programs with all data types, functions, classes, objects and numpy
Prerequisites	C programming

UNIT – I **Introduction:**

Problem solving strategies – program design tools – Types of errors – Testing and Debugging- Basics: Literals – variables and identifiers – data types - input operation – comments – reserved words – indentation – Operators and Expressions – Decision Control Statements: Introduction – conditional statement – iterative statements – Nested Loops – break, continue and pass statements – else in loops.

UNIT – II **Lists, Tuples and Dictionary:**

Lists:Access, update, nested, cloning, operations, methods , comprehensions, looping - Tuple:Create, utility, access, update, delete, operations, assignments, returning multiple values, nested tuples, index and count method - Dictionary: Create, access, add and modify, delete, sort, looping, nested, built-in methods – list vs tuple vs dictionary.

UNIT – III **Strings and Regular Expressions:**

Strings:Concatenation , append, multiply on strings – Immutable – formatting operator – Built-in string methods and functions – slice operation – functions – operators – comparing – iterating – string module – Regular Expressions **–** match, search, sub, findall and finditer functions – flag options.

UNIT – IV **Functions and Modules:**

Functions:Introduction - definition – call – variable scope and lifetime – return statement – function arguments – lambda function – documentation strings – programming practices recursive function- Modules: Modules – packages – standard library methods – function redefinition.

UNIT – V **Object Orientation:**

Class and Objects: Class and objects – class methods and self – constructor – class and object variables – destructor – public and private data member. **NumPy :**NumPy Arrays – Computation on NumPy Arrays. **Matplotlib :** Line plots – Scatter Plots

List of Exercises/Experiments:

1.Programs using conditional and looping statements

2. Implementation of list and tuple operations

3. Implementation of dictionary operations

4. Perform various string operations

5. Use regular expressions for validating inputs

6. Demonstration of different types of functions and parameter passing

7. Develop programs using classes and objects

8. Perform computation on Numpy arrays

9. Draw different types of plots using Matplotlib

Lecture:45, Practical : 15 Total: 60

TEXT BOOK:

1 ReemaThareja., “Python Programming using problem solving approach”, 3rd impression, Oxford University Press., New Delhi, 2017.

REFERENCES:

1 NageswaraRao, “Core Python Programming”, 2nd Edition, DreamTech Press, New Delhi, 2018.

2 Jake Vander Plas ,” Python Data Science Handbook Essential Tools for Working with Data”, O’Reilly publishers,1st Edition,2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	understand the basics of python programming using nested and control statements.	Understanding (K2)
CO2:	apply list, tuple and dictionary to handle variety of data.	Applying (K3)
CO3:	apply strings and regular expression for searching in a string.	Applying (K3)
CO4:	solve the problems using functions and modules.	Applying (K3)
CO5:	understand the object oriented concepts and perform data science operations	Applying (K3)
CO6:	implement the basic data types and control statements.	Applying (K3)
CO7:	demonstrate functions, regular expressions and object oriented concepts.	Applying (K3)
CO8:	perform numpy operations and analyse results using matplotlib	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	
CO2			3		3								2	2
CO3			3		3							3	2	2
CO4			3		3							3	2	2
CO5			3		3							3	2	3
CO6			3		3							3		3
CO7			3		3							3		3
CO8			3		3							3		3

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

ASSESSMENT PATTERN

Test/Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT 1-50 marks	25	25	50				100
CAT 2-50 marks	20	20	60				100
CAT 3-50 marks	20	20	60				100
ESE -100 marks	25	25	50				100

20ITO05 COMPUTER VISION

Programme & Branch	All Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	OE	3	1	0	4

