KONGU ENGINEERING COLLEGE

(Autonomous Institution Affiliated to Anna University, Chennai)

PERUNDURAI ERODE – 638 060

TAMILNADU INDIA

REGULATIONS, CURRICULUM & SYLLABI - 2018

(CHOICE BASED CREDIT SYSTEM &
OUTCOME BASED EDUCATION)

(For the students admitted during 2018 - 2019 and onwards)

BACHELOR OF ENGINEERING DEGREE
IN
COMPUTER SCIENCE ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

KONGU
Assuring the Best

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KONGU ENGINEERING COLLEGE
PERUNDURAI ERODE – 638 060
(Autonomous)

INSTITUTE VISION

To be a centre of excellence for development and dissemination of knowledge in Applied Sciences, Technology, Engineering and Management for the Nation and beyond.

INSTITUTE MISSION

We are committed to value based Education, Research and Consultancy in Engineering and Management and to bring out technically competent, ethically strong and quality professionals to keep our Nation ahead in the competitive knowledge intensive world.

QUALITY POLICY

We are committed to

- Provide value based quality education for the development of students as competent and responsible citizens.
- Contribute to the nation and beyond through research and development
- Continuously improve our services

DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

VISION

To be a centre of excellence for nurturing competent computer professionals of high caliber and quality for catering to the ever-changing needs of the industry and society.

MISSION

Department of Computer Science Engineering is committed to:

MS1: Develop innovative, competent and ethically strong computer engineers to meet global challenges.

MS2: Foster consultancy and basic as well as applied research activities to solve real world problems.

MS3: Endeavour for constant upgradation of technical expertise to cater to the needs of the industry and society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduate of Computer Science Engineering programme will:

PEO1: Utilize the fundamental knowledge of basic sciences and engineering to succeed in their professional career.

PEO2: Analyze, design, develop and verify computer-based solutions to real world problems.

PEO3: Exhibit soft skills, ethical code of conduct and ability for life-long learning.

MAPPING OF MISSION STATEMENTS (MS) WITH PEOs

MS\PEO	PEO1	PEO2	PEO3
MS1	2	2	3
MS2	3	3	2
MS3	3	2	3

1 – Slight, 2 – Moderate, 3 – Substantial

PROGRAM OUTCOMES (POs)

Graduates of Computer Science Engineering will**:**

PO1 **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Graduates of Computer Science Engineering will**:**

PSO1 **Foundations of Computer Science:** Ability to use the mathematical and computing knowledge to propose viable ideas and solutions to solve real world problems.

PSO2 **Software design and Development:** Ability to develop computer based systems using engineering skills, knowledge of software design process, programming languages and tools.

MAPPING OF PEOs WITH POs AND PSOs

PEO\ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PEO1	3	2	-	-	-	-	2	-	-	-	1	2	3	1
PEO2	-	3	3	3	2	-	1	-	-	-	2	2	1	3
PEO3	-	-	-	-	-	3	-	3	3	3	-	3	1	1

1 – Slight, 2 – Moderate, 3 – Substantial

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638060

(Autonomous)

REGULATIONS 2018
(Revision: 4)

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 2018 – 2019 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
BTech	Chemical Engineering
	Information Technology
	Food Technology

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/industrial training, project work, internship, etc. that have been approved by the respective Board of Studies and Academic Council of the College. All the programmes have well defined Programme Outcomes (PO), Programme Specific Outcomes (PSO) and Programme Educational Objectives (PEOs) as per Outcome Based Education (OBE). The content of each course is designed based on the Course Outcomes (CO). The courses shall be categorized as follows:

i. Humanities and Social Sciences (HS) including Management Courses

ii. Basic Science (BS) Courses

iii. Engineering Science (ES) Courses

iv. Professional Core (PC) Courses

v. Professional Elective (PE) Courses

vi. Open Elective (OE) Courses

vii. Employability Enhancement Courses (EC) like Project work, Professional Skills/Industrial Training, Comprehensive Test & Viva, Entrepreneurships/Start ups and Internship in Industry or elsewhere

viii. Audit Courses (AC)

ix. Mandatory Courses (MC)

4.2 Credit Assignment

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 programme shall vary from 168 to 173 as per the chosen programme of study.

4.3 Employability Enhancement Courses

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

4.3.1 Professional Skills Training/Industrial 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 and Viva

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

4.3.3 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 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 courses or dropping of already registered additional elective 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) and earn continuous assessment marks. This will be considered as an attempt for the purpose of classification.

6.3 If a candidate is prevented from writing end semester examination of a course due to lack of attendance, the candidate has to attend the classes, when offered next, and fulfill the attendance requirements as per clause 8 and earn continuous assessment marks. If the course, in which the candidate has a lack of attendance, is an elective, the candidate may register for the same or any other elective course in the subsequent semesters and that will be considered as an attempt for the purpose of classification.

7. ASSESSMENT AND EXAMINATION PROCEDURE FOR AWARDING MARKS

7.1 The BE/BTech programmes consist of Theory Courses, Theory cum Practical courses, Practical courses, Comprehensive Test and Viva, Project Work, Professional Skills 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:

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

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

7.3 Theory Courses

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

7.5.1 The apportionment of continuous assessment marks for each course shall be decided by the course coordinator based on rubrics of that particular course.

Type	Max. Marks	Remarks
Assessment based on rubrics for each experiment	50	Absolute Mark System
Assessment Test	50	
Total	100	Rounded off to one decimal place

7.6 Project Work II / Project Work I 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/ Project Work I Phase II and the Viva-Voce Examination shall be distributed as below:

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

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

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

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

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

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

7.7 Project Work I 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	Supervisor	Review Committee (excluding supervisor)	Supervisor	Review Committee (excluding supervisor)	Supervisor	Review Committee	Supervisor	Review Committee
0	0	10	10	15	15	20	10	20

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

7.8 Professional Skills Training

Phase I training shall be conducted for minimum of 80 hours in 4^{th} semester vacation and during 5^{th} semester. Phase II training shall be conducted for minimum of 80 hours in 5^{th} semester vacation and during 6^{th} semester. The evaluation procedure shall be approved by the Principal.

7.9 Comprehensive Test and Viva

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

7.10 Entrepreneurships/ Start ups

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

A review committee shall be formed by the Principal for reviewing the progress of the Start ups / Business models, innovativeness, etc. The review committee can recommend the appropriate grades for academic performance for the candidate(s) involved in the start ups. This course shall carry a maximum of two credits in fifth semester and 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 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 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 Universal Human Values

The course imparting the human values shall be taught for all candidates who have joined in various branches of all BE/BTech programmes. This course shall carry a maximum of 100 marks and shall be evaluated through continuous assessment tests only vide clause 7.1. The candidate(s) can earn 2 credits by successfully completing this course. Two continuous assessment tests will be conducted and the average marks will be taken for the GPA and CGPA calculations.

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 and satisfy the attendance requirements.

9. REQUIREMENTS FOR APPEARING FOR END SEMESTER EXAMINATION

9.1 A candidate shall normally be permitted to appear for end semester examination of the current semester if he/she has satisfied the semester completion requirements as per clause 8, and has registered for examination in all courses of that semester. Registration is mandatory for current semester examinations as well as for arrear examinations failing which the candidate shall not be permitted to move on to the higher semester.

9.2 When a candidate is deputed for a National / International Sports event during End Semester examination period, supplementary examination shall be conducted for such a candidate on return after participating in the event within a reasonable period of time. Such appearance shall be considered as first appearance.

9.3 A candidate who has already appeared for a course in a semester and passed the examination is not entitled to reappear in the same course for improvement of letter grades / marks.

10. PROVISION FOR WITHDRAWAL FROM EXAMINATIONS

10.1 A candidate may, for valid reasons, be granted permission to withdraw from appearing for the examination in any regular course or all regular courses registered in a particular semester. Application for withdrawal is permitted only once during the entire duration of the degree programme.

10.2 The withdrawal application shall be valid only if the candidate is otherwise eligible to write the examination (vide clause 9) and has applied to the Principal for permission prior to the last examination of that semester after duly recommended by the Head of the Department.

10.3 The withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class with Distinction/First Class.

10.4 If a candidate withdraws a course or courses from writing end semester examinations, he/she shall register the same in the subsequent semester and write the end semester examinations. A final semester candidate who has withdrawn shall be permitted to appear for supplementary examination to be conducted within reasonable time as per clause 14.

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

11. PROVISION FOR BREAK OF STUDY

11.1 A candidate is normally permitted to avail the authorised break of study under valid reasons (such as accident or hospitalization due to prolonged ill health or any other valid reasons) and to rejoin the programme in a later semester. He/She shall apply in advance to the Principal, through the Head of the Department, stating the reasons therefore, in any case, not later than the last date for registering for that semester examination.

A candidate is permitted to avail the authorised break of study only once during the entire period of study for a maximum period of one year. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for the break of study.

11.2 The candidates permitted to rejoin the programme after break of study / prevention due to lack of attendance shall be governed by the rules and regulations in force at the time of rejoining.

11.3 The candidates rejoining in new Regulations shall apply to the Principal in the prescribed format through Head of the Department at the beginning of the readmitted semester itself for prescribing additional/equivalent courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.

11.4 The total period of completion of the programme reckoned from the commencement of the semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5 irrespective of the period of break of study in order to qualify for the award of the degree.

11.5 If any candidate is prevented for want of required attendance, the period of prevention shall not be considered as authorized break of study.

11.6 If a candidate has not reported to the college for a period of two consecutive semesters without any intimation, the name of the candidate shall be deleted permanently from the college enrollment. Such candidates are not entitled to seek readmission under any circumstances.

12. PASSING REQUIREMENTS

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

12.2 A candidate who secures not less than 50 % in continuous assessment marks prescribed for the courses which are evaluated based on continuous assessment only shall be declared to have successfully passed the course. If a candidate secures less than 50% in the continuous assessment marks, he / she shall have to re-enroll for the same in the subsequent semester and satisfy the attendance requirements.

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

13. REVALUATION OF ANSWER SCRIPTS

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

14. SUPPLEMENTARY EXAMINATION

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

15. AWARD OF LETTER GRADES

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:

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

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

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

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

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

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

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

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

16. ELIGIBILITY FOR THE AWARD OF DEGREE

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

i. Successfully completed all the courses under the different categories, as specified in the regulations.

ii. Successfully gained the required number of total credits as specified in the curriculum corresponding to the candidate's programme within the stipulated time (vide clause 5).

iii. Successfully passed any additional courses prescribed by the respective Board of Studies whenever readmitted under regulations other than R-2018 (vide clause 11.3)

iv. No disciplinary action pending against him / her.

17. CLASSIFICATION OF THE DEGREE AWARDED

17.1 First Class with Distinction:

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

- Should have passed the examination in all the courses of all the eight semesters (six semesters for lateral entry candidates) in the **First Appearance** within eight consecutive semesters (six consecutive semesters for lateral entry candidates) excluding the authorized break of study (vide clause 11) after the commencement of his / her study.
- Withdrawal from examination (vide clause 10) shall not be considered as an appearance.
- Should have secured a CGPA of not less than 8.50

(OR)

17.1.2 A candidate who joins from other institutions on transfer or a candidate who gets readmitted and has to move from one regulations to another regulations and who qualifies for the award of the degree (vide clause 16) and satisfies the following conditions shall be declared to have passed the examination in First class with Distinction:

- Should have passed the examination in all the courses of all the eight semesters (six semesters for lateral entry candidates) in the First Appearance within eight consecutive semesters (six consecutive semesters for lateral entry candidates) excluding the

authorized break of study (vide clause 11) after the commencement of his / her study.

- Submission of equivalent course list approved by the respective Board of studies.
- Withdrawal from examination (vide clause 10) shall not be considered as an appearance.
- Should have secured a CGPA of not less than 9.00

17.2 First Class:

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

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

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.

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.

All amendments until the 16th Academic council meeting have been incorporated.

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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	3	1	1	2		3		13	**7.69**
BS	11	11	4	4					30	**17.76**
ES	7	4	4	4					18	**10.65**
PC		3	11	16	19	12			61	**36.09**
PE						3	9	3	15	**8.88**
OE					4	4	3	3	14	**8.28**
EC					2	4	6	6	18	**10.65**
Semesterwise Total	21	21	20	24	27	23	21	12	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**

CATEGORISATION OF COURSES

HUMANITIES AND SOCIAL SCIENCE INCLUDING MANAGEMENT (HS)

S. No.	Course Code	Course Name	L	T	P	C	Sem
1.	18EGT11	English for Communication I	3	0	0	3	I
2.	18EGT21	English for Communication II	3	0	0	3	II
3.	18VEC11	Value Education	2	0	1	1	II
4.	18EGL31	English for Workplace Communication	0	0	2	1	IV
5.	18MBT71	Engineering Economics and Management	3	0	0	3	VII
6.	18GET51	Universal Human Values	2	0	0	2	V
Total Credits to be earned						**13**	

BASIC SCIENCE (BS)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	18MAC11	Mathematics I	3	1*	2*	4	I
2.	18PHC11	Applied Physics	3	0	2*	3.5	I
3.	18CYC11	Applied Chemistry	3	0	2*	3.5	I
4.	18MAC21	Mathematics II	3	1*	2*	4	II
5.	18PHC24	Solid State Physics	3	0	2*	3.5	II
6.	18CYC25	Environmental Science and Organic Electronic Materials	3	0	2*	3.5	II
7.	18MAT31	Discrete Mathematics	3	1*	2*	4	III
8.	18MAC42	Probability and Statistics	3	1*	2*	4	IV
Total Credits to be earned						**30**	

ENGINEERING SCIENCE (ES)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	18GET11	Introduction to Engineering	3	0	0	3	I
2.	18CSC11	Problem Solving and Programming	2	0	2	3	I
3.	18MEC11	Engineering Drawing	2	0	2	3	II
4.	18MEL11	Engineering Practices Laboratory	0	0	2	1	II
5.	18ITC31	Digital Principles and Design	3	0	2	4	III
6.	18ECT44	Microprocessor and Embedded Systems	3	0	0	3	IV
7.	18ECL43	Microprocessor and Embedded Systems Laboratory	0	0	2	1	IV
Total Credits to be earned						**18**	

PROFESSIONAL CORE (PC)								
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**	**Domain/ Stream**
1.	18CSC21	Programming and Linear Data Structures	2	0	2	3	II	SD
2.	18CST31	Data Structures	3	0	0	3	III	SD
3.	18CST32	Computer Organization	3	0	0	3	III	SD
4.	18CST33	Object Oriented Programming	3	0	0	3	III	SD
5.	18CSL31	Data Structures Laboratory	0	0	2	1	III	SD
6.	18CSL32	Object Oriented Programming Laboratory	0	0	2	1	III	SD

7.	18CST42	Design and Analysis of Algorithms	3	1	0	4	IV	SD
8.	18CST41	Database Management Systems	3	1	0	4	IV	SD
9.	18ITT41	Python Programming and Frameworks	3	0	0	3	IV	SD
10.	18CST43	Operating Systems	3	1	0	3	IV	SD
11.	18ITL41	Python Programming and Frameworks Laboratory	0	0	2	1	IV	SD
12.	18CSL41	Database Management Systems Laboratory	0	0	2	1	IV	SD
13.	18CST51	Computer Networks	3	0	0	3	V	NS
14.	18CST52	Web Technology	3	0	0	3	V	SDE
15.	18CST53	Theory of Computation	3	1	0	4	V	FCS
16.	18CST54	Distributed Systems	3	0	0	3	V	AI
17.	18CSC51	Software Engineering	3	0	2	4	V	SDE
18.	18CSL51	Network Laboratory	0	0	2	1	V	NS
19.	18CSL52	Web Technology Laboratory	0	0	2	1	V	SDE
20.	18CST61	Principles of Compiler Design	3	0	0	3	VI	SD
21.	18CST62	Machine Learning	3	0	0	3	VI	SD
22.	18CST63	Mobile Communication and IoT	3	0	0	3	VI	NS
23.	18CSL61	Compiler Design Laboratory	0	0	2	1	VI	SD
24.	18CSL62	Machine Learning Laboratory	0	0	2	1	VI	SD
25.	18CSL63	Mobile Communication and IoT Laboratory	0	0	2	1	VI	NS
Total Credits to be earned						**61**		

PROFESSIONAL ELECTIVE (PE)								
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**	**Domain/ Stream**
		Elective 1						
1.	18CSE01	Multicore Architecture	3	0	0	3	VI	SD
2.	18CSE02	Artificial Intelligence	3	0	0	3	VI	AI
3.	18CSE03	Modeling and Simulation	3	0	0	3	VI	SD
4.	18CSE04	Wireless and Sensor Networks	3	0	0	3	VI	NS
5.	18CSE05	Data Warehousing and Data Mining	3	0	0	3	VI	SDE
6.	18CSE06	Building Enterprise Applications	3	0	0	3	VI	SDE
		Elective 2						
7.	18CSE07	BlockChain Technologies	3	0	0	3	VII	NS

8.	18CSE08	Cloud Computing	3	0	0	3	VII	NS
9.	18CSE09	Decision Support Systems	3	0	0	3	VII	AI
10	18CSE10	Social Network Analysis	3	0	0	3	VII	SD
11	18CSE11	Agile Methodologies	3	0	0	3	VII	SDE
12	18CSE12	Human Computer Interface	3	0	0	3	VII	SDE
		Elective 3						
13.	18CSE13	Cryptography and Network Security	3	0	0	3	VII	NS
14.	18CSE14	Deep Learning	3	0	0	3	VII	AI
15.	18CSE15	Parallel Computing Architecture and Programming	3	0	0	3	VII	SD
16.	18CSE16	Game Theory and its Applications	3	0	0	3	VII	SD
17.	18CSE17	Software Quality and Testing	3	0	0	3	VII	SDE
18.	18CSE18	Big Data Analytics	3	0	0	3	VII	SDE
		Elective 4						
19.	18CSE19	Software Defined Networks	3	0	0	3	VII	NS
20.	18CSE20	Information Security	3	0	0	3	VII	NS
21.	18CSE21	Intelligent Systems	3	0	0	3	VII	AI
22.	18CSE22	Software Project Management	3	0	0	3	VII	SDE
23.	18CSE23	Data Visualization Techniques	3	0	0	3	VII	SDE
24.	18GEE01	Fundamentals of Research	3	0	0	3	VII	GE
		Elective 5						
25.	18MBE49	Entrepreneurship Development	3	0	0	3	VIII	GE
26.	18CSE24	Cyber Forensics	3	0	0	3	VIII	NS
27.	18CSE25	Data Science	3	0	0	3	VIII	AI
28.	18CSE26	Business Intelligence and its Applications	3	0	0	3	VIII	SDE
29.	18CSE27	Predictive Data Analytics	3	0	0	3	VIII	SDE
Total Credits to be earned						**15**		

EMPLOYABILITY ENHANCEMENT COURSES (EC)

S. No.	Course Code	Course Name	L	T	P	C	Sem	Domain/ Stream
1.	18GEL51/ 18GEI51	Professional Skills Training I / Industrial Training I	0	0	0	2	V	--
2.	18GEL61/ 18GEI61	Professional Skills Training II / Industrial Training II	0	0	0	2	VI	--
3.	18GEP71	Comprehensive Test and Viva	0	0	0	2	VII	--
4.	18CSP61	Project Work I Phase I	0	0	4	2	II	--

5.	18CSP71	Project Work I Phase II	0	0	8	4	III	--
6.	18CSP81	Project Work II	0	0	12	6	IV	--
Total Credits to be earned						**18**		

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

OPEN ELECTIVE COURSES OFFERED TO OTHER DEPARTMENTS (OE)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	18CSO01	Data Structures and its Applications	3	0	2	4	5
2.	18CSO02	Formal Languages and automata theory	3	1	0	4	5
3.	18CSO03	Computational Science for Engineers	3	1	0	4	5
4.	18CSO04	Web Engineering	3	0	2	4	6
5.	18CSO05	Foundations of Data Analytics	3	1	0	4	6
6.	18CSC06	Nature Inspired Optimization Techniques	3	1	0	4	6
7.	18CSC07	Introducing Data Science	3	1	0	4	6
8.	18CSO08	Artificial intelligence and its Applications	3	0	0	3	7
9.	18CSO09	Applied Machine Learning	3	0	0	3	8
10.	18CSO10	Fundamentals of BlockChain	3	0	0	3	8
11.	18CSO11	Fundamentals of Internet of Things	3	0	0	3	8

OPEN ELECTIVE COURSES OFFERED BY OTHER DEPARTMENTS (OE)

S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**OFFERED BY**
		SEMESTER V					
12.	18MAO01	Mathematical Foundations of Machine Learning	3	1	0	4	MATHS
13.	18PHO01	Thin film Technology	3	1	0	4	PHYSICS
14.	18CYO01	Corrosion Science and Engineering	3	1	0	4	CHEMISTRY
15.	18CEO01	Remote Sensing and its Applications	3	0	2	4	CIVIL
16.	18MEO01	Renewable Energy Sources	3	0	2	4	MECH
17.	18MTO01	Design of Mechatronics Systems	3	1	0	4	MTS
18.	18AUO01	Automotive Engineering	3	0	2	4	AUTO
19.	18ECO01	PCB Design and Fabrication	3	0	2	4	ECE
20.	18ECO02	Neural Networks and Fuzzy Logic for Engineering Applications	3	0	2	4	ECE

21.	18EEO01	Electrical Wiring and Lighting	3	1	0	4	EEE
22.	18EEO02	Solar and Wind Energy Systems	3	1	0	4	EEE
23.	18EIO01	Neural Networks and Deep Learning	3	1	0	4	EIE
24.	18ITO01	Python Programming	3	0	2	4	IT
25.	18ITO02	Advanced Java Programming	3	0	2	4	IT
26.	18CHO01	Polymer Technology	3	1	0	4	CHEM
27.	18CHO02	Introduction to Drugs and Pharmaceuticals Technology	3	1	0	4	CHEM
28.	18FTO01	Food Processing Technology	3	1	0	4	FT
29.	18FTO02	Baking Technology	3	0	2	4	FT
		SEMESTER VI					
30.	18MAO02	Graph Theory and its Applications	3	1	0	4	MATHS
31.	18MAO03	Number Theory and Cryptography	3	1	0	4	MATHS
32.	18CYO02	Instrumental Methods of Analysis	3	1	0	4	CHEMISTRY
33.	18CEO02	Disaster Management	3	1	0	4	CIVIL
34.	18MEO02	Design of Experiments	3	0	2	4	MECH
35.	18MTO02	Factory Automation	3	0	2	4	MTS
36.	18MTO03	Data Acquisition and Virtual Instrumentation	3	0	2	4	MTS
37.	18AUO02	Autonomous Vehicles	3	1	0	4	AUTO
38.	18ECO03	Principles of Quantum Computing	3	0	2	4	ECE
39.	18EEO03	Energy Conservation and Management	3	1	0	4	EEE
40.	18EIO02	Digital Image Processing and Its Applications	3	1	0	4	EIE
41.	18EIO03	Industrial Automation	3	1	0	4	EIE
42.	18ITO03	Java Programming	3	1	0	4	IT
43.	18ITO04	Next Generation Databases	3	1	0	4	IT
44.	18CHO03	Bio Energy Resources	3	1	0	4	CHEM
45.	18CHO04	Fundamentals of Nanoscience and Nanotechnology	3	1	0	4	CHEM
46.	18FTO03	Processing of Milk and Milk Products	3	0	2	4	FT
47.	18FTO04	Processing of Fruits and Vegetables	3	0	2	4	FT
		SEMESTER VII					
48.	18MAO04	Advanced Linear Algebra	3	0	0	3	MATHS
49.	18MAO05	Optimization Techniques	3	0	0	3	MATHS

50.	18PHO02	Structural and Optical Characterization of Materials	3	0	0	3	PHYSICS
51.	18CYO03	Waste and Hazardous Waste Management	3	0	0	3	CHEMISTRY
52.	18CEO03	Introduction to Smart Cities	3	0	0	3	CIVIL
53.	18CEO04	Environmental Health and Safety	3	0	0	3	CIVIL
54.	18MEO03	Fundamentals of Ergonomics	3	0	0	3	MECH
55.	18MEO04	Principles of Management and Industrial Psychology	3	0	0	3	MECH
56.	18MTO04	3D Printing and Design	3	0	0	3	MTS
57.	18MTO05	Drone System Technology	3	0	0	3	MTS
58.	18AUO03	Alternate Fuels for Automobile	3	0	0	3	AUTO
59.	18ECO04	Electronic Hardware and Troubleshooting	2	0	2	3	ECE
60.	18ECO05	Principles of Communication Techniques	3	0	0	3	ECE
61.	18EEO04	Micro Grid and Smart Grid	3	0	0	3	EEE
62.	18EEO05	Electrical Safety	3	0	0	3	EEE
63.	18EIO04	Biomedical Instrumentation and Applications	3	0	0	3	EIE
64.	18EIO05	PLC Programming and Its Applications	3	0	0	3	EIE
65.	18ITO05	Business Continuity Planning	3	0	0	3	IT
66.	18ITO06	Mobile Application Development	3	0	0	3	IT
67.	18CHO05	Enzyme Engineering	3	0	0	3	CHEM
68.	18CHO06	Nuclear Engineering	3	0	0	3	CHEM
69.	18FTO05	Principles of Food safety	3	0	0	3	FT
70.	18FTO06	Food and Nutrition	3	0	0	3	FT
		SEMESTER VIII					
71.	18CEO05	Infrastructure Planning and Management	3	0	0	3	CIVIL
72.	18CEO06	Environmental Laws and Policy	3	0	0	3	CIVIL
73.	18MEO05	Safety Measures for Engineers	3	0	0	3	MECH
74.	18MEO06	Energy Conservation in Thermal Equipments	3	0	0	3	MECH
75.	18MTO06	Robotics	3	0	0	3	MTS
76.	18MTO07	Virtual and Augment Reality in Industry 4.0	3	0	0	3	MTS
77.	18AUO04	Automotive Electronics	3	0	0	3	AUTO
78.	18AUO05	Vehicle Maintenance	3	0	0	3	AUTO
79.	18ECO06	Bioinspired Computing Technologies	2	0	2	3	ECE

80.	18EEO06	Electric Vehicle	3	0	0	3	EEE
81.	18EIO06	Measurements and Instrumentation	3	0	0	3	EIE
82.	18EIO07	Graphical Programming using Virtual Instrumentation	3	0	0	3	EIE
83.	18ITO07	Essentials of Information Technology	3	0	0	3	IT
84.	18ITO08	Virtual and Augmented Reality Frameworks	3	0	0	3	IT
85.	18CHO07	Fertilizer Technology	3	0	0	3	CHEM
86.	18FTO07	Food Ingredients	3	0	0	3	FT
87.	18FTO08	Fundamentals of Food Packaging and Storage	3	0	0	3	FT

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

S. No.	Course Code	Course Title	L	T	P	C	Offering Department	Semester
88.	18GEO01	German Language Level 1	4	0	0	4	ECE	V/ VI/ VII/ VIII
89.	18GEO02	Japanese Language Level 1	4	0	0	4	ECE	V/ VI/ VII/ VIII
90.	18GEO03	Design Thinking for Engineers	3	0	0	3	CSE	VI
91.	18GEO04	Innovation and Business Model Development	3	0	0	3	MTS	VIII
92.	18GEO05	German Language Level 2	4	0	0	4	ECE	V/ VI/ VII/ VIII
93.	18GEO06	German Language Level 3	3	0	0	3	ECE	V/ VI/ VII/ VIII
94.	18GEO07	German Language Level 4	3	0	0	3	ECE	V/ VI/ VII/ VIII
95.	18GEO08	Japanese Language Level 2	4	0	0	4	ECE	V/ VI/ VII / VIII
96.	18GEO09	Japanese Language Level 3	3	0	0	3	ECE	V/ VI/ VII / VIII
97.	18GEO10	Japanese Language Level 4	3	0	0	3	ECE	V/ VI/ VII / VIII
98.	18GEO11	NCC Studies (Army Wing) – I	3	0	2	4	EEE	V/ VI
99.	18GEO12	NCC Studies (Air Wing) – I	3	0	2	4	IT	V / VI

KEC R2018: SCHEDULING OF COURSES – BE (Computer Science and Engineering) Total Credits :169

Sem.	Course1	Course2	Course3	Course4	Course5	Course6	Course7	Course8	Course9	Course10	Credits
I	18EGT11 English for Communi-cation I (3-0-0-3)	18MAC11 Mathematics I (3-1*-2*-4)	18PHC11 Applied Physics (3-0-2*-3.5)	18CYC11 Applied Chemistry (3-0-2*-3.5)	18GET11 Introduction to Engineering (3-0-0-3)	18CSC11 Problem Solving and Programming (2-0-2-3)	18VEC11 Value Education (2-0-1-1				**21**
II	18EGT21 English for Communi-cation II (3-0-0-3)	18MAC21 Mathematics II (3-1*-2*-4)	18PHC25 Materials Science and Opto Electronic Devices (3-0-2*-3.5)	18CYC25 Environmental Science and Organic Electronic Materials (3-0-2*-3.5)	18MEC11 Engineering Drawing (2-0-2-3)	18EET21 Principles of Electrical and Electronics Engineering (3-0-0-3)	18MEL11 Engineering Practices Laboratory (0-0-2-1))				**21**
III	18MAT31 Discrete Mathematics (3-1*-2*-4)	18ITC31 Digital Principles and Design (3-1-0-4)	18CST31 Data Structures (3-0-0-3)	18CST32 Computer Organization (3-0-0-3)	18CST33 Object Oriented Programming (3-0-0-3)	18CSL31 Data Structures Laboratory (0-0-2-1)	18CSL32 Object Oriented Programming Laboratory (0-0-2-1)	18EGL31 English for Work Place Communicatio n(0-0-2-1)			**20**
IV	18MAC42 Probability and Statistics (3-1-2*-4)	18ECT44 Microprocesso r and Embedded systems (3-1-0-4)	18CST42 Design and Analysis of Algorithms (3-1-0-4)	18CST41 Database Management Systems (3-1-0-4)	18ITT41 Python Programming and Frameworks (3-0-0-3)	18CST43 Operating Systems (0-0-2-1)	18ECL43 Microprocesso r and Embedded Systems Laboratory (0-0-2-1)	18ITL41 Python Programming and Frameworks Laboratory (0-0-2-1)	18CSL41 Database Management Systems Laboratory (0-0-2-1)		**24**
V	18CST51 Computer Networks (3-0-0-3)	18CST52 Web Technology (3-0-0-3)	18CST53 Theory of Computation (3-1-0-4)	18CST54 Distributed Systems (3-0-0-3)	18CSC51 Software Engineering (3-0-2-4)	Open Elective I (3-1/0-0/2-4)	18CSL51 Network Laboratory (0-0-2-1)	18CSL52 Web Technology Laboratory (0-0-2-1)	18GEL51/ 18GEI51 Professional Skills Training I / Industrial Training I (0-0-0-2)	18GET51 Universal Human Values (2-0-0-2)	**27**
VI	18CST61 Principles of Compiler Design (3-0-0-3)	18CST62 Machine Learning (3-0-0-3)	18CST63 Mobile Communicatio n and IoT (3-0-0-3)	Professional Elective I (3-0-0-3)	Open Elective II (3-1/0-0/2-4)	18CSL61 Compiler Design Laboratory (0-0-2-1)	18CSL62 Machine Learning Laboratory (0-0-2-1)	18CSL63 Mobile Communicatio n and IoT Laboratory (0-0-2-1)	18GEL61/ 18GEI61 Professional Skills Training II / Industrial Training II (0-0-0-2)	18CSP61 Project Work I Phase I (0-0-4-2)	**23**
VII	18MBT71 Engineering Economics and Management (3-0-0-3)	Open Elective III (3-0-0-3)	Professional Elective II (3-0-0-3)	Professional Elective III (3-0-0-3)	Professional Elective IV (3-0-0-3)	18GEP71 Comprehen-sive Test & Viva (0-0-0-2)	18CSP71 Project Work I Phase II (0-0-8-4)				**21**
VIII	Open Elective IV (3-0-0-3)	Professional Elective V (3-0-0-3)	18CSP81 Project Work II (0-0-12-6)								**12**

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	18EGT11	English for Communication I						✓			✓	✓	✓	✓		
1	18MAC11	Mathematics I	✓	✓	✓	✓	✓									
1	18PHC11	Applied Physics	✓	✓	✓	✓										
1	18CYC11	Applied Chemistry	✓	✓	✓	✓										
1	18GET11	Introduction to Engineering	✓	✓	✓	✓		✓	✓					✓		
1	18CSC11	Problem Solving and Programming	✓	✓	✓	✓	✓					✓				
1	18VEC11	Value Education						✓		✓				✓		
2	18EGT21	English for Communication II						✓			✓	✓	✓	✓		
2	18MAC21	Mathematics II	✓	✓	✓		✓									
2	18PHC25	Solid State Physics	✓	✓	✓	✓										
2	18CYC25	Environmental Science and Organic Electronic Materials	✓	✓	✓	✓			✓							
2	18MEC11	Engineering Drawing	✓	✓	✓	✓					✓	✓	✓	✓		
2	18CST21	Programming and Linear Data Structures	✓	✓	✓	✓									✓	✓
2	18MEL11	Engineering Practices Laboratory	✓	✓	✓	✓	✓				✓	✓	✓	✓		
3	18MAT31	Discrete Mathematics	✓	✓	✓	✓	✓									
3	18ITC31	Digital Principles and Design	✓	✓	✓										✓	✓
3	18CST31	Data Structures	✓	✓	✓	✓									✓	✓
3	18CST32	Computer Organization	✓	✓	✓										✓	✓
3	18CST33	Object Oriented Programming	✓	✓	✓	✓									✓	✓
3	18CSL31	Data Structures Laboratory	✓	✓	✓	✓	✓								✓	✓
3	18CSL32	Object Oriented Programming Laboratory	✓		✓	✓	✓							✓	✓	✓
3	18EGL31	English for Work Place Communication									✓	✓		✓	✓	✓
4	18MAC42	Probability and Statistics	✓	✓	✓	✓	✓									
4	18ECT44	Microprocessor and Embedded systems	✓	✓	✓	✓									✓	✓
4	18CST42	Design and Analysis of Algorithms	✓	✓	✓	✓	✓								✓	✓