Preamble	This is a basic course on Computer Vision. Starting with fundamentals of vision, it explores image segmentation and feature based alignment. It also deals with motion and image stitching. It finally concludes with some applications for computer vision.	
Unit - I	**Fundamentals of Vision:**	**9+3**
What is computer vision? – A brief history – Image formation: geometric primitives and transformation – photometric image formation – The digital camera		
Unit - II	**Image Processing and Feature detection:**	**9+3**
Image Processing: point operators – linear filtering – more neighbourhood operators – Fourier transforms –pyramids and wavelets – Geometric transformations – global optimizations. **Feature detection and matching**: points and patches – edges – lines.		
Unit - III	**Segmentation and Feature based Alignment:**	**9+3**
Segmentation: Active contours – split and merge – mean shift and mode finding – normalized cuts – graph cuts and energy-based methods. **Feature based alignment**: 2D and 3D feature-based alignment – pose estimation – geometric intrinsic calibration.		
Unit - IV	**Motion:**	**9+3**
Structure from motion: Triangulation – Two-frame structure from motion – factorization – bundle adjustment – constrained structure and motion. **Dense motion estimation**: Translational alignment – parametric motion – spline-based motion – optical flow – layered motion. **Image stitching**: motion models – global alignment – compositing.		
Unit - V	**Applications for Computer Vision:**	**9+3**
Recognition: Object detection – face recognition – instance recognition – category recognition – context and scene understanding – recognition databases and test-sets.		

Lecture :45, Tutorial:15, Total:60

TEXT BOOK:

1	Richard Szeliski, " Computer Vision: Algorithms and Applications", Springer International, 2011.

REFERENCES:

1	Reinhard Klette, "Concise Computer Vision: An introduction into Theory and Algorithms", Springer International, 2014
2	E.R. Davies, "Computer and Machine Vision",4th Edition, Elsevier, 2012

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	outline the fundamental concepts of computer vision	Applying (K3)
CO2	make use of basic image processing and feature detection concepts	Applying (K3)
CO3	experiment with different types of segmentation and feature-based alignments	Applying (K3)
CO4	interpret how different types of motion affect the structure of the objects	Applying (K3)
CO5	illustrate recognition as an application of computer vision	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	40	30	30				100
CAT2	40	30	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)**

20ITO06 DATA SCIENCE

Programme & Branch	All Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	OE	3	1	0	4

Preamble	This course provides basic concepts of data science , analyze large amounts of data using machine learning approaches and store and process data in distributed environment	
Unit - I	**Introduction to data science:**	**9+3**
Benefits of Data Science – Facets of Data – Data Science Process –Big Data Ecosystem and Data Science–Example using Hadoop. The Data Science Process: Overview – Defining Research Goals – Retrieving Data – Data Preparation – Exploratory Data Analysis – Building Models – Building Applications		
Unit - II	**Machine learning and handling big data:**	**9+3**
Applications for Machine Learning in Data Science – Machine Learning in Data Science Process – The Modeling Process. Handling Large Data: Problems in Handling Large Data – General Techniques – Programming Tips – Case Studies.		
Unit - III	**Distributed data storage and processing:**	**9+3**
Distributing Data Storage and Processing with Frameworks: Hadoop – Spark – Case Study: Assessing Risk with Loaning Money.		
Unit - IV	**NoSQL and graph database:**	**9+3**
Introduction: ACID– CAP Theorem – The BASE Principles of NoSQL Databases – NoSQL Database Types – Case Study: What disease is that?– Graph Database: Introducing Connected Data and Graph Databases – Connected Data Example.		
Unit - V	**Text Mining and Text Analytics:**	**9+3**
Test Mining in Real World – Text Mining Techniques: Bag of Words – Stemming and Lemmatization – Decision Tree Classifier – Case Study: Classifying Reddit Posts.		

Lecture :45, Tutorial:15, Total:60

TEXT BOOK:

1	Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science – Big Data, Machine Learning and more, Using Python Tools", First Edition, Manning Publications, 2016

REFERENCES:

1	http://education.EMC.com/academicalliance, "Data Science and Big data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", 1st Edition, EMC Education Services, 2015
2	Joel Grus, "Data Science from the Scratch", 2nd Edition, O"Reilly Publications, 2019

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	make use of data science principles in developing applications	Applying (K3)
CO2	apply machine learning methods to solve problems with large data	Applying (K3)
CO3	experiment with Hadoop and Spark platform for data science applications	Applying (K3)
CO4	apply the data science process to solve real world problems using NoSQL database and Graph database	Applying (K3)
CO5	make use of text analytics techniques for building solutions for text mining 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										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

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

ASSESSMENT PATTERN - THEORY

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

20ITO07 ADVANCED JAVA PROGRAMMING

Programme& Branch	B.E. – Computer Science and Design	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	OE	3	1	0	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+3**
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+3**
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+3**
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+3**
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+3**
Testing a Spring Boot Application: Unit Testing and Integration Testing – JUnit and Mockito framework – Checking code coverage – Testing RESTFul web services – Cucumber automation testing. Deploying a Spring Boot Application – Docker and containerization - Setting up Docker- Heroku CLI and deployment. Case Study.		