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
4	18CST41	Database Management Systems	✓	✓	✓										✓	✓
4	18ITT41	Python Programming and Frameworks	✓	✓	✓		✓							✓		✓
4	18CST43	Operating Systems	✓	✓	✓	✓									✓	✓
4	18ECL43	Microprocessor and Embedded Systems Laboratory	✓	✓	✓	✓									✓	✓
4	18ITL41	Python Programming and Frameworks Laboratory	✓	✓	✓		✓							✓	✓	✓
4	18CSL41	Database Management Systems Laboratory	✓	✓	✓	✓	✓					✓	✓		✓	✓
5	18CST51	Computer Networks	✓	✓	✓	✓						✓			✓	✓
5	18CST52	Web Technology	✓	✓	✓	✓									✓	✓
5	18CST53	Theory of Computation	✓	✓	✓	✓									✓	✓
5	18CST54	Distributed Systems	✓	✓	✓	✓									✓	✓
5	18CSC51	Software Engineering	✓	✓	✓			✓				✓		✓	✓	✓
5	18CSL51	Network Laboratory	✓	✓	✓	✓	✓								✓	✓
5	18CSL52	Web Technology Laboratory	✓	✓	✓	✓									✓	✓
5	18GEL51/ 18GEI51	Professional Skills Training I / Industrial Training I	✓	✓				✓	✓		✓	✓	✓	✓		✓
5	18GET51	Universal Human Values						✓	✓	✓	✓	✓				
6	18CST61	Principles of Compiler Design	✓	✓	✓	✓	✓								✓	✓
6	18CST62	Machine Learning	✓	✓	✓	✓									✓	✓
6	18CST63	Mobile Communication and IoT	✓	✓	✓										✓	✓
6	18CSL61	Compiler Design Laboratory	✓	✓	✓	✓	✓								✓	✓
6	18CSL62	Machine Learning Laboratory	✓	✓	✓	✓									✓	✓
6	18CSL63	Mobile Communication and IoT Laboratory	✓	✓	✓	✓	✓								✓	✓
6	18CSP61	Project Work IPhase I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7	18MBT71	Engineering Economics and Management	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
7	18GEP71	Comprehensive Test and Viva	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓
7	18CSP71	Project Work I Phase II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7	18GEL61/ 18GEI61	Professional Skills Training II / Industrial Training II	✓	✓				✓	✓		✓	✓	✓	✓		✓

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
8	18CSP81	Project Work II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Professional Elective Courses														
6	18CSE01	Multicore Architecture	✓	✓	✓										✓	✓
6	18CSE02	Artificial Intelligence	✓	✓	✓	✓									✓	✓
6	18CSE03	Modeling and Simulation	✓	✓	✓	✓									✓	✓
6	18CSE04	Wireless and Sensor Networks	✓	✓	✓	✓									✓	✓
6	18CSE05	Data Warehousing and Data Mining	✓	✓	✓	✓									✓	✓
6	18CSE06	Building Enterprise Applications	✓	✓	✓	✓								✓	✓	✓
7	18CSE07	BlockChain Technologies	✓	✓	✓	✓									✓	✓
7	18CSE08	Cloud Computing	✓	✓	✓	✓									✓	✓
7	18CSE09	Decision Support Systems	✓	✓	✓			✓	✓					✓	✓	✓
7	18CSE10	Social Network Analysis	✓	✓	✓	✓									✓	✓
7	18CSE11	Agile Methodologies	✓	✓	✓	✓	✓				✓		✓		✓	✓
7	18CSE12	Human Computer Interface	✓	✓	✓	✓									✓	✓
7	18CSE13	Cryptography and Network Security	✓	✓	✓		✓							✓	✓	✓
7	18CSE14	Deep Learning	✓	✓	✓	✓									✓	✓
7	18CSE15	Parallel Computing Architecture and Programming	✓	✓	✓	✓									✓	✓
7	18CSE16	Game Theory and its Applications	✓	✓	✓										✓	✓
7	18CSE17	Software Quality and Testing	✓	✓	✓										✓	✓
7	18CSE18	Big Data Analytics	✓	✓	✓		✓								✓	✓
7	18CSE19	Software Defined Networks	✓	✓	✓	✓	✓								✓	✓
7	18CSE20	Information Security	✓	✓	✓										✓	✓
7	18CSE21	Intelligent Systems	✓	✓	✓	✓									✓	✓
7	18CSE22	Software Project Management	✓	✓	✓	✓					✓		✓		✓	✓
7	18CSE23	Data Visualization Techniques	✓	✓	✓	✓									✓	✓
8	18MBE49	Entrepreneurship Development	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
8	18CSE24	Cyber Forensics	✓	✓	✓										✓	✓
8	18CSE25	Data Science	✓	✓	✓	✓									✓	✓
8	18CSE26	Business Intelligence and its Applications	✓	✓	✓	✓									✓	✓
8	18CSE27	Predictive Data Analytics	✓	✓	✓	✓									✓	✓

		Open Elective Courses														
5	18MAO01	Mathematical Foundations of Machine Learning	✓	✓	✓	✓	✓									
5	18PHO01	Thin film Technology	✓	✓	✓											
5	18CYO01	Corrosion Science and Engineering	✓	✓	✓	✓										
5	18CEO01	Remote Sensing and its Applications	✓	✓	✓	✓	✓									
5	18MEO01	Renewable Energy Sources	✓	✓	✓	✓			✓			✓		✓		
5	18MTO01	Design of Mechatronics Systems	✓	✓	✓	✓	✓							✓		
5	18AUO01	Automotive Engineering	✓	✓	✓		✓									
5	18ECO01	PCB Design and Fabrication	✓	✓	✓	✓	✓				✓					
5	18ECO02	Neural Networks and Fuzzy Logic for Engineering Applications	✓	✓	✓	✓	✓				✓					
5	18EEO01	Electrical Wiring and Lighting	✓	✓	✓	✓	✓	✓								
5	18EEO02	Solar and Wind Energy Systems	✓	✓	✓	✓										
5	18EIO01	Neural Networks and Deep Learning	✓	✓	✓	✓	✓									
5	18ITO01	Python Programming			✓		✓									
5	18ITO02	Advanced Java Programming			✓		✓									
5	18CHO01	Polymer Technology	✓	✓												
5	18CHO02	Introduction to Drugs and Pharmaceuticals Technology	✓	✓	✓	✓	✓									
5	18FTO01	Food Processing Technology	✓	✓	✓	✓										
5	18FTO02	Baking Technology	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓		

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
6	18MAO02	Graph Theory and its Applications	✓	✓	✓											
6	18MAO03	Number Theory and Cryptography	✓	✓	✓		✓									
6	18CYO02	Instrumental Methods of Analysis	✓	✓	✓	✓										
6	18CEO02	Disaster Management	✓	✓	✓			✓	✓					✓		
6	18MEO02	Design of Experiments	✓	✓	✓	✓	✓						✓	✓		
6	18MTO02	Factory Automation	✓	✓	✓	✓	✓	✓			✓	✓		✓		
6	18MTO03	Data Acquisition and Virtual Instrumentation	✓	✓	✓	✓	✓				✓	✓		✓		
6	18AUO02	Autonomous Vehicles	✓	✓	✓											
6	18ECO03	Principles of Quantum Computing	✓	✓	✓	✓	✓									
6	18EEO03	Energy Conservation and Management	✓	✓	✓		✓									
6	18EIO02	Digital Image Processing and Its Applications	✓	✓	✓	✓	✓									
6	18EIO03	Industrial Automation	✓	✓	✓	✓	✓									
6	18ITO03	Java Programming	✓	✓	✓	✓	✓	✓						✓		
6	18ITO04	Next Generation Databases	✓	✓	✓	✓										
6	18CHO03	Bio Energy Resources	✓	✓	✓	✓	✓									
6	18CHO04	Fundamentals of Nanoscience and Nanotechnology	✓	✓	✓	✓	✓									
6	18FTO03	Processing of Milk and Milk Products	✓	✓	✓		✓	✓		✓	✓	✓		✓		
6	18FTO04	Processing of Fruits and Vegetables	✓	✓	✓		✓	✓		✓	✓	✓		✓		
7	18MAO04	Advanced Linear Algebra	✓	✓	✓											
7	18MAO05	Optimization Techniques	✓	✓	✓											
7	18PHO02	Structural and Optical Characterization of Materials	✓	✓	✓											
7	18CYO03	Waste and Hazardous Waste Management	✓	✓	✓	✓			✓							
7	18CEO03	Introduction to Smart Cities	✓	✓	✓				✓							
7	18CEO04	Environmental Health and Safety	✓	✓	✓	✓										
7	18MEO03	Fundamentals of Ergonomics	✓	✓	✓	✓		✓	✓			✓		✓		
7	18MEO04	Principles of Management and Industrial Psychology			✓			✓	✓	✓	✓	✓				

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
7	18MTO04	3D Printing and Design	✓	✓	✓	✓	✓						✓	✓		
7	18MTO05	Drone System Technology	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓		
7	18AUO03	Alternate Fuels for Automobile	✓	✓												
7	18ECO04	Electronic Hardware and Troubleshooting	✓	✓	✓	✓	✓	✓								
7	18ECO05	Principles of Communication Techniques	✓	✓	✓	✓	✓									
7	18EEO04	Micro Grid and Smart Grid	✓	✓	✓	✓	✓									
7	18EEO05	Electrical Safety	✓	✓	✓											
7	18EIO04	Biomedical Instrumentation and Applications	✓	✓	✓	✓	✓									
7	18EIO05	PLC Programming and Its Applications	✓	✓	✓	✓	✓									
7	18ITO05	Business Continuity Planning	✓	✓	✓	✓										
7	18ITO06	Mobile Application Development	✓	✓	✓	✓										
7	18CHO05	Enzyme Engineering	✓	✓	✓	✓	✓									
7	18CHO06	Nuclear Engineering	✓	✓												
7	18FTO05	Principles of Food safety	✓	✓	✓		✓	✓	✓	✓				✓		
7	18FTO06	Food and Nutrition	✓	✓	✓	✓								✓		
7	18CEO05	Infrastructure Planning and Management	✓	✓	✓											
8	18CEO06	Environmental Laws and Policy	✓	✓	✓	✓										
8	18MEO05	Safety Measures for Engineers		✓		✓	✓	✓	✓	✓	✓			✓		
8	18MEO06	Energy Conservation in Thermal Equipments	✓	✓	✓			✓	✓			✓	✓	✓		
8	18MTO06	Robotics	✓	✓	✓	✓	✓							✓		
8	18MTO07	Virtual and Augment Reality in Industry 4.0	✓	✓	✓	✓	✓	✓						✓		
8	18AUO04	Automotive Electronics	✓	✓	✓											
8	18AUO05	Vehicle Maintenance	✓		✓			✓								
8	18ECO06	Bioinspired Computing Technologies	✓	✓	✓	✓										
8	18EEO06	Electric Vehicle	✓	✓	✓	✓	✓									
8	18EIO06	Measurements and Instrumentation	✓	✓	✓	✓	✓									
8	18EIO07	Graphical Programming using Virtual Instrumentation	✓	✓	✓	✓	✓									

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
8	18ITO07	Essentials of Information Technology	✓	✓	✓	✓										
8	18ITO08	Virtual and Augmented Reality Frameworks	✓	✓	✓	✓										
8	18CHO07	Fertilizer Technology	✓	✓												
8	18FTO07	Food Ingredients	✓	✓	✓			✓						✓		
8	18FTO08	Fundamentals of Food Packaging and Storage	✓	✓	✓		✓	✓		✓				✓		
		General Open Elective														
5,6,7,8	18GEO01	German Language Level 1								✓	✓	✓		✓		
5,6,7,8	18GEO02	Japanese Language Level 1								✓	✓	✓		✓		
7	18GEO03	Design Thinking for Engineers	✓	✓	✓	✓										
8	18GEO04	Innovation and Business Model Development	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5,6,7,8	18GEO05	German Language Level 2								✓	✓	✓		✓		
5,6,7,8	18GEO06	German Language Level 3								✓	✓	✓		✓		
5,6,7,8	18GEO07	German Language Level 4								✓	✓	✓		✓		
5,6,7,8	18GEO08	Japanese Language Level 2								✓	✓	✓		✓		
5,6,7,8	18GEO09	Japanese Language Level 3								✓	✓	✓		✓		
5,6,7,8	18GEO10	Japanese Language Level 4								✓	✓	✓		✓		
5,6	18GEO11	NCC Studies (Army Wing) – I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
5,6	18GEO12	NCC Studies (Air Wing) – I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				

B.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM – R2018

SEMESTER – I									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
18EGT11	English for Communication I	3	0	0	3	50	50	100	HS
18MAC11	Mathematics I	3	1*	2*	4	50	50	100	BS
18PHC11	Applied Physics	3	0	2*	3.5	50	50	100	BS
18CYC11	Applied Chemistry	3	0	2*	3.5	50	50	100	BS
18GET11	Introduction to Engineering	3	0	0	3	50	50	100	ES
18CSC11	Problem Solving and Programming	2	0	2	3	50	50	100	ES
Practical / Employability Enhancement									
18VEC11	Value Education	2	0	1	1	50	50	100	HS
Total Credits to be earned					**21**				

***Alternate Weeks**

SEMESTER – II									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
18EGT21	English for Communication II	3	0	0	3	50	50	100	HS
18MAC21	Mathematics II	3	1*	2*	4	50	50	100	BS
18PHC24	Solid State Physics	3	0	2*	3.5	50	50	100	BS
18CYC25	Environmental Science and Organic Electronic Materials	3	0	2*	3.5	50	50	100	BS
18MEC11	Engineering Drawing	2	0	2	3	50	50	100	ES
18CSC21	Programming and Linear Data Structures	2	0	2	3	50	50	100	PC
Practical / Employability Enhancement									
18MEL11	Engineering Practices Laboratory	0	0	2	1	100	0	100	ES
Total Credits to be earned					**21**				

***Alternate Weeks**

B.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM – R2018

SEMESTER – III									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
18MAT31	Discrete Mathematics	3	1	0	4	50	50	100	BS
18ITC31	Digital Principles and Design	3	0	2	4	50	50	100	ES
18CST31	Data Structures	3	0	0	3	50	50	100	PC
18CST32	Computer Organization	3	0	0	3	50	50	100	PC
18CST33	Object Oriented Programming	3	0	0	3	50	50	100	PC
Practical / Employability Enhancement									
18CSL31	Data Structures Laboratory	0	0	2	1	100	0	100	PC
18CSL32	Object Oriented Programming Laboratory	0	0	2	1	100	0	100	PC
18EGL31	English for Workplace Communication	0	0	2	1	100	0	100	HS
Total Credits to be earned					**20**				

SEMESTER – IV									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
18MAC42	Probability and Statistics	3	1*	2*	4	50	50	100	BS
18ECT44	Microprocessor and Embedded Systems	3	0	0	3	50	50	100	ES
18ITT41	Python Programming and Frameworks	3	0	0	3	50	50	100	PC
18CST41	Database Management Systems	3	1	0	4	50	50	100	PC
18CST42	Design and Analysis of Algorithms	3	1	0	4	50	50	100	PC
18CST43	Operating Systems	3	0	0	3	50	50	100	PC
Practical / Employability Enhancement									
18ECL43	Microprocessor and Embedded Systems Laboratory	0	0	2	1	100	0	100	PC
18ITL41	Python Programming and Frameworks Laboratory	0	0	2	1	100	0	100	PC
18CSL41	Database Management Systems Laboratory	0	0	2	1	100	0	100	PC
Total Credits to be earned					**24**				

***Alternate Weeks**

B.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM – R2018

SEMESTER – V									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
18CST51	Computer Networks	3	0	0	3	50	50	100	PC
18CST52	Web Technology	3	0	0	3	50	50	100	PC
18CST53	Theory of Computation	3	1	0	4	50	50	100	PC
18CST54	Distributed Systems	3	0	0	3	50	50	100	PC
18CSC51	Software Engineering	3	0	2	4	50	50	100	PC
	Open Elective I	3	1/0	0/2	4	50	50	100	OE
Practical / Employability Enhancement									
18CSL51	Network Laboratory	0	0	2	1	100	0	100	PC
18CSL52	Web Technology Laboratory	0	0	2	1	100	0	100	PC
18GEL51/ 18GEI51	Professional Skills Training I / Industrial Training I *	--	--	--	2	100	0	100	EC
18GET51	Universal Human Values	2	0	0	2	100	0	100	HS
Total Credits to be earned					**27**				

***80 Hours of Training**

SEMESTER – VI									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
18CST61	Principles of Compiler Design	3	0	0	3	50	50	100	PC
18CST62	Machine Learning	3	0	0	3	50	50	100	PC
18CST63	Mobile Communication and IoT	3	0	0	3	50	50	100	PE
	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									
18CSL61	Compiler Design Laboratory	0	0	2	1	100	0	100	PC
18CSL62	Machine Learning Laboratory	0	0	2	1	100	0	100	PC
18CSL63	Mobile Communication and IoT Laboratory	0	0	2	1	100	0	100	PC
18GEL61/ 18GEI61	Professional Skills Training II / Industrial Training II *	---	---	---	2	100	0	100	EC
18CSP61	Project Work I Phase I	0	0	4	2	100	0	100	EC
Total Credits to be earned					**23**				

***80 Hours of Training**

B.E. COMPUTER SCIENCE AND ENGINEERING CURRICULUM – R2018

SEMESTER – VII									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
18MBT71	Engineering Economics and Management	3	0	0	3	50	50	100	HS
	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
	Open Elective III	3	0	0	3	50	50	100	OE
Practical / Employability Enhancement									
18GEP71	Comprehensive Test / Viva	---	---	---	2	100	0	100	EC
18CSP71	Project Work I Phase II	0	0	8	4	50	50	100	EC
Total Credits to be earned					**21**				