Lecture:45, Tutorial :15, Total: 60

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.
2. Rajput, D. “Mastering Spring Boot 2.0: Build modern, cloud-native, and distributed systems using Spring Boot”, Packt Publishing Ltd, 2018.
3. 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)
CO2	Demonstrate the common annotations of the Spring Data and Spring Data JPA	Applying (K3)
CO3	Build RESTFul Microservices and Secured Web Application	Applying (K3)
CO4	Implement Resilience4J and Swagger API and host the apps on Cloud.	Applying (K3)
CO5	Learn to demonstrate Testing and Deploying a Spring Boot Application	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

20ITO08 NCC STUDIES (AIR WING) – I

Programme & Branch	All 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 & National Integration**	**9**
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 & Weapon Training**	**9**
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**
Laws of motion-Forces acting on aircraft–Bernoulli's theorem-Stalling-Primary control surfaces – secondary control surfaces-Aircraft recognition.		
Unit - IV	**Aero Engines:**	**9**
Introduction of Aero engine-Types of engine-piston engine-jet engines-Turboprop engines-Basic Flight Instruments-Modern trends.		
Unit – V	**Aero Modeling:**	**9**
History of aero modeling-Materials used in Aero-modeling-Types of Aero-models – Static Models-Gliders-Control line models-Radio Control Models-Building and Flying of Aero-models.		

Lecture :45, Practical30, 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" by DG NCC, New Delhi.
2	"Cadets Handbook – Specialised Subjects SD/SW" by DG NCC, New Delhi.
3	"NCC OTA Precise" by DGNCC, 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 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 airplanes 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.						

20ITO09 BIO NATURAL LANGUAGE PROCESSING

Programme& Branch	All Circuit Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	6	OE	3	0	0	3

Preamble	The course provides the foundation on Natural Language Processing concepts. Staring from words as the unit of a language, this course deals with statistical models, word embeddings and sequence modeling using advanced neural architectures. It also illustrates some practical NLP systems like Machine translation, Question Answering systems and chatbots.	
Unit - I	**Words and Their Statistical Models**	**9**
Regular Expressions – Words – Corpora – Text normalization – Minimum edit distance. N-Gram Language Models – N-Grams – Evaluating Language Models – Generalizations and zeros – Smoothing – Kneser-Ney Smoothing – Huge Language Models – Backoff – Perplexity vs. Entropy. Naïve-Bayes classifiers –Naïve-Bayes as Language Model – Evaluation – Test set and cross validation – Statistical significance testing		
Unit - II	**Vectors and Embeddings**	**9**
Lexical Semantics – Vector Semantics – Wordsand Vectors – Cosine for measuring similarity – TF-IDF: weighing terms in vectors – pointwise Mutual Information (PMI) – Applications of TF-IDF and PPMI – Word2Vec – Visualizing embeddings – Bias and Embeddings – Evaluating vector models. Neural Network Language Models – Units – XOR problem – Feed Forward Neural Networks – Training Neural Nets – Neural Language Models.		
Unit - III	**Sequence Labeling and Deep Learning Architectures**	**9**
English word classes –Part-of-Speech (PoS) Tagging – Named Entities and Named Entities Tagging – HMM PoS – Conditional Random Fields – Evaluation of Named Entity Recognition. Deep Learning Architecturesfor sequence modeling – Recurrent Neural Networks – Managing contexts in RNNs: LSTMs and GRUs – Self Attention Networks (Transformers) – Potential harms from Language Models.		
Unit - IV	**Machine Translation (MT) and Encoder-Decoder Models**	**9**
Language divergences and Typology – The Encode-Decoder model –Encoder-Decoder with RNNs – Attention – Beam Search – Encoder-Decoder with Transformers –Practical details on building MT systems – MT evaluation – Bias and ethical issues.		
Unit - V	**Practical NLP Systems**	**9**
Question Answering: Information Retrieval – IR based Factoid Question Answering – Entity Linking – Knowledge based Question Answering – Using Language Models for Question Answering – Classic QA models – Evaluation of factoid answers. **Chatbots and Dialogue systems** – Properties of human conversations – Chatbots – GUS: a simple frame-based dialogue system – Evaluating dialogue systems – Dialogue system design		

Lecture: 45, Total: 45

Textbook:

1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing”, 3rdEdition, Pearson Education, New Delhi, 2020.