SEMESTER – VIII									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
	Professional Elective V	3	0	0	3	50	50	100	PE
	Open Elective IV	3	0	0	3	50	50	100	OE
Practical / Employability Enhancement									
18CSP81	Project Work II	---	---	12	6	50	50	100	EC
Total Credits to be earned					**12**				

Total Credits :169

LIST OF PROFESSIONAL ELECTIVE COURSES (PE)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
		Elective I					
1.	18CSE01	Multicore Architecture	3	0	0	3	VI
2.	18CSE02	Artificial Intelligence	3	0	0	3	VI
3.	18CSE03	Modeling and Simulation	3	0	0	3	VI
4.	18CSE04	Wireless and Sensor Networks	3	0	0	3	VI
5.	18CSE05	Data Warehousing and Data Mining	3	0	0	3	VI
6.	18CSE06	Building Enterprise Applications	3	0	0	3	VI
		Elective II					
7.	18CSE07	BlockChain Technologies	3	0	0	3	VII
8.	18CSE08	Cloud Computing	3	0	0	3	VII
9.	18CSE09	Decision Support Systems	3	0	0	3	VII
10	18CSE10	Social Network Analysis	3	0	0	3	VII
11	18CSE11	Agile Methodologies	3	0	0	3	VII
12	18CSE12	Human Computer Interface	3	0	0	3	VII
		Elective III					
13.	18CSE13	Cryptography and Network Security	3	0	0	3	VII
14.	18CSE14	Deep Learning	3	0	0	3	VII
15.	18CSE15	Parallel Computing Architecture and Programming	3	0	0	3	VII
16.	18CSE16	Game Theory and its Applications	3	0	0	3	VII
17.	18CSE17	Software Quality and Testing	3	0	0	3	VII
18.	18CSE18	Big Data Analytics	3	0	0	3	VII
		Elective IV					
19.	18CSE19	Software Defined Networks	3	0	0	3	VII
20.	18CSE20	Information Security	3	0	0	3	VII
21.	18CSE21	Intelligent Systems	3	0	0	3	VII
22.	18CSE22	Software Project Management	3	0	0	3	VII
23.	18CSE23	Data Visualization Techniques	3	0	0	3	VII
24.	18GEE01	Fundamentals of Research	3	0	0	3	VII

		Elective V					
25.	18MBE49	Entrepreneurship Development	3	0	0	3	VIII
26.	18CSE24	Cyber Forensics	3	0	0	3	VIII
27.	18CSE25	Data Science	3	0	0	3	VIII
29.	18CSE26	Business Intelligence and its Applications	3	0	0	3	VIII
30.	18CSE27	Predictive Data Analytics	3	0	0	3	VIII

LIST OF OPEN ELECTIVE COURSES (OE) OFFERED TO OTHER DEPARTMENTS							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	18CSO01	Data Structures and its Applications	3	0	2	4	5
2.	18CSO02	Formal Languages and Automata Theory	3	1	0	4	5
3.	18CSO03	Computational Science for Engineers	3	1	0	4	5
4.	18CSO04	Web Engineering	3	0	2	4	6
5.	18CSO05	Foundations of Data Analytics	3	1	0	4	6
6.	18CSC06	Nature Inspired Optimization Techniques	3	1	0	4	6
7.	18CSC07	Introducing Data Science	3	1	0	4	6
8.	18CSO08	Artificial intelligence and its Applications	3	0	0	3	7
9.	18GEO03	Design T hinking for Engineers	3	0	0	3	7
10.	18CSO09	Applied Machine Learning	3	0	0	3	8
11.	18CSO10	Fundamentals of Block Chain	3	0	0	3	8
12.	18CSO11	Fundamentals of Internet of Things	3	0	0	3	8

18EGT11 - ENGLISH FOR COMMUNICATION I

(Common to all Engineering and Technology Branches)

Programme & Branch	B.E. & Computer Science and Engineering	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 B1 level in the Common European Framework (CEFR).	
Unit - I	**Listening, Speaking, Reading and Writing. Activity Based Learning – Phase – I:**	**9**
Listening - People talking about their 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.		
Unit - II	**Listening, Speaking, Reading and Writing. 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.		
Unit - III	**Listening, Speaking, Reading and Writing. 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.		
Unit - IV	**Listening, Speaking, Reading and Writing. 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.		
Unit - V	**Listening, Speaking, Reading and Writing. 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.		

Total: 45

TEXT BOOK:

1. Jack C. Richards, "Interchange, Student's Book 2", 4th Edition, Cambridge University Press, New York, 2017.

REFERENCES:

1. Jack C. Richards & Theodore Rodgers, "Approaches and Methods in Language Teaching", 3rd Edition, Cambridge University Press, New York, 2014.
2. Penny Ur, "A Course in English Language Teaching", 2nd Edition, Cambridge University Press, New York, 2012.

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		3	47	17		33	100
CAT2			37	23		40	100
CAT3		3	47	33		17	100
ESE		2	42	27		29	100

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

18MAC11 - MATHEMATICS I

(Common to All Engineering and Technology Branches)

Programme & Branch	B.E. & Computer Science and Engineering	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, multivariable functions and differential equations.	
Unit - I	**Matrices:**	**9**
Introduction to Matrices in Engineering – Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors (without proof) – Cayley – Hamilton theorem (Statement and applications only) - Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Nature of Quadratic forms - Reduction of quadratic form to canonical form by orthogonal transformation – Applications of Eigen values and Eigen vectors: Electric circuit – Mass string problems.		
Unit - II	**Multivariable Calculus:**	**9**
Functions of two 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 - III	**First Order Ordinary Differential Equations:**	**9**
Solutions of differential equations in variables separable form – Exact differential equations – Linear first order differential equations – Bernoulli's equation – Clairaut's equation.		
Unit - IV	**Ordinary Differential Equations of Higher Order:**	**9**
Linear differential equations of second and higher order with constant coefficients - Particular Integrals for the types: e^{ax} – cosax, sinax – x^n – e^{ax} x^n , e^{ax} sinbx and e^{ax} cosbx – x^n sinax and x^n cosax – Differential Equations with variable coefficients: Euler-Cauchy's equation – Legendre' s equation.		
Unit - V	**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).		

List of Exercises / Experiments:

1.	Introduction to MATLAB
2.	Matrix operations : Addition, Multiplication, Transpose and Inverse
3.	Computation of eigen values and eigen vectors
4.	Finding ordinary and partial derivatives
5.	Computing extremes of a single variable function
6.	Plotting and visualizing single variable functions
7.	Solving first and second order ordinary differential equations
8.	Solution of Simultaneous first order ODEs

***Alternate Weeks**

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

TEXT BOOK:

1.	Grewal B. S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, New Delhi, 2011.

REFERENCES:

1.	Duraisamy C., Vengataasalam S., Arun Prakash K. and Suresh M., "Engineering Mathematics - I", 2nd Edition, Pearson India Education, New Delhi, 2018.
2.	Won Y. Yang, Young K. Choi, Jaekwon Kim, Man Cheol Kim, Jin Kim H. and Taeho Im, "Engineering Mathematics with MATLAB", 1st Edition, CRC Press, London, 2018.

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	compute extremal values which arise in function of several	Understanding (K2)
CO3	identify the appropriate method for solving first order ordinary differential equations	Applying (K3)
CO4	solve higher order linear differential equations with constant and variable coefficients	Applying (K3)
CO5	apply the concept of ordinary differential equations for modeling and finding solutions to engineering problems	Applying (K3)
CO6	determine eigen values and eigen vectors of a given matrix using MATLAB	Applying (K3), Manipulation (S2)
CO7	compute maxima and minima of a single variable function, plot and visualize single variable function using MATLAB	Applying (K3), Manipulation (S2)
CO8	solve first and second order ordinary differential equations and simultaneous first order ordinary differential equations 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	2	1										
CO2	3	2												
CO3	3	3	1	1										
CO4	3	3	1	1										
CO5	3	3	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	20	10	70				100
CAT2	20	10	70				100
CAT3	20	10	70				100
ESE	20	10	70				100

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

18PHC11 - APPLIED PHYSICS

(Common to All Engineering and Technology Branches)

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	1	BS	3	0	2*	3.5

Preamble	This course aims to impart the essential concepts of properties of matter, acoustics, ultrasonics, quantum physics, laser and fibre optics, 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	**Properties of Matter:**	**9**
Elasticity: Stress – Strain – Hooke's law – Stress-strain diagram – Poisson's ratio - Modulus of elasticity - Beams – Bending of beams – Expression for bending moment - Cantilever – Depression of the loaded end of a cantilever - Young's modulus by uniform and non-uniform bending methods - I-shaped girders. Viscosity: Viscous force – Viscosity – Co-efficient of viscosity – Importance of viscosity of liquids (qualitative).		
Unit - II	**Acoustics and Ultrasonics:**	**9**
Acoustics: Sound - Reverberation and reverberation time – Growth and decay of sound and Sabine's formula (qualitative) - Absorption coefficient - Factors affecting acoustics of buildings and their remedies. Ultrasonics: Properties of ultrasonic waves - Production of ultrasonic waves - Magnetostrictive generator - Piezoelectric generator - Applications of ultrasonic waves in non destructive testing.		
Unit - III	**Thermal and Quantum Physics:**	**9**
Thermal Physics: Modes of heat transfer - Thermal conductivity - Radial and cylindrical heat flow - Conduction through compound media (series and parallel). Quantum Physics: Matter waves - Schrodinger's time independent and time dependent wave equations – Physical significance of wave function - Particle in a one dimensional box.		
Unit - IV	**Laser, Fibre Optics and Applications:**	**9**
Laser and Applications: Spontaneous emission and stimulated emission - Population inversion - Pumping methods - Einstein's coefficients - Nd:YAG laser - Holography. Fiber Optics and Applications: Principle of propagation of light through optical fibers - Numerical aperture and acceptance angle - Classification of optical fibers based on refractive index, modes and materials - Fiber optical communication links (block diagram).		
Unit - V	**Crystal Physics:**	**9**
Crystal systems - Bravais lattice - Lattice planes - Miller indices - Interplanar spacing in cubic lattice - Atomic radius, Coordination number and Packing factor for SC, BCC and FCC crystal structures - Crystal imperfections: line and surface imperfections.		

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 viscosity of a given liquid using Poiseuilles' method.
3.	Determination of the velocity of ultrasonic waves in a liquid and the compressibility of a liquid using ultrasonic interferometer.
4.	Determination of the wavelength and the angle of divergence of a semiconductor laser.
5.	Determination of the acceptance angle and the numerical aperture of a given optical fiber.

***Alternate Weeks**

Lecture:45, Practical:15, Total:60

TEXT BOOK:

1. Tamilarasan K. and Prabu K., "Engineering Physics - I", 3rd Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 2014.

REFERENCES:

1. Gaur R.K. and Gupta S.L., "Engineering Physics", 8th Edition, Dhanpat Rai and Sons, New Delhi, 2009.
2. Mehta and Neeraj, "Applied Physics for Engineers", 1st Edition, Prentice-Hall of India Pvt. Ltd., New Delhi, 2011.
3. Tamilarasan K. and Prabu K., "Physics Laboratory Manual", 3rd Edition, SCM Publishers, Erode, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	make use of the concepts of elasticity and bending moment of a beam to a simple structure under simple loading to compute the Young\'s modulus of a material, and to explain the concepts of viscosity of liquids.	Applying (K3)
CO2	apply the concepts of growth and decay of sound energy in a hall to recognize the requirements of acoustically good buildings, and to describe the production of ultrasonic waves and non-destructive testing using ultrasonic waves.	Applying (K3)
CO3	use the concepts of heat flow to explain heat conduction through materials, and to describe the behavior of electrons in a metal by means of quantum physics.	Applying (K3)
CO4	apply the concepts of laser 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 fiber optic communication link.	Applying (K3)
CO5	explain seven crystal systems, atomic packing factor of the select crystal systems and the types of crystal defects.	Understanding (K2)
CO6	determine the Young\'s modulus of a material using the concepts of elasticity and bending moment of a beam, and to determine the viscosity of a liquid using the concepts of viscosity.	Applying (K3), Precision (S3)
CO7	compute the velocity of ultrasonic waves in a liquid and the compressibility of a liquid using the concepts of propagation of sound through a medium.	Applying (K3), Precision (S3)
CO8	determine the wavelength and the angle of divergence of a semiconductor laser beam using the concepts of propagation of light through a medium, and to compute the acceptance angle and the numerical aperture of an optical fiber using the concept of total internal reflection.	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											
CO2	3	2	1											
CO3	3	2	1											
CO4	3	2	1											
CO5	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	20	40	40				100
CAT2	20	45	35				100
CAT3	20	50	30				100
ESE	20	40	40				100

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

18CYC11 - APPLIED CHEMISTRY

(Common to All Engineering and Technology Branches)

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	1	BS	3	0	2*	3.5

Preamble	Applied Chemistry course imparts the basic principles and concepts of chemistry in the field of Engineering and Technology. It also imparts knowledge on Water Technology, Electrochemistry, Corrosion and its control, Fuels & Combustion and Polymers.	
Unit - I	**Water Technology:**	**9**
Introduction - Sources of water - Impurities in water - Types of water – Water Quality Standards - Hardness of water - Expression of hardness - Units of hardness - Estimation of hardness of water by EDTA method - Determination of alkalinity - Disadvantages of using hard water - Boiler troubles - Scale and sludge - Softening of water - External treatment method - Demineralization process - Internal treatment process - Carbonate and Calgon conditioning - Desalination by reverse osmosis method.		
Unit - II	**Electrochemistry:**	**9**
Introduction - Cells - Representation of a galvanic cell - Reversible and irreversible cells - Electrode potential - Nernst equation - Reference electrode - Standard hydrogen electrode - Glass electrode - Electrochemical series and its applications - Conductometric titrations - Mixture of weak and strong acid vs strong base.		
Unit - III	**Corrosion and its Control:**	**9**
Introduction - Chemical corrosion - Electrochemical corrosion - Galvanic corrosion - Concentration cell corrosion - Galvanic series - Factors influencing rate of corrosion - Corrosion control methods - Sacrificial anodic method - Protective coatings - Pretreatment of metal surface - Metallic coating - Electroplating - Nonmetallic coating - Phosphate coating - Organic coating - Paints - Constituents and their functions - Special paints - water repellant and luminescent paints.		
Unit - IV	**Fuels and Combustion:**	**9**
Introduction - Classification of fuels - Requirements of a good fuel - Combustion - Principle of combustion - Calorific value - Gross and net calorific values - Explosive range - Spontaneous ignition temperature - Calorific intensity - Solid fuels - Coal and its varieties - Proximate analysis - Significance - Metallurgical coke - Otto-Hoffman byproduct method - Liquid fuel - Refining of petroleum - Manufacture of synthetic petrol - Hydrogenation of coal - Bergius method - Knocking - Octane number - Cetane number - Gaseous fuel - LPG.		
Unit - V	**Polymers:**	**9**
Introduction - Classification of polymers - Functionality - Polymerization - Plastics - Types - Thermo and thermosetting plastics - Individual polymers - Polypropylene, PVC, PET and epoxy resin - Preparation, properties and uses - Compounding of plastics - Fabrication of plastics - Compression, injection, extrusion and blow moulding methods - Foamed plastics.		

List of Exercises / Experiments:

1.	Estimation of total, temporary and permanent hardness of water by EDTA method.
2.	Estimation of Ca2+ and Mg2+ hardness separately by EDTA method.
3.	Estimation of alkalinity of the given water sample.
4.	Conductometric titration - Mixture of acids.
5.	Estimation of hydrochloric acid using pH meter.

***Alternate Weeks**

Lecture:45, Practical:15, Total:60

TEXT BOOK:

1. Palanisamy P.N., Manikandan P., Geetha A & Manjula Rani K., "Applied Chemistry", 5th Edition, Tata McGraw Hill Education Pvt. Ltd, New Delhi, 2018.

REFERENCES:

1. Jain & Jain, "Engineering Chemistry", 16th Edition, Dhanpat Rai Publishing Company, New Delhi, 2016.
2. Sharma B.K., "Industrial Chemistry", Krishna Prakasan Media Pvt. Ltd, Meerut, 2014.
3. Palanisamy P.N., Manikandan P., Geetha A & Manjula Rani K., "Chemistry Laboratory Manual", Rajaganapathy Publishers, Erode, 2018.

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 to construct cells and measure the electrode potential	Applying (K3)
CO3	adopt the suitable corrosion control methods for the given practical 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)
CO6	estimate the amount of hardness for the given water sample by EDTA method	Applying (K3), Precision (S3)
CO7	estimate the amount of alkalinity for the given water sample	Applying (K3), Precision (S3)
CO8	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	2	1	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2												
CO5	3	2												
CO6	3	2	1	3										
CO7	3	2	1	3										
CO8	3	2	1	3										

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

ASSESSMENT PATTERN - THEORY

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

18GET11 - INTRODUCTION TO ENGINEERING

(Common to All Engineering and Technology Branches)

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	1	ES	3	0	0	3

Preamble	The objective of this course is to realize the importance of engineering, measurements and the fundamental concepts of common engineering disciplines like Civil, Mechanical, Electrical and Electronics Engineering.	
Unit - I	**Engineering and Measurements:**	**9**
Engineering and Measurements: Engineering - Engineer and Engineering Graduate - Graduate attributes - Role of engineer - Professional bodies and their role. Physical Quantities - Dimensions - SI Units, Symbols and Conversions - Mechanical Measuring Instruments - Electrical Measuring Instruments - Accuracy and Precision - Data Acquisition System.		
Unit - II	**Mechanical Engineering:**	**9**
Mechanical Engineering: IC Engines - Power Plants - Boilers and Furnaces - Pumps - Refrigeration and Air Conditioner - CAD/CAM - Additive Manufacturing. Hybrid Electric Vehicles, Industry 4.0.		
Unit - III	**Civil Engineering:**	**9**
Civil Engineering: Selection of the site for Building - Building approval process - Contract and tenders - Building Materials - Components of Building - Sequence of works for building construction - Prefabricated Structures - Water Management - Rainwater harvesting - Infrastructure - Bridges, Dams and Roads.		
Unit - IV	**Electrical Engineering:**	**9**
Electrical Engineering: Terminologies - Current, voltage, potential difference, power, energy - Supply: DC, AC - single phase and three phase - Energy conversion - Utility structure - Single line diagram of power system - Apparatus - Tariff - House wiring. Alternator - Induction motor - Solar and wind energy.		
Unit - V	**Electronics Engineering:**	**9**
Electronics Engineering: Resistor, Inductor, capacitor - Diode - LEDs - Rectifier - Power Supply - Transistor - Transistor as an amplifier - MOSFET - Logic Gates - Microprocessor - Micro controller - Radio communication - Internet of Things.		

Total:45

TEXT BOOK:

1. Faculty of Mechanical Engineering, "Introduction to Engineering", McGraw Hill Education India Pvt. Ltd., Chennai.

REFERENCES:

1. Arvid R. Eide, Roland D. Jenison, Steven K. Mickelson and Larry L. Northup. , "Engineering Fundamentals and Problem Solving", 7th Edition, McGraw Hill Education, New York, 2018.
2. Navaneethakrishnan P., Selvakumar P., Rajeshkumar G. and Sangeetha R.K., "Basic Civil and Mechanical Engineering", McGraw Hill Education, New Delhi, 2016.
3. Senthilnathan N., Logeswaran T. and Suresh M., "Basic Electrical and Electronics Engineering", McGraw Hill, New Delhi, 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	recognize the roles of engineer, measurement quantities and systems in Engineering	Understanding (K2)
CO2	infer the components and principles of mechanical engineering applications	Understanding (K2)
CO3	summarize the process involved in building construction, infrastructure and water conservation	Understanding (K2)
CO4	recognize the fundamental terms involved in electrical engineering	Understanding (K2)
CO5	explain the working of basic electronic components and its applications	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	3	2	1	1		2	1					3		
CO3	3	2	1	1		2	1					3		
CO4	2	1										3		
CO5	3	2	1	1								3		

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

ASSESSMENT PATTERN - THEORY

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

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

18CSC11 - PROBLEM SOLVING AND PROGRAMMING
(Common to All Engineering and Technology Branches)

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	ES	2	0	2	3

Preamble	This course mainly focuses on the basic concepts of computing, the methodology of problem solving and developing skills in programming using C language.	
Unit - I	**Introduction to Computer and Problem Solving:**	**6**
Overview of computers - Applications of computers - Characteristics of computer - Basic computer Organization - Number System - Problem solving: Planning the computer program – Algorithms - Flowcharts – Pseudocodes - Structuring the logic.		
Unit - II	**Case Study on Problem Solving:**	**6**
Algorithm, Flowchart and Pseudo code for the problems: Exchanging the values of two variables - Finding the biggest number - Counting - Summation of numbers - Factorial computation - Generation of Fibonacci Sequence - Summation of series - Base Conversion - Reversing the digits of an Integer.		
Unit - III	**Introduction to C and Control Statements:**	**6**
Overview of C - Basic structure of a C Program - Executing a C Program - C Character set - Tokens - Keywords and Identifiers - Constants - Variables - Data types - Storage classes - Managing Input and Output operations - Operators and Expressions - Decision making and Branching - Looping - Break and continue statements.		
Unit - IV	**Arrays, Strings and Structures:**	**6**
Arrays - One dimensional and Two dimensional arrays - Handling of character strings: Declaring and initializing string variables - Performing simple string operations - Introduction to structures: Structure definition - Structure declaration - Accessing a structure member - Structure initialization - Unions.		
Unit - V	**Functions:**	**6**
User defined functions: Elements of user defined functions - String handling functions - Library functions (strings and characters manipulation) - Passing arguments to functions – Recursion. Introduction to Pointers: Understanding pointers - Accessing address of a variable - Declaring pointer variables - Initialization of pointer variables - Accessing a variable through its pointer - Parameter passing mechanisms.		

List of Exercises / Experiments :

1.	Writing algorithms and drawing flowcharts using Raptor Tool for problems involving sequential, selective and repetitive structures
2.	Programs for demonstration of working of different types of operators like arithmetic, logical, relational and ternary operators involving sequential structures
3.	Demonstration of programs using decision making statements namely ‘if’, ‘else if’, ‘switch’, conditional and unconditional ‘goto’ (selective structures)
4.	Programs for demonstrating repetitive control statements like ‘for’, ‘while’ and ‘do-while’ (iterative structures)
5.	Demonstration of programs for declaration, initialization and performing operations on one-dimensional and two-dimensional numeric arrays
6.	Demonstration of programs for implementing various string operations like ‘copy’, ‘finding length’, ‘compare’, ‘concatenate’ with and without built-in library functions.
7.	Demonstration of programs for making use of user-defined data types namely structures and unions
8.	Demonstration of modular programming concepts using functions – developing programs using built-in and user-defined functions and parameter passing mechanisms

Lecture:30, Practical:30, Total:60

TEXT BOOK:

1. "Problem Solving and Programming", compiled by Department of CSE, Kongu Engineering College, Internal circulation, 2017.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	outline the characteristics, organisation, working principles and applications of computers	Understanding (K2)
CO2	express the solution for the given real world problems in terms of algorithm, flowchart and pseudocode	Applying (K3)
CO3	identify the appropriate looping and control statements in C for providing the solution to the given problems	Understanding (K2)
CO4	demonstrate the usage of arrays, strings and structures to solve the given problems	Understanding (K2)
CO5	apply fundamental modular programming knowledge to solve the given problems and recall the basic concepts of pointers	Understanding (K2)
CO6	demonstrate the execution of flowchart for the given problem using Raptor	Applying (K3), Precision (S3)
CO7	demonstrate the application of control statements using simple C programs	Applying (K3), Precision (S3)
CO8	implement solutions to the given problem using user defined functions and data types	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	2	2		2									
CO3		3	1											
CO4		3	1											
CO5		3	1											
CO6	3	2	1	1	1					1				
CO7	3	2	1	1	1					1				
CO8	3	2	1	1	1					1				

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	15	25				50
CAT2	5	15	30				50
CAT3	5	15	30				50
ESE	20	30	50				100

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

18VEC11 - VALUE EDUCATION

(Common to All Engineering and Technology Branches)

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	1	HS	2	0	1	1

Preamble	The aim of the course is to make the students to understand the purpose and value of life and to exhibit positive human values.	
Unit - I	**Philosophy of Life Science:**	**4**
Life - Purpose of life (four stages of life) - Philosophy of life (who am I') – Law of nature (cause of the life and body) - Content of the Life (five sheaths) - Goal of life. Five duties in life. Methodology: Life and messages of spiritual and national leaders - The forgotten hero, etc. Project report: Complementing with happiness - Every soul is potentially divine.		
Unit - II	**Human Values - Moral Foundation:**	**4**
Truth, forgiveness, compassion, endurance, humility, non violence,moderate diet, non stealing, self purification, self discipline, self study, content, cleanliness, honesty, and totality in faith - Good habits - Attitude forming for Individual peace. Practical Methods: Personal experience with above characters, Puranic Stories - Self resolve diary maintenance.		
Unit - III	**Social Values:**	**4**
Family - Family System - Greatness of women - World brotherhood (vasudeiva kudumbagam) - Glorious Bharath - Bharathian systems - Past-Present-Future - Team spirit - Goal setting - Economics - Education - Politics - Responsibilities of people - Preserving natural resources. Methodology: Preparing an album on glorious Bharath Past, Present and Future Plans. Goal setting - Management Games.Team Spirit - Yogic Games.		
Unit - IV	**Development of Mental Prosperity:**	**4**
Prosperity of mind - Functions of mind - Obstacles of mind - Practical method to perfect mind is yoga - Types - Uses - Precaution - Contradiction - Kriyas - Asanas - Pranayamas - Meditative techniques. Methodology: Asana - Pranayama - Cyclic meditation - Nada anu sandhana - Meditation - Yogic games for memory. Album on asanas, pranayama and mantra.		
Unit - V	**Maintenance of Physical Health:**	**4**
Human body - Structure - Ten Systems of the body as per modern science.Five elements - Harmonious relationship - Life force - Conserving vitality and health through natural life -Pranic food and its importance - Uses of herbs - Right way of cooking to preserve nutrients - Cause of the disease - Acute and chronic - Disease - Life and death. Methodology: Natural food making, traditional millet dishes. Asanas, pranayamas, cleansing procedures, Quiz on healthy living, Uses of herbs or kitchen garden.		

List of Exercises / Experiments:

1.	List of Loosening Exercises: Neck Movements, Shoulder Joint Movements, Elbow Joint Movement, Wrist Joint Movements, Finger Joint Movements, Rip Joint Movement, Hip Joint Movements, Spinal Cord Movement, Knee Joint Movements, Ankle Joint Movements, Toe Joint Movements.
2.	List of Asanas: Surya Namaskara, Shavasana, Makarasanas, Uttanpadasana, Pawanamuktasana, Sedubandasana, Naukasana, Vipareetakarani, Bhujangasana, Sarpasana, Shalabasana, Dhanurasana, Padmasana,Parvatasana, Vakrasana, Janu Sirashasana, Ustrasana, Yoga Mudra, Meru Tandasana, Tadasana, Katichakrasana, Paadahastasana, Parivarta Trikonasana, Ardha Chakrasana, Viruksasana.
3.	List of Pranayamas: Naadi Sodhana Pranayama, Bhastrika Pranayama, Bhramari Pranayama, Sheetali Pranayama.

Lecture:20, Practical:10, Total:30

TEXT BOOK:

1.	Value Education, "Compiled by Vethathiri Maharishi Institute for Spiritual and Intuitional Education", Aliyar, Pollachi, 2018.

REFERENCES:

1.	Value Education - Yoga Practical Guide, "Compiled by Padmasoorya Naturopathy and Yoga Foundation", Coimbatore, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand the purpose and value of life.	Understanding (K2)
CO2	exhibit positive human values.	Understanding (K2)
CO3	understand social values.	Understanding (K2)
CO4	take steps to develop mental and physical health	Applying (K3), Imitation (S1)

Mapping 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				3		
CO3						3		3				3		
CO4														
CO5														
CO6						3		3				3		
CO7														
CO8														

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1							0
CAT2							0
CAT3							0
ESE	25	75					100

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

18EGT21 - ENGLISH FOR COMMUNICATION II

(Common to All Engineering and Technology Branches)

Programme & Branch	All BE/BTech branches	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	2	HS	3	0	0	3

Preamble	This course is designed to impart required levels of fluency in using the English Language at B1 level in the 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, "Interchange, Student's Book 3", 4th Edition, Cambridge University Press, New York, 2017.

REFERENCES:

1. Jane Willis, "A Framework for Task Based Learning", Longman, Harlow, 1996.
2. Rod Ellis, "Task Based Language Learning and Teaching", Oxford University Press, London, 2003.

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	3	3	30	40		24	100
CAT2	3	3	33	43		18	100
CAT3	3	3	33	43		18	100
ESE	3	3	31	45		18	100

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

18MAC21 - MATHEMATICS II

(Common to All Engineering and Technology Branches)

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	BS	3	1*	2*	4

Preamble	To impart the knowledge of 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	**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 - II	**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 and Gauss divergence theorems (without proof) – Verification of the above theorems and evaluation of integrals using them.		
Unit - III	**Beta and Gamma Functions:**	**9**
Definition of beta and gamma Functions – Properties – Relation between beta and gamma functions – Transformations of gamma function – Applications of beta and gamma functions: Evaluation of definite integrals in terms of beta and gamma functions.		
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 – 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.	Evaluating indefinite and definite integrals
2.	Evaluating double and triple integrals
3.	Finding the area between two curves
4.	Computing gradient, divergence and curl
5.	Computation of beta and gamma 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 Weeks**

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

TEXT BOOK:

1. Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, New Delhi, 2014.

REFERENCES:

1. Duraisamy C., Vengataasalam S., Arun Prakash K. and Suresh M., "Engineering Mathematics - II", 2nd Edition, Pearson India Education, New Delhi, 2018.
2. Won Y. Yang, Young K. Choi, Jaekwon Kim, Man Cheol Kim, Jin Kim H. and Taeho Im, "Engineering Mathematics with MATLAB", 1st Edition, CRC Press, London, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	Solve problems involving double and triple integrals	Understanding (K2)
CO2	Apply the concept of vectors in engineering problems	Applying (K3)
CO3	Use Beta and Gamma functions to improper evaluate integrals	Applying (K3)
CO4	Identify, construct and apply analytic functions in electrostatics and fluid flow problems	Applying (K3)
CO5	Evaluate complex integrals which is extensively applied in engineering	Applying (K3)
CO6	Evaluate line, double and triple integrals and determine area between two curves using MATLAB	Applying (K3), Manipulation (S2)
CO7	Compute gradient, curl and divergence of a vector function 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	2	2											
CO2	3	2												
CO3	3	2	1											
CO4	3	1												
CO5	3	2	2											
CO6					3									
CO7					2									
CO8					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	10	70				100
CAT2	20	10	70				100
CAT3	20	10	70				100
ESE	20	10	70				100

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

18PHC24 - SOLID STATE PHYSICS
(Common to ECE, CSE & IT branches)

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Applied Physics	2	BS	3	0	2*	3.5

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 semiconducting 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 **9**

Conducting and Superconducting Materials: Conducting Materials: Introduction - Classical free electron theory - Electrical conductivity - Quantum free electron theory of metals - Fermi distribution function - Effect of temperature on Fermi function - Energy band theory of solids (qualitative). Superconducting Materials: Properties - Type I and Type II superconductors - Applications: Magnetic levitation.

UNIT – II **9**

Semiconducting Materials and Devices: Intrinsic semiconductor: Carrier concentration, electrical conductivity and band gap (qualitative) - Extrinsic semiconductor - p-n junction diode: Construction and V-I characteristics - Zener diode: Construction and characteristics - Uni-junction Transistor (UJT): Construction and characteristics - Hall effect: Determination of Hall coefficient and Applications.

UNIT –III **9**

Magnetic and Dielectric Materials: Magnetic materials: Origin of magnetism - Types of magnetic materials – Domain theory of ferromagnetism – Hysteresis - Soft and hard magnetic materials – Transformer core. Dielectric Materials: Introduction - Dielectric constant - Types of polarization (qualitative) - Frequency and temperature dependence of polarization – Concepts of dielectric loss and dielectric breakdown – Uses of dielectric materials in capacitor.

UNIT – IV **9**

Optoelectronic Materials and Devices: LED: Materials, principle, construction and working – LDR: Materials, principle, construction and working - Solar cell: principle, construction and working - Birefringence crystals: Opto-electric effect - Electro-optic amplitude modulator: Franz –Keldysh and Stark effect modulators.

UNIT – V **9**

Nano Materials: Low dimensional structures: Quantum dot, quantum wire and quantum well – Properties of nano materials – Synthesis: Top down and bottom up approaches – Lithographic methods – Physical vapor deposition method – Carbon nanotubes: Structures, properties, synthesis by laser ablation method - Applications of nanomaterials.

List of Experiments:

1. Determination of the specific resistance of a material using Carey–Foster's bridge.
2. Determination of the band gap of a semiconductor using post office box.
3. Determination of hysteresis loss in a ferromagnetic material.
4. Observation of the V-I characteristics of a p-n junction diode.
5. Determination of the thickness of a nano-structured material using air-wedge arrangement.

Lecture:45, Practical: 15, Total: 60

TEXT BOOK:

1. Tamilarasan K. and Prabu K., "Engineering Physics-II", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2014.

REFERENCES / MANUAL:

1. Raghavan V., "Materials Science and Engineering: A first course", 5th Edition, Prentice-Hall of India, New Delhi, 2009.
2. Albert Malvino and David J. Bates, "Electronic Principles", 8th Edition, McGraw-Hill Publications, 2016.
3. Tamilarasan K. and Prabu K., "Physics Laboratory Manual", SCM Publishers, Erode, 2018.