References:

2. Christopher Manning and Hinrich Schuetze,” Foundations of Statistical Natural Language Processing”, 1st Edition, MIT Press, London, 2000.
3. Li Deng and Yang Liu, ” Deep Learning in Natural Language Processing“,1st Edition, Springer,2018

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply formal and statistical models for word processing	Applying (K3)
CO2	develop word vector embeddings for a given language	Applying (K3)
CO3	Utilize deep learning architectures for modeling sequences in NLP	Applying (K3)
CO4	make use of encoder-decoders models to build Machine Translation systems	Applying (K3)
CO5	build question answering and chatbots for practical applications	Applying (K3)

Mapping of COs with POs s						
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	2	1	1		
CO2	3	2	1	1		
CO3	3	2	1	1		
CO4	3	2	1	1		
CO5	3	2	1	1		
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy						

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	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)(CAT 1,2,3 – 50 marks & ESE – 100 marks)**

20ITO10 DISASTER MANAGEMENT FOR INFORMATION TECHNOLOGY

Programme & Branch	All Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	6	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		

Lecture: 45, 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	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										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

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

ASSESSMENT PATTERN - THEORY

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

20ITO11 MODERN APPLICATION DEVELOPMENT

Programme & Branch	All Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Web Technologies	**8**	**OE**	**3**	**0**	**0**	**3**

Preamble	This course provides knowledge about powerful modern web applications that form the foundation for mobile application and websites	
Unit - I	**Domain Knowledge**:	**9**
Introduction - analysis - Selecting the supporting architecture - UX-driven design - Architectural options for a web solution - Layered architecture.		
Unit - II	**ASP.NET**	**9**
Introduction - Technical aspects of ASP.NET Core 1.0 – ASP.NET MVC		
Unit - III	**Bootstrap:**	**9**
Introduction – layouts – table – form - web elements – extensions - Organizing the ASP.NET MVC project		
Unit - IV	**Data Handling:**	**9**
Presenting Data: structure, display, adding views – Editing Data - Persistence and modeling		
Unit - V	**User experience:**	**9**
Creating more interactive views - Pros and cons of responsive design - Making websites mobile-friendly		

Lecture: 45, Total: 45

TEXT BOOK:

1. Dino Esposito. “Modern Web Development: Understanding domains, technologies, and user experience”, 1st Edition, Microsoft Press, USA, 2016

REFERENCES:

1. https://www.javatpoint.com/asp-net-tutorial
2. https://www.w3schools.com/bootstrap/

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	illustrate the architectural options for a web solution	Applying (K3)
CO2	apply the technical aspects of ASP.NET	Applying (K3)
CO3	create simple applications using Bootstrap	Applying (K3)
CO4	develop data handling applications	Applying (K3)
CO5	design a responsive application using Bootstrap	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

20ITO12 OBJECT ORIENTED SYSTEM DEVELOPMENT USING UML

Programme & Branch	All Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	8	OE	3	0	0	3

Preamble	This course provides a concise introduction to the fundamental concepts of object oriented system design with patterns and UML diagrams.	
Unit - I	**Introduction:**	**9**
An overview of object oriented systems development - Object basics – Object oriented systems development life cycle- Software development process - Building high-quality software - Rumbaugh methodology – Booch methodology - Jacobson methodology - Patterns – Frameworks – Unified Approach		
Unit - II	**UML:**	**9**
Introduction - Unified Modeling Language – Static model - Dynamic model - UML diagrams- UML class diagram - Use case diagram – UML dynamic modeling - UML interaction diagrams -UML state chart diagram - UML activity diagram - Implementation Diagrams -component diagram -Deployment diagram - UML extensibility - Use-case model-Developing effective documentation		
Unit - III	**Object Oriented Analysis:**	**9**
Noun Phrase Approach-Common class patterns approach-Use case driven Approach-Classes-Responsibilities- Collaborators- Naming classes- Associations-Super-Sub Class relations-A-part of Relationships – Aggregations-Class Responsibility: Identifying Attributes and Methods-Defining Attributes by analysing Use cases and other UML diagrams-Object Responsibilities-Case study		
Unit - IV	**Object Oriented Design:**	**9**
Object oriented design process - Object oriented design axioms-Corollaries- Coupling – Cohesion –Design Patterns- Designing classes - UML object constraint language-Class visibility - Refining attributes - Designing methods and protocols-Designing Methods for Bank Objects-Packages and Managing Classes		
Unit - V	**Design Patterns**:	**9**
Introduction – Describing design patterns - Catalog of Design Patterns - Organizing the Catalog - How Design Patterns Solve Design Problems - How to Select a Design Pattern. Creational Patterns - Structural Patterns - Behavioral Patterns.		