* Alternate week

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 explain band theory of solids, and to summarize the types, properties and applications of superconductor, and the working of magnetic levitation	Applying (K3)
CO2:	use the concept of density of states to describe the carrier concentration, electrical conductivity and band gap of intrinsic semiconductors, extrinsic semiconductors, the working of p-n junction, Zener diodes and UJT, Hall Effect and its applications	Applying (K3)
CO3:	explain the select types, properties and applications of magnetic and dielectric materials, and the hysteresis loss of ferromagnetic material	Understanding (K2)
CO4:	apply the theory of p-n junction to describe the materials, construction, working and applications of the select optoelectronic devices (LED, LDR and Solar cells) and the application of opto-electric effect in modulator	Applying (K3)
CO5:	explain the properties, types and applications, and the select preparation methods of nanomaterials and carbon nanotubes	Understanding (K2)
CO6:	determine the specific resistance of conducting materials and the band gap of semiconducting materials using the concept of electrical conductivity	Applying (K3), Precision (S3)
CO7:	determine the hysteresis loss in a ferromagnetic materials using the concept of domain theory of ferromagnetism, and to obtain the V-I characteristics of a p-n junction diode using the theory of p-n junction	Applying (K3), Precision (S3)
CO8:	determine the thickness of nano-crystalline thin films using the concept of interference of light	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											
CO2	3	2	1											
CO3	2	1												
CO4	3	2	1											
CO5	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	20	40	40				100
CAT2	20	45	35				100
CAT3	25	40	35				100
ESE	20	40	40				100

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

18CYC25 - ENVIRONMENTAL SCIENCE AND ORGANIC ELECTRONIC MATERIALS
(Common to CSE, EEE & IT branches)

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Applied Chemistry	2	BS	3	0	2*	3.5

Preamble: Environmental Science aims to realize the interdisciplinary and holistic nature of the environment for engineering students and stimulate them to know about environment, ecosystem, biodiversity, organic electronic materials, e-waste management and environmental impact assessment for sustainable development.

UNIT - I		9

Environmental Pollution: Environment - planet earth - components of environment- atmosphere-hydrosphere-lithosphere-biosphere-interrelationship between components and sub components - environmental pollution - environmental pollutants-sources, effects and control methods of air, water, soil and noise pollution - role of an individual in prevention of pollution - case studies.

UNIT - II		9

Ecosystems and Biodiversity: Ecosystems - definition - concept of an ecosystem – components of an ecosystem - structural and functional features – energy flow in the ecosystem- functional attributes (food chain and food web only) – introduction, types, characteristic features, structure and functions of the (a) forest ecosystem (b) aquatic ecosystems (ponds, rivers and oceans) - Biodiversity - introduction – classification –values of biodiversity - India as a mega diversity nation - biodiversity at global, national and local level- hotspots of biodiversity – threats to biodiversity – endangered and endemic species of India – in-situ and ex-situ conservation of biodiversity.

UNIT – III		9

Chemistry of Organic Electronic Materials: Organic semiconducting materials – principle, applications and advantages over inorganic semiconducting materials - P-type and N-type organic semiconducting materials (definition and examples) - organic dielectric materials - principle and examples – organic light emitting polymer (definition, examples and applications) – conducting polymers and its applications.

UNIT – IV		9

E-Waste and its Management: 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 - case studies.

UNIT – V		9

Environmental Impact Assessment and Auditing: Sustainability -three pillars of sustainability- factors affecting environmental sustainability-approaches for sustainable development - Introduction to EIA - objectives of EIA - steps in EIA - participants of EIA - general approach of environmental auditing - audit programmes in India - ISO 14001 certification - environment protection act – air (prevention and control of pollution) act – water (prevention and control of pollution) act.

List of Experiments:

1. Estimation of chloride ion in the given water sample using Argentometric method.
2. Estimation of chromium (Cr^{6+}) in wastewater sample.
3. Determination of dissolved oxygen in the given wastewater sample.
4. Estimation of iron using permanganometry.
5. Estimation of copper in the given solution by Iodometric method.

Lecture:45, Practical:15, Total: 60

TEXT BOOK:

1. Palanisamy P.N., Manikandan P., Geetha A., Manjula Rani K., Kowshalya V.N., “Environmental Science”, Pearson Education, New Delhi, Revised Edition 2019.

REFERENCES / MANUALS:

1. Rakesh Johri, “E-waste: implications, regulations, and management in India and current global best practices”, The Energy and Resources Institute (TERI), 2013.
2. Hagen Klauk, “Organic Electronics: Materials, Manufacturing and Applications”, Wiley-VCH, 2006.
3. Palanisamy P.N., Manikandan P., Geetha A. and Manjula Rani K., “Chemistry Laboratory Manual”, Rajaganapathy Publishers, Erode, 2018.

* Alternate week

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1:	manipulate the sources, effects and control methods of various environmental pollution	Applying (K3)
CO2:	elaborate the features of ecosystems and biodiversity to find the need for conservation	Understanding (K2)
CO3:	outline the organic electronic materials and its applications in various field	Understanding (K2)
CO4:	utilize the knowledge to handle the e-waste and reduce its impacts on environment	Applying (K3)
CO5:	make use of the knowledge of EIA, EA and environmental legislation laws towards sustainability	Applying (K3)
CO6:	determine the amount of iron in the given solution using permanganometry	Applying (K3), Precision (S3)
CO7:	determine the amount of chloride and copper in the given solution	Applying (K3), Precision (S3)
CO8:	estimate the amount of chromium and DO in the given wastewater	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							
CO2	3	2					3							
CO3	3	2												
CO4	3	2	1	1			3							
CO5	3	2	1	1			3							
CO6	3	2	1	3										
CO7	3	2	1	3										
CO8	3	2	1	3										

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

ASSESSMENT PATTERN - THEORY

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

18MEC11 - ENGINEERING DRAWING
(Common to all Engineering and Technology Branches)

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	1	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**
General Principles of Orthographic Projection: 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 Solid: 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: 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 Surfaces: 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**
Isometric Projection and Introduction to AutoCAD: 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.		

Total:45

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	20	40	40				100

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

18CSC21 - PROGRAMMING AND LINEAR DATA STRUCTURES
(Common to CSE & IT branches)

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	2	PC	2	0	2	3

Preamble: This course provides an introduction to the advanced features of C language, basic concepts and applications of Linear data Structures like linked list, stack and queue.

UNIT – I		**6**

Pointers and Arrays, Pointers and Strings: Pointers- pointer basics – pointer operators – pointer arithmetic – NULL pointers – generic pointers – pointers and arrays: Pointers and 1D,2D arrays – passing an array to a function – returning an array from function – array of pointers – pointers and strings – two dimensional character array – array of pointers to strings – dynamic memory allocation

UNIT – II		**6**

Pointers and Functions, Pointers and Structures: Function pointers – calling a function using a function pointer – array of function pointers – Structures – typedef and its use in structure declaration – nesting of structures - array of structures - Arrays within structure - structures and functions – passing structures to functions - structure pointers - self referential structures.

UNIT – III		**6**

File Handling and Preprocessor Directives: Introduction - Operations on Files - opening and closing - Input and Output operations - Sequential and random access - Detecting the end-of-file - Renaming and Removing a file - Preprocessor directives – Macros - File Inclusion - Conditional Compilation – Command line Arguments.

UNIT – IV		**6**

Data Structures and Linked List: Introduction to Data Structures – Classification – Introduction to linked lists - Linked lists Vs arrays – Memory allocation and deallocation for a linked list – different types of linked list – singly linked list – traversing – searching – inserting and deleting a node in a linked list

UNIT – V		**6**

Stack and Queue: Introduction – Stack – Implementation of stack using array and linked list – Application of stack – Queue – Implementation of Queue using array and linked list– Other variations of Queue – Applications of Queue.

List of Exercises / Experiments:

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 using array and linked list
10. Program to implement Queue using array and linked list

Lecture:30, Practical:30, Total: 60

TEXT BOOK:

1. Sumitabha Das, “Computer Fundamentals and Programming”, 1st Edition, McGraw Hill Education (India) Pvt. Ltd., 2018.

REFERENCES / MANUAL / SOFTWARE:

1. Yashavant Kanetkar, “Pointers in C”, 4th Edition, BPB Publications, 2017.
2. Pradip Dey, Manas Ghosh, “Programming in C”, 2nd Edition, Oxford University Press, 2011.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	write C programs that use pointers to access arrays and strings	Understanding (K2)
CO2:	develop C programs using pointers to access functions and structures	Applying (K3)
CO3:	implement file operations and apply preprocessor directives to solve the given problems	Understanding (K2)
CO4:	explain memory allocation during runtime and implement linked list using pointers	Understanding (K2)
CO5:	outline the operations on stacks and queues and their usage	Understanding (K2)
CO6:	use pointers to perform operations on arrays and structures	Applying (K3), Precision(S3)
CO7:	write programs to demonstrate the application of dynamic memory allocation and macros	Applying (K3), Precision(S3)
CO8:	compare and use appropriate data structure for a given application	Analyzing (K4), Precision(S3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	10	80				100
CAT2	10	10	80				100
CAT3	10	50	40				100
ESE	10	30	60				100

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

18MEL11 - ENGINEERING PRACTICES LABORATORY
(Common to all Engineering and Technology Branches)

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	I	ES	0	0	2	1
Preamble	This course is designed to provide a hands-on experience in the field of mechanical engineering and electrical engineering such as fitting, plumbing, wood working, sheet metal work, welding, safety aspects, assembly and testing of electrical and electronic circuits.						

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.	To prepare a leak proof sheet metal tray/box/funnel using modern power tools.
6.	Welding practice using welding simulator.
7.	Project: Preparing innovative articles using wood/sheet metal.
	PART B – ELECTRICAL AND ELECTRONICS ENGINEERING
8.	Safety Aspects of Electrical Engineering, Electrical Symbols, Components Identification, Fuse selection and installation, Circuit Breakers selection
9.	Wiring circuit for fluorescent lamp and stair case wiring
10.	Measurement of earth resistance
11.	Soldering of simple circuits and trouble shooting
12.	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	3	3	3	3	3				3	3	2	3		
CO2	3	2	1	1					3	2	2	3		
CO3	2	1							3	2	2	3		
CO4	3	2	1	1					3	3	2	3		
CO5	3	2	1	1					3	2	2	3		

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

18MAT31 - DISCRETE MATHEMATICS

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

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	3	BS	3	1	0	4

Preamble: To impart knowledge in mathematical logic, partial ordering and lattices, investigate various category of functions and develop skills to apply group structures in coding theory.

UNIT – I **9**

Propositional Calculus: Propositions – Logical connectives – Compound propositions – Conditional and biconditional propositions – Truth tables – Tautologies and contradictions – Contrapositive – Logical equivalences and implications – DeMorgan's Laws – Normal forms – Principal conjunctive normal form and Principal disjunctive normal form – Rules of inference – Arguments – Validity of arguments.

UNIT – II **9**

Predicate Calculus: Predicates – Statement function – Variables – Free and bound variables – Quantifiers – Universe of discourse – Logical equivalences and implications for quantified statements – Theory of inference – Rules of universal specification and generalization – Validity of arguments.

UNIT – III **9**

Set Theory: 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 **9**

Functions: 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 **9**

Group Theory: Groups and Subgroups (Definitions only) – Homomorphism – Cosets – Lagrange's theorem – Normal subgroups – Coding Theory – Group codes – 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. Kenneth H. Rosen, "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Publishing Company, 2012.
2. Susanna S. Epp, "Discrete Mathematics with Applications", 4th Edition, Cengage Learning, USA, 2011.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	use mathematical proof techniques to solve computing problems	Applying (K3)
CO2:	construct algorithms to derive complexities	Applying (K3)
CO3:	possess knowledge of sets that are required for developing computational model	Understanding (K2)
CO4:	perform computational operations associated with functions	Applying (K3)
CO5:	implement 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	2	2										

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

ASSESSMENT PATTERN - THEORY

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

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

18ITC31 - DIGITAL PRINCIPLES AND DESIGN

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

Programme & Branch	B.E. & Computer Science and Engineering	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 number system, Binary Codes, Boolean algebra, digital logic gates, combinational and sequential circuits. And it also provides discussion on registers, counters and programmable logic devices.

UNIT – I		**9**

Number Systems and Boolean Algebra: Number Systems and their conversions- Complements – Signed Binary Numbers – Binary Codes – Binary Logic - Boolean Algebra: Definitions – Basic and Axiomatic –Theorems of Boolean Algebra – Boolean functions: Realization of functions using Logic gates.

UNIT – II		**9**

Gate Level Minimization: Canonical and Standard Forms of Boolean functions – Minimization of functions using Karnaugh Map – Don't–Care Conditions – NAND and NOR Implementation– Exclusive-OR function - Minimization of functions using Quine-McCluskey method

UNIT – III		**9**

Combinational Logic: Analysis procedure – Design procedure – Half Adder – Full Adder - Half Subtractor – Full Subtractor – Binary Adder-Subtractor – BCD Adder – Code Converters - Magnitude Comparator – Decoders – Encoders – Multiplexers – Demultiplexers – Boolean Functions implementation using Multiplexers and Decoders.

UNIT – IV		**9**

Sequential Logic: Introduction – Latches and Flip-flops – Triggering – Analysis of clocked sequential circuits: State Equations – State Table – State Diagram– State Reduction and Assignment– Mealy and Moore machines and their circuit design procedure

UNIT – V		**9**

Register, Counter and Programmable Logic: Shift Registers: SISO– SIPO– PISO–PIPO–Bidirectional Shift register–Universal Shift register– Synchronous Counters: Binary Counter – up-down Binary Counter – BCD Counter – modulo-N Counter – Ring Counter – Johnson Counter – Programmable Logic devices: PROM – PLA – PAL**.**

List of Exercises:

1. Simplify and Implement of Boolean functions using logic gates
2. Implement the following combinational logic circuits using logic gates
   i. Half Adder and Full Adder
   ii. Half Subtractor and Full Subtractor
3. Design and Implement 4- Bit Adder /Subtractor
4. Design and Implement BCD Adder /Subtractor
5. Design a 4-bit binary to gray and gray to binary code converter
6. Implement Multiplexer and Demultiplexer circuits using logic gates
7. Design and implement decoders and encoders
8. Implement various Flip-flops using Logic gates
9. Design various Shift Registers.
10. Design various Synchronous counters.

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.

REFERENCES/MANUAL:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1:	summarize the different number systems and their conversion and boolean algebra	Understanding (K2)
CO2:	interpret boolean expression using map and tabulation technique and realize it using logic gates	Applying (K3)
CO3:	design combinational logic circuits	Applying (K3)
CO4:	design sequential logic circuits	Applying (K3)
CO5:	implement digital systems using registers, counters and programmable logic devices	Applying (K3)
CO6:	experiment the combinational logic circuits for the given application using logic gates	Applying (K3), Manipulation (S2)
CO7:	design and implement combinational logic circuits	Applying (K3), Manipulation (S2)
CO8:	implement sequential logic circuits using flip-flops	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	1											3	1
CO2	3	2	2										3	2
CO3	3	2	2										3	2
CO4	3	2	2										3	2
CO5	3	2	2										3	2
CO6	3	2	2										3	2
CO7	3	2	2										3	2
CO8	3	2	2										3	2

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

ASSESSMENT PATTERN - THEORY

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

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

18CST31 - DATA STRUCTURES

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

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Programming and Linear Data Structures	3	PC	3	0	0	3

Preamble: This course provides an introduction to the basic concepts and techniques of nonlinear data structures and applications of Linear data structures		
UNIT – I		**9**
List and its Applications: Abstract Data Types (ADT) – 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		
UNIT – II		**9**
Stack, Queue and its Applications: Stack Implementation – Applications of stack: Towers of Hanoi – Balancing Parenthesis - Evaluating Expressions – Expression Conversion – String Reversal - Queue Implementation – Priority Queue - Deque – Applications of Queue:Reversing the Stack using Queue		
UNIT – III		**9**
Trees: General trees - Terminology - Representation of trees - Tree traversal - Binary tree - Representation - Expression tree – Binary tree traversal - Binary Search Tree: Construction - Searching - Insertion – Deletion - Find Min - Find Max - AVL trees: Rotation – Insertion – Deletion		
UNIT – IV		**9**
Graphs: Definition – Representation of Graph – Types of graph – Breadth-first traversal – Depth-first traversal – Topological Sort – Applications of DFS: Bi-connectivity - Euler circuits - Finding Strong Components – Applications of BFS: Bipartite- Graph coloring		
UNIT – V		**9**
Advanced Trees and Hashing: B-Trees-insertion-deletion, Splay trees, Red-Black Trees-Rotation-Insertion- Deletion - 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 Asia, New Delhi, 1997.

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, 3rd Edition, MIT Press, USA, 2009.
2. Langsam Y.M., Augenstein J. and Tenenbaum A. M., “Data Structures using C and C++”, 2nd Edition, Pearson Education, 1996.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	employ the linked list for solving the given problem	Applying (K3)
CO2:	solve the computational problems using stack and queue	Applying (K3)
CO3:	demonstrate the structure and operations on trees	Applying (K3)
CO4:	apply appropriate graph algorithms for solving computing problems	Applying (K3)
CO5:	implement the operations of special treesand 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	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	10	10	80				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)**

18CST32 - COMPUTER ORGANIZATION

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

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	3	PC	3	0	0	3

Preamble: Provides knowledge on basics of computer organization, introduces various arithmetic operations. Analyzes performance issues in processor, memory and I/O design of a digital computer

UNIT – I		9

Basic Structure of Computers and Machine Instructions: 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		9

Arithmetic Unit: 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		9

Basic Processing Unit: Fundamental Concepts–Instruction Execution –Hardware Components–Instruction Fetch and Execution Steps – Control Signals - Hardwired control – CISC Style Processors. **Pipelining:** Pipelining – Basic concepts – Pipeline Organization – Pipelining Issues - Data Dependencies – Memory Delay – Branch Delay – Performance Evaluation

UNIT – IV		9

Memory System: 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		9

I/O Organization: Accessing I/O Devices–Interrupts - Enabling and Disabling Interrupts – Handling Multiple Devices – Bus Structure – Bus Operation – Arbitration – Interface Circuits – Interconnection Standards: USB.

Total: 45

TEXT BOOK:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky and NaraigManjikian, “Computer Organization and Embedded Systems”, 6th Edition, McGraw Hill International Edition, 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 and operation 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 various bus organizations to determine the control sequence for an instruction and apply the concepts of pipelining identify and handle the data hazards and instructional hazards	Applying (K3)
CO4:	distinguish between different types of memory organization and apply the mapping functions between main memory and cache	Applying (K3)
CO5:	compare the different ways of communication between memory and I/O devices and standard I/O interfaces	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										3	1
CO2	3	2	1										3	1
CO3	3	2	1										3	1
CO4	3	2	1										3	1
CO5	2	1											2	

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

ASSESSMENT PATTERN - THEORY

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

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

18CST33 - OBJECT ORIENTED PROGRAMMING

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

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	3	PC	3	0	0	3

Preamble	To provide a concise introduction to the fundamental concepts of object oriented programming	
UNIT – I		**9**
Introduction to OOP, Java, Classes and Objects: 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 -Stack Class.		
UNIT – II		**9**
Reusability, Packages and Interfaces: 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		**9**
Exception Handling, Multithreading, I/O and Applet: 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 – Inter thread Communication – Suspending - Resuming, and Stopping Threads – Multithreading. Enumerations - Wrappers – Auto boxing – Annotations. I/O Basics - Reading and Writing Console I/O - PrintWriter Class - Reading and Writing Files - Applet – Architecture – Skeleton – Display methods - Repainting – Applet tag – Passing parameters - transient and volatile modifiers.		
UNIT – IV		**9**
String Handling, Generics and Event Handling: String Class – methods – String Buffer Class – Methods – String Builder.Generics – Example – Parameters - General Form- Bounded Types - Wildcard Arguments - Generic Method and Interfaces – Raw Types and Legacy Code - Generic Class Hierarchies. Event Handling – Mechanisms -Delegation Event Model - Event Classes - Sources of Events - Event Listener Interfaces – Mouse and Keyboard events - Adapter Classes - Inner Classes		
UNIT – V		**9**
AWT: AWT Classes - Window Fundamentals - Frame Windows - Frame Window in an Applet – Graphics –Color – Fonts – Font Metrics. AWT Controls - Layout Managers - Menu Bars and Menus -Dialog Boxes - FileDialog - Handling Events by Extending AWT Components.		
		Total: 45

TEXT BOOK:

1. Schildt Herbert, "Java: The Complete Reference", 9th Edition,Tata McGraw Hill Publishing Company, New Delhi, 2014.

REFERENCES:

1. Buyya Rajkumar, Thamarai Selvi S. and Xingchen Chu, "Object Oriented Programming with Java Essentials and Applications", Tata McGraw Hill, 2009.

2. Deitel Paul and Deitel Harvey, "Java How to Program", 8th Edition, Eastern Economy Edition, 2010.

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:	experiment with exception handling mechanisms, multithreaded model, I/O packages and Applet classes	Applying (K3)
CO4:	make use of string classes, generics and event handling concepts to solve real world problems	Applying (K3)
CO5:	integrate the concepts of AWT for developing GUI based 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	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	15	25	60				100
CAT2	15	20	65				100
CAT3	15	20	65				100
ESE	10	20	70				100

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

18CSL31 - DATA STRUCTURES LABORATORY

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

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Programming and Linear Data Structures	3	PC	0	0	2	1

Preamble: This course provides an introduction to the concepts and techniques of linear and non-linear data structures, implements applications using these data structures and analyze the various algorithm.

List of Experiments:

1.a. A music player needs to store Illayaraja's hit songs. Develop a C program to implement the following operations:

i) Read the hit songs of Illayaraja and store it in the beginning of the music player
ii) Get a song 'x' and search 'x' in music player. If 'x' is present then play the song otherwise add to the list of the songs
iii) Display the songs in the music player and count the number of songs in the music player
iv) Select a song 'x' from music player and play the previous and next song
v) Print the play list in reverse order

2. Perform the following polynomial operations:

i) Add $10x^5+2x^3-1$ to $8x^4-x^3+16x^2$
ii) Subtract $100x^4-19x^2-7x$ from $150x^3+8x-14$

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. Perform infix into postfix expression conversion.

b. Consider that you are given the following C program:

```
void main()
{
    printf("KONGU";
    if((a>b)&&(b>c)
}
```

When the program is executed, the compiler reports an error "Missing parenthesis". Show how the compiler detects the error.

5. Write a program to show how the evaluation of an expression takes place in a computer.
For example:
printf("%d",(2* 5 +(7+9))); will produce the output 26.
printf("%d",(2*(5 +(7+9)))); will produce the output 42.

6. Assume 'n' number of air planes are waiting for the instruction to land. The services are provided from the ground station on first come first serve basis.

i) Display the order in which the air planes are serviced
ii) Display the air planes in the order of waiting time in air (Lowest to highest)

7. Implement the following service using priority queue.

Vehicle Type	Priority (Assume lowest value has highest priority)
Medium Passenger Vehicle (Bus)	2
Light motor vehicle(cars)	4
Ambulance	1
Medium goods vehicle	3

8. Suppose the customer is getting online orders placed and he wants to maintain the live data in sorted order of prices. For example, he wishes to know the number of items purchased at cost below a given cost at any moment. Or he wishes to know number of items purchased at higher cost than given cost. Help the customer to implement the above scenario.

9. Google maps uses graphs for building transportation systems, where intersection of two(or more) roads are considered to be a vertex and the road connecting two vertices is considered to be an edge, Visit the roads using BFS and DFS.

10. 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.

11. A person wants to travel from a home city to all other cities. Find the order in which the person has to visit the cities (No need to return back).

12. Implement the operations of Red Black tree:
    i) Store a number on to the tree
    ii) Delete a number from the tree
    iii) Display all the numbers in the tree

Total: 30

REFERENCES/MANUAL/SOFTWARE:

1. Operating System : Windows/Linux
2. Software : C
3. Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	identify the appropriate data structure for solving the given problem	Applying (K3), Precision (S3)
CO2:	use a data structure to implement another data structure	Applying (K3), Precision (S3)
CO3:	synthesize operations like searching, insertion, deletion and traversing on various data structures	Applying (K3), Precision (S3)

Mapping of COs with POs and PSOs

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

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

18CSL32 - OBJECT ORIENTED PROGRAMMING LABORATORY

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

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	3	PC	0	0	2	1

Preamble: In this course, programs will be implemented in java where virtually a complete application in any domain can be implemented.

List of Experiments:

1	Use Eclipse IDE or Netbeans IDE platform and acquaint with the various menus. Create a test project, add a test class and methods using class wizard, and run it. See how you can use auto suggestions, auto fill.Try code formatter, code search/replace and code refactoring likerenaming variables, methods, and classes. Try debug step by step with a small program of about 10 to 15 lines whichcontains at least one if else condition and a for loop.
2	Simple java programs using operators, arrays and control statements • Finding the prime numbers between 1 to n • Counting the alphabets, digits, special characters in a given string • Multiplication of two Matrices
3	Develop a stack and queue data structures using classes and objects.
4	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.
5	Develop an application using interfaces and by accessing super class constructors and methods.
6	Develop the Employee payroll application using packages.
7	Program to illustrate exception handling in java and creation of user defined exception.
8	Program to demonstrate thread concepts • A multi-threaded program which has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd the third thread will print the cubeof the number. • Program to implement the producer –consumer problem using the concept of inter-thread communication.
9	Program to copy the contents of one file into another file, count the number of characters and print the file size in bytes.
10	Develop and configure a simple banner applet
11	Program to demonstrate the features of generics classes and interfaces. • Implement sorting algorithm for integer, character, float and double data types • Implement stack data structure for integer and string data types
12	Program to capture the various keyboard and mouse events.
13	Develop any ONE of the applications using AWT components. • Scientific calculator • Text editor with basic file and edit functionalities

Total: 30

REFERENCES/MANUAL/SOFTWARE:

1. Operating System : Windows/Linux
2. Software : Eclipse/Netbeans IDE, Java SE 12.0
3. Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	design and develop java program using object oriented programming concepts	Applying (K3), Precision (S3)
CO2:	develop application using package, multithreading concepts and generics	Applying (K3), Precision (S3)
CO3:	create applets, GUIs and event driven programming 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	1		3	2									2	2
CO2	1		3	2									2	3
CO3			3	3	1	1						3		3

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

18EGL31 - ENGLISH FOR WORKPLACE COMMUNICATION
(Common to all Engineering & Technology Branches)

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

Preamble	This course is designed to impart required levels of fluency in using the English Language at B2 level in the CEFR through activities, hands-on training and application.	
Unit - I	**Listening:**	**6**
Techniques for effective listening - Listening and note taking - Listening activities using listening texts - Listening to discourse samples of native English speakers – Focussed listening for improving pronunciaition - understanding different accents.		
Unit - II	**Reading:**	**6**
Developing reading skills - Reading aloud - Group reading activities - Reading with correct word stress and intonation.		
Unit - III	**Soft Skills:**	**6**
Attitude - Goal setting - Time Management - Team Work - Telephonic conversation skills.		
Unit - IV	**Writing:**	**6**
Making preparatory notes, drafts and PPT"s for laboratory activities - Word editing features - editing and proof reading..		
Unit - V	**Speaking:**	**6**
Verbal and non-verbal communication - Introducing oneself - Introducing others – Mock Interviews - Making presentations on chosen topics - Group Discussion.		

Total:30

REFERENCES/ MANUALS:

1. Kumar, Sanjay and Pushp Lata, "Communication Skills", 2nd Edition, Oxford University Press, New Delhi, 2017.
2. Laboratory Manual.

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		3		
CO2									2	2		2		
CO3									2	2		2		

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

18MAC42 - PROBABILITY AND STATISTICS

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

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	4	BS	3	1*	2*	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		**9**
Random Variables: Discrete and Continuous random variables – Probability Mass and Probability density functions – Mathematical expectation and Variance – Moments – Moment generating functions.		
UNIT – II		**9**
Standard Probability Distributions: Discrete Distributions: Binomial distribution – Poisson distribution – Geometric distribution – Continuous Distributions: Uniform distribution – Exponential distribution – Normal distribution.		
UNIT – III		**9**
Two Dimensional Random Variables: Joint probability distributions – Marginal and conditional distributions – Covariance – Correlation and regression.		
UNIT – IV		**9**
Testing of Hypothesis: Introduction – Critical region and level of significance – Types of Errors – Large sample tests: Z-test for single mean and difference of means – Small sample tests: Student's t-test for significance of means – F-test for comparison of variances – Chi-square test for goodness of fit and independence of attributes.		
UNIT – V		**9**
Design of Experiments: Analysis of variance – One way classification: Completely Randomized Design – Two way classification: Randomized Block Design – Three way classification: Latin Square Design.		

List of Exercises / Experiments:

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

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

TEXT BOOK:

1. Douglas C. Montgomery & George C. Runger , "Applied Statistics and Probability for Engineers ", 6th Edition, John Wiley and Sons, USA, 2016.

REFERENCES:

1. Veerarajan T., "Probability and Statistics, Random Processes and Queuing Theory", 4th Edition, Tata McGraw Hill Education, New Delhi, 2018.
2. William Mendenhall, Robert J. Beaver & Barbara M. Beaver, "Introduction to Probability and Statistics", 14th Edition, Cengage Learning, USA, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	classify random variables and apply suitably in practical problems	Applying (K3)
CO2	use different types of distributions in engineering problems	Applying (K3)
CO3	apply effectively the concepts of two dimensional random variables	Applying (K3)
CO4	identify large and small samples and apply suitable tests for getting required results	Applying (K3)
CO5	apply the concepts of analysis of variance to experimental data	Applying (K3)
CO6	understand the basics of R studio and calculate the probability using various distributions in R studio.	Applying (K3), Manipulation (S2)
CO7	estimate the correlation coefficient, find marginal and conditional probability of two-dimensional random variables using R studio	Applying (K3), Manipulation (S2)
CO8	analyze large samples, independence of attributes and difference in means by completely randomized design using R studio.	Applying (K3), Manipulation (S2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1											
CO2	3	2	1											
CO3	3	2	1											
CO4	3	2	1	3										
CO5	3	2	1	3										
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	10	80				100
CAT2	10	10	80				100
CAT3	10	10	80				100
ESE	10	10	80				100

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

18ECT44 - MICROPROCESSOR AND EMBEDDED SYSTEMS

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

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Digital Electronics	4	PC	3	0	0	3
Preamble	This course focuses on the architectures and programming of microprocessors and microcontrollers for an embedded system design.						

UNIT – I		**9**
8086 Microprocessor: 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		
UNIT – II		**9**
8086 Microprocessor Programming and Stack: Simple Assembly Language Programming - Introduction to stack - Interrupt and interrupt service routines-Time delays using counter.		
UNIT – III		**9**
89c51 Microcontroller: 89c51 Microcontroller hardware block diagram - Data and program memory mapping - Register organization - Instruction sets - Addressing modes- simple programming		
UNIT – IV		**9**
89C51 Interfacing with I/O and Memory: I/O port programming - Timer and counter programming –Serial Data Communication – Interrupt programming - Interfacing to external memory		
UNIT – V		**9**
Principles of Embedded Systems: Introduction -Embedded systems description, definition, design considerations and requirements - Overview of Embedded system Architecture (CISC and RISC) -Categories of Embedded Systems -Embedded processor selection and tradeoffs.		

Total:45

TEXT BOOK:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay & Lyla B. Das, "Microprocessors and Microcontrollers", 1st Edition, Pearson Education, New Delhi, 2013.

REFERENCES:

1. Ray K & Bhurchandi K.M, "Advanced Microprocessors and Peripherals: Architecture, Programming and Interface", 3rd Edition, McGraw Hill, New Delhi, 2012.
2. Lyla B. Das, "Embedded Systems: An Integrated Approach", 1st Edition, Pearson Education, New Delhi, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	describe the internal blocks and register organisation of 8086 microprocessor architecture.	Understanding (K2)
CO2	use assembly language programming skill for simple addition/Subtraction/Multiplication/Division and sorting program using 8086 processor.	Applying (K3)
CO3	describe the internal blocks of 8051 microcontroller Architecture and interfacing external memory.	Understanding (K2)
CO4	use assembly language programming skill for Timer/Counter programming for generation of various delays.	Applying (K3)
CO5	apply programming skills to program internal peripherals devices and Interrupts.	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

18ITT41 - PYTHON PROGRAMMING AND FRAMEWORKS

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

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Object Oriented Programming	4	PC	3	0	0	3
Preamble	To acquire knowledge on Python programming and develop solutions for different real world problems using Python concepts and its frameworks.						

UNIT – I		**9**
Basic Concepts: Introduction - Variable, Expressions and Statements – Functions – Case Study: Interface Design – Conditional and recursion – Fruitful Functions: return values, parameters, local and global scope, function composition – Iteration Statements		
UNIT – II		**9**
Data Structures: Mutable vs immutable data types - Strings – String slices – Searching – looping and Counting – String methods – Case Study : word play – Lists – List operations, slices and methods- Dictionaries – Tuples – Case Study : Data Structure Selection – Files – Exception handling		
UNIT – III		**9**
Object Oriented Programming: Classes and Objects–Classes and Functions – Classes and methods: Object-oriented features – __init__() method - __str__() method – Operator Overloading – Type-based dispatch– Polymorphism – Inheritance – Aggregation and Association		
UNIT – IV		**9**
Python Database Integration: Need for database programming – Connect SQL Database – CRUD operations – Cursor Attributes. **Python Environment and Frameworks:** Anaconda – Jupyter notebook **- NumPy:** NumPy Arrays – Computation on NumPy Arrays – Aggregation – Sorting Arrays – Structured Arrays		
UNIT – V		**9**
Data Visualization with Pandas: Pandas Objects – Data Indexing and Selection – Operating on data – Handling missing data - Hierarchical Indexing – Concat and Append – Merge and Join –Aggregation and Grouping - **Matplotlib:** Line plots – Scatter Plots – Visualizing Errors – Density and Contour plots –Three Dimensional Plotting		

Total:45

TEXT BOOK:

1. Allen B.Downey, "Think Python: How to Think Like a Computer Scientist", 2 Edition, O'Reilly Media, 2016 for Units I,II,III.
2. Jake Vander Plas, "Python Data Science Handbook Essential Tools for Working with Data", 1 Edition, O'Reilly Media, 2016 for Units IV,V.

REFERENCES:

1. Bill Lubanovic, "Introducing Python Modern Computing in Simple Packages", 1 Edition, O'Reilly Media, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand the basic concepts of Python programming	Understanding (K2)
CO2	write programs using functions and different data structures	Applying (K3)
CO3	implement object oriented programming concepts	Applying (K3)
CO4	perform CRUD operations using cursor attributes	Applying (K3)
CO5	make use of python frameworks to provide data visualization	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3		2							2		3
CO2	3	3	3		2							3		3
CO3	3	3	3		2							3		3
CO4	3	3	3		2							3		3
CO5	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	10	70	20				100
CAT2	5	15	80				100
CAT3		20	80				100
ESE	10	30	60				100

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

18CST41 - DATABASE MANAGEMENT SYSTEMS

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

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	4	PC	3	1	0	4
Preamble	To learn the fundamentals of data models, conceptualize and depict a database system using different techniques and methods.						