Lecture: 45, Total: 45

TEXT BOOK:

1	Ali Bahrami, "Object Oriented Systems Development", 1stEdition, Tata McGraw-Hill, New Delhi, 2017.	I –IV units
2	Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, "Design Patterns: Elements of Reusable Object-Oriented Software", 1st Edition, Pearson Education, 2015.	V Unit

REFERENCES:

1	John Deacon, "Object Oriented Analysis and Design", 1st Edition, Pearson Education, 2009.
2	Craig Larman, "Object Oriented Analysis and Design", 3rd Edition, Prentice Hall, India, 2005.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply different techniques to get the system requirements and present it in standard format	Applying (K3)
CO2	utilize software objects to build systems that are more robust	Applying (K3)
CO3	design projects using the Object-Oriented Analysis and Design (OOAD) concepts	Applying (K3)
CO4	identify objects, relationships, services and attributes and construct UML diagrams using appropriate notations	Applying (K3)
CO5	apply appropriate design patterns for solving real world 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										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

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

ASSESSMENT PATTERN - THEORY

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

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

20ITO13 REINFORCEMENT LEARNING

Programme & Branch	All Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	8	OE	3	0	0	3

Preamble	This course deals with modeling, analysis tools and techniques for problems of dynamic decision making under uncertainty. It also deals with convergence and accuracy of such algorithms.

Lecture: 45, Total: 45

Unit - I	**Introduction and Basics of RL**:	**9**
Reinforcement Learning- Examples- Elements of Reinforcement Learning- Limitations and Scope- An Extended Example: Tic-Tac-Toe- History of Reinforcement Learning.		
Unit - II	**Tabular Solution Methods:**	**9**
Multi-arm Bandits - An n-Armed Bandit Problem- Action-Value Methods- Incremental Implementation- Tracking a Nonstationary Problem- Optimistic Initial Values- Upper-Confidence-Bound Action Selection- Gradient Bandit- Associative Search.		
Unit - III	**Finite Markov Decision Processes:**	**9**
The Agent–Environment Interface- Goals and Rewards- Returns- Unified Notation for Episodic and Continuing Tasks- The Markov Property- Markov Decision Processes- Value Functions- Optimal Value Functions- Optimality and Approximation.		
Unit - IV	**Dynamic Programming and Monte Carlo Methods:**	**9**
Dynamic Programming - Policy Evaluation- Policy Improvement- Policy Iteration- Value Iteration- Generalized Policy Iteration. Monte Carlo Methods: Monte Carlo Prediction- Monte Carlo Estimation of Action Values- Monte Carlo Control- Monte Carlo Control without Exploring Starts.		
Unit - V	**Temporal-Difference Learning:**	**9**
TD Prediction- Advantages of TD Prediction Methods- Optimality of TD(0) -Sarsa: On-Policy TD Control- Q-Learning: Off-Policy TD Control- Games, After states, and Other Special Cases		

Lecture: 45, Total: 45

TEXT BOOK:

1	Richard S. Sutton and Andrew G. Barto, “Reinforcement Learning: An Introduction", 2nd Edition, MIT Press, London, 2018..

REFERENCES:

1	Phill winder, “Reinforcement Learning: Industrial applications of intelligent agents", 1st Edition, O'Reilly Media, 2020..

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	illustrate RL tasks and the core principles behind the RL	Applying (K3)
CO2	Apply tabular methods to solve classical control problems	Applying (K3)
CO3	utilize Markov decision process in optimization of complex problems	Applying (K3)
CO4	solve problems using dynamic programming and Monte-Carlo methods	Applying (K3)
CO5	outline temporal-difference learning and Q-learning	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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