UNIT – I		**9+3**
Data Models and Relational Model: Introduction – Database System Applications – Purpose of database systems – View of data – Database Languages – Relational Databases **–** Database Architecture – Database Users and administrators – Relational Model – Structure of Relational Databases – Database Schema – Keys – Schema Diagrams – Relational Query Languages - Relational Algebra – Fundamental Relational Operations – Additional relational operations.		
UNIT – II		**9+3**
SQL and Database Design: Database Design – E-R model – Constraints – ER diagrams – Reduction to Relational Schema – ER design issues. SQL: Basic structure – Operations – Aggregate Functions –Sub queries – Nested Sub queries – modification of the database – Intermediate SQL: Joins – views– Index – Integrity Constraints – SQL data types and schemas – Authorization.		
UNIT – III		**9+3**
Relational Database Design: Features of good relational designs – Functional dependency – Decomposition using functional dependencies – Normal Forms: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF – Data Storage: RAID – Tertiary storage – File Organization – Organization of Records in Files – Data dictionary storage.		
UNIT – IV		**9+3**
Indexing, Hashing and Transactions: Ordered indices – B tree index files – B+ Tree index files – Multiple key access – Static and Dynamic Hashing – Bitmap indices – Transaction concept – Transaction model –Storage structure – Transaction atomicity and durability – Isolation – Serializability .		
UNIT – V		**9+3**
Concurrency Control and Recovery System: Lock-based Protocols – Deadlock Handling – Multiple Granularity – Timestamp and Validation Based Protocols – Failure classification – Storage – Recovery and atomicity – Algorithm – Buffer management – Failure with loss of nonvolatile storage – early lock release and logical undo operations – Overview of query processing and query optimization.		

Lecture:45, Tutorial:15, Total:60

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	determine the various keys and sketch a suitable schema for a given application	Applying (K3)
CO2	design an ER model and write SQL queries for a queries for a given scenario	Applying (K3)
CO3	design relational database using normalization methods for a given application	Applying (K3)
CO4	apply indexing and hashing techniques in the design of 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										3	1
CO2	3	2	1						2				3	1
CO3	3	2	1						2				3	1
CO4	3	2	1										3	1
CO5	3	2	1										3	1

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

ASSESSMENT PATTERN - THEORY

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

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

18CST42 - DESIGN AND ANALYSIS OF ALGORITHMS

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

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Data Structures, Problem Solving and Programming	4	PC	3	1	0	4
Preamble	This course offers first formal introduction to various common algorithm design techniques, methods for analyzing the performance of corresponding algorithms and improving their efficiency. The theoretical aspects of this course are supplemented by tutorial sessions.						

UNIT – I		**9+3**
Introduction: 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		**9+3**
Brute Force: 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		**9+3**
Decrease and Conquer: Insertion sort –Topological Sorting- Fake coin problem- Computing a Median and the Selection Problem - Transform and conquer: Presorting – Balanced search trees –AVL trees -2-3Trees- Heaps and Heap sort.		
UNIT – IV		**9+3**
Dynamic Programming: Warshall's and Floyd's algorithm - Optimal Binary Search Trees - Knapsack Problem and Memory functions - Greedy Technique: Prim's algorithm – Kruskal's Algorithm - Dijkstra's Algorithm – Huffman Trees.		
UNIT – V		**9+3**
Backtracking: n-Queens problem –Hamiltonian Circuit Problem –Subset Sum Problem **-** Branch and Bound: Assignment problem – Knapsack Problem – Traveling Salesman Problem - Overview of P, NP and NP-Complete Problems.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

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

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, Prentice Hall of India, 2009.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Reprint Edition, Pearson Education, 2006.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	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 & 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	2
CO2	3	3	2	2	1								3	2
CO3	3	2	1	1									2	1
CO4	3	2	1	1									2	1
CO5	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	30	40	20			100
CAT2	10	30	50	10			100
CAT3	10	30	50	10			100
ESE	10	20	50	20			100

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

18CST43 - OPERATING SYSTEMS

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

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	4	PC	3	0	0	3
Preamble	To provide basic operating system abstractions, mechanisms and their implementations.						

UNIT – I		**9**
Operating Systems Overview: 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		**9**
Process Management: Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication – IPC in Shared Memory and Message Passing Systems. **CPU Scheduling:** Scheduling Criteria – Scheduling Algorithms. **Multithreaded Programming:** Threads Overview, Multicore Programming, Multithreading Models.		
UNIT – III		**9**
Process Synchronization: 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		**9**
Memory Management: Main Memory – Background – Contiguous Memory Allocation – Paging – Segmentation – Structure of the page table – Swapping**.** Virtual Memory: Background – Demand Paging – Page Replacement – thrashing.		
UNIT – V		**9**
Storage Management: 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.		

Total:45

TEXT BOOK:

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

REFERENCES:

1. William Stallings, "Operating Systems Internals and Design Principles", 9th Edition Edition, Prentice Hall, 2018.
2. Andrew S. Tanenbaum, "Modern Operating Systems", 4th Edition Edition, Pearson Education, 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	Understanding (K2)
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	2	1											3	1
CO2	3	3	2	2									3	1
CO3	3	2	1	1									2	1
CO4	3	3	2	2									2	1
CO5	2	1	1	1									2	1

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

ASSESSMENT PATTERN - THEORY

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

18ECL43 - MICROPROCESSOR AND EMBEDDED SYSTEMS LABORATORY
(Common to Computer Science and Engineering & Information Technology branches)

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	4	PC	0	0	2	1
Preamble	This course focuses on programming of microprocessors and microcontrollers for an embedded system design.						

List of Experiments:
1. Arithmetic operations using 8086
2. Sorting, searching and string manipulation using 8086.
3. Hex./ASCII/BCD code conversion using 8086 microprocessor
4. Matrix Multiplication using 8086 microprocessor
5. Data transfer and String manipulation using 8086 microprocessor
6. 8 bit and Multibyte arithmetic operations using 8051 microcontroller
7. Interfacing of LED and switch
8. Interfacing of seven segment display
9. Interfacing of LCD
10. Interfacing of DC/stepper motor

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	predict the usage of instruction sets and addressing modes for a given simple addition/Subtraction/Multiplication/Division and sorting program in 8086 processor.	Applying (K3), Manipulation (S2)
CO2	build LED , LCD and Switch Interface with 8051 Microcontroller.	Applying (K3), Precision (S3)
CO3	demonstrate speed control of DC Motors and Stepper Motor using 8051 Microcontroller.	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
CO2	3	2	1	1										3
CO3	3	2	1	1										3

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

18ITL41 - PYTHON PROGRAMMING AND FRAMEWORKS LABORATORY

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

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Object Oriented Programming Laboratory	4	PC	0	0	2	1
Preamble	Provides hands-on experience in implementing Python concepts and frameworks to develop real time applications of different domains.						

List of Experiments:

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

Total:30

REFERENCES / MANUALS / SOFTWARE:

1. Python 3 interpreter for Windows/Linux

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	write, test and debug simple Python programs using control structures and functions	Applying (K3), Precision (S3)
CO2	develop real time applications using Object Oriented Programming concepts and database programming	Applying (K3), Precision (S3)
CO3	demonstrate data manipulation and data visualization using Numpy, Pandas and Matplotlib	Applying (K3), Precision (S3)

Mapping of COs with POs and PSOs

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

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

18CSL41 - DATABASE MANAGEMENT SYSTEMS LABORATORY

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

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	4	PC	0	0	2	1
Preamble	The course explores the features of database management systems and to interface with front end tools.						

List of Exercises:

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

Total: 30

REFERENCES/MANUAL/SOFTWARE:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	develop 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	solve real world problems using database concepts	Applying (K3), Precision (S3)

Mapping of COs with POs and PSOs

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

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

18CST51 - COMPUTER NETWORKS

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	PC	3	0	0	3

Preamble	This course is to provide an overview of the basics of data communications and networking in general and the protocols used in the Internet in particular. The course presents the bottom-up approach of layers with distinct concepts and protocols as well as the overall picture. It presents the functionalities and protocols of different layers such as physical layer, data link layer, network layer, transport layer and application layer.	
Unit - I	**Network Models and Physical Layer:**	**9**
Data Communications – Networks – Networks Types – Internet – Standards – TCP/IP Protocol Suite – The OSI Model – Data and Signals – Periodic Analog Signals – Digital Signals: Bit Rate – Bit Length – Data Rate Limits – Performance – Line Coding Schemes: Unipolar – Polar – Bipolar – Transmission Modes – Transmission Media.		
Unit - II	**Data Link Layer:**	**9**
Introduction – Link Layer Addressing – Error Detection and Correction: Introduction – Block Coding – CRC – Checksum Concept – DLC Services – Data Link Layer Protocols: Simple – Stop-and-wait – Piggybacking – HDLC – PPP: Services – Framing – Media Access Control Protocols: Random Access Protocols – Wired LANs: Ethernet – Connecting Devices – Virtual LANs.		
Unit - III	**Network Layer:**	**9**
Network Layer Services – Packet Switching – Network Layer Performance – IPv4 Addresses – Forwarding of IP Packets – Internet Protocol (IP) – ICMPv4 – Unicast Routing - Routing Algorithms – RIP – OSPF – IPv6 Addressing – IPv6 Protocol.		
Unit - IV	**Transport Layer:**	**9**
Transport Layer Services – Connectionless and Connection Oriented Services – Transport Layer Protocols: Go-back-N – Selective Repeat – UDP – TCP: TCP Services – TCP Features – TCP Segment – TCP Connection – TCP Congestion Control.		
Unit - V	**Application Layer:**	**9**
Introduction – Client-Server Programming – Iterative Programming in C – WWW – HTTP – FTP – E-Mail – Telnet – SSH – DNS.		

Total:45

TEXT BOOK:

1. Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, McGraw Hill, 2015.

REFERENCES:

1. Kurose James F. & Ross Keith W., "Computer Networking: A Top-Down Approach", 6th Edition, Pearson Education, New Delhi, 2017.
2. Tanenbaum, Andrew S. & David Wetherall, "Computer Networks", 5th Edition, Prentice Hall of India, New Delhi, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain the fundamentals of data communication and transmission media and apply various line coding schemes for digital data conversion	Applying (K3)
CO2	make use of the knowledge of error detection and correction methods and protocols at data link layer	Applying (K3)
CO3	make use of the different addressing schemesto find subnet address and apply the various routing protocols at network layer	Applying (K3)
CO4	identify different transport layer protocols and their services and apply the congestion control mechanisms of TCP protocol	Applying (K3)
CO5	develop client-server application using UDP/TCP socket program and explain various standard application layer protocols.	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	1
CO2	3	2	1										3	1
CO3	3	2	1										3	1
CO4	3	2	1										3	1
CO5	3	2	1										3	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT- 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	45	25				100
CAT2	10	45	45				100
CAT3	25	45	30				100
ESE	20	40	40				100

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

18CST52 - WEB TECHNOLOGY

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Object Oriented Programming	5	PC	3	0	0	3

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 Typescript and Angular for developing web applications.	
Unit - I	**UI Design:**	**9**
HTML5: 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**
JavaScript: 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	**TypeScript and Angular 6.0:**	**9**
TypeScript: Introduction – Features – Variables – Data types – Enum – Array – Tuples – Functions – OOP concepts – Interfaces – Classes – Modules – Decorators. Angular 6.0 : Introduction – Needs – Features – Evolution – Setup and Configuration – Components and Modules – Templates – Change Detection – Directives – Nested Components.– Data Binding – Pipe.		
Unit - V	**Client-side JS Framework:**	**9**
Services – HTTP – Routing – Forms in Angular – Template Driven Forms – Model Driven Forms \ Reactive Forms – Custom Validators – Dependency Injection.		

Total:45

TEXT BOOK:

1.	Paul Deitel, Harvey M. Deitel & Abbey Deitel, "Internet and World Wide Web - How To Program", 5th Edition, Prentice Hall, 2011. I[first half], II
2.	Infosys campus connect material shared by infy. I[Second Half] III,IV,V

.REFERENCES:

1.	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 javascript	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	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	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)**

18CST53 - THEORY OF COMPUTATION

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Discrete Mathematics	5	PC	3	1	0	4

Preamble	The course helps the learners to know the models of computation, along with their variants in the context of formal languages and their recognizers and to familiarize students with the foundations and principles of computer science. This can be applied in designing compilers and pattern recognition system.	
Unit - I	**Automata and Regular Expressions:**	**9+3**
Introduction to formal proof – Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Equivalence between NFA and DFA – Finite Automata with Epsilon transitions – Conversion of NFA into DFA – Equivalence and minimization of automata.		
Unit - II	**Regular Expressions and Languages:**	**9+3**
Regular expression – Equivalence of finite automata and regular expressions – Proving languages not to be regular (Pumping Lemma) – Closure properties of regular languages.		
Unit - III	**Context Free Grammar and Languages:**	**9+3**
Context-Free Grammar (CFG) – Parse trees – Ambiguity in grammars and languages – Definition of the pushdown automata (PDA) – Languages of pushdown automata – Equivalence of pushdown automata and CFG-CFG to PDA-PDA to CFG – Deterministic Pushdown Automata.		
Unit - IV	**Context Free Languages and Turing Machines:**	**9+3**
Normal forms for CFG – Chomsky Normal Form and Greibach Normal Form – Pumping lemma for CFL – Closure properties of Context Free Languages – Turing machines: Basic model – definition and representation – Instantaneous Description – Language acceptance by TM – Variants of Turing Machine – TM as Computer of Integer functions – Programming techniques for Turing machines (subroutines).		
Unit - V	**Undecidability:**	**9+3**
A language that is not Recursively Enumerable (RE) – An undecidable problem that is RE –Undecidable problems about Turing machine – Post's correspondence problem – The classes P and NP –Kruskal's algorithm – Traveling Salesman Problem.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Hopcroft J.E., Motwani R. & Ullman J.D., "Introduction to Automata Theory, Languages and Computations", 3rd Edition, Pearson Education, New Delhi, 2008.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply induction and contradiction methods for theorem proving.	Applying (K3)
CO2	design finite automata and regular expression for regular languages.	Applying (K3)
CO3	develop and normalize context free grammar for context free languages and demonstrate the recognition of context free languages using push down automata.	Applying (K3)
CO4	construct Turing Machine to accomplish specific task and argue formally about its correctness.	Applying (K3)
CO5	make use of Turing machines to distinguish decidable / undecidable problems and compare different classes of problems.	Applying (K3)

Mapping of 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	1									2	1
CO5	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	30	60				100
CAT2	10	30	60				100
CAT3	10	45	45				100
ESE	10	30	60				100

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

18CST54 - DISTRIBUTED SYSTEMS

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Operating Systems	5	PC	3	0	0	3

Preamble	This course provides an understanding of distributed systems architecture and the principles on which the internet and distributed applications and file systems are developed.	
Unit - I	**Characteristics:**	**9**
Introduction – Examples – Trends – focus on resource sharing – Challenges in distributed systems – Case study: The World Wide Web. System models: physical – Architectural and Fundamental models.		
Unit - II	**Inter process communications:**	**9**
Introduction – the API for the Internet protocol – External data representation and Marshalling – Multicast Communication – Network Virtualization – Case study: MPI. Remote Invocation: Introduction – request-reply protocol – Remote Method Invocations – Case study: Java RMI. Indirect Communication: Group communication – Publish-Subscribe systems – message queues and shared memory approaches.		
Unit - III	**Peer-to-peer Systems:**	**9**
Introduction – Napster and its legacy – Peer-to-peer – Middleware – Routing overlays Case study: Pastry. Distributed File System: Introduction – file service architecture – Case Study – Andrew File System. Name Services: Introduction – Name Services and DNS – directory services – case study: Global Name Service.		
Unit - IV	**Time Synchronization:**	**9**
Introduction – clocks – events and process states – synchronizing physical clocks – logical time and logical clocks. Transaction and Concurrency Control: transactions – nested transaction – locks – optimistic concurrency control and timestamp ordering. Distributed transactions: flat and nested – atomic commit protocols and concurrency control.		
Unit - V	**Replication:**	**9**
System model and group communications – fault tolerant services – Case Study: The Gossip architecture. Distributed Multimedia Systems: Characteristics of multimedia data – Quality of service management – Resource Management – Stream Adaptation – Case Study: – BitTorrent. Designing Distributed Systems: GOOGLE Case Study – architecture and design philosophy – communication paradigms – data Storage and coordination services – Distributed Computation services.		

Total:45

TEXT BOOK:

1. Coulouris George, Dollimore Jean & Kindberg Tim, "Distributed Systems Concepts and Design", 5th Edition, Pearson Education, 2013.

REFERENCES:

1. Tanenbaum A.S. & Van Steen M., "Distributed Systems: Principles and Paradigms", 2nd Edition, Pearson Education, 2013.
2. Pradeep K. Sinha, "Distributed Operating Systems: Concepts and Design", Eastern Economy Edition, Prentice Hall, 2011.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	discuss the Characteristics and apply in the models of distributed system	Applying (K3)
CO2	apply different communication models in distributed application development	Applying (K3)
CO3	analyze various services offered by distributed systems	Applying (K3)
CO4	implement synchronization and concurrency in transactions	Applying (K3)
CO5	make use of the features of fault-tolerant and multimedia distributed systemsto improve quality of service	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	1									2	1
CO3	3	2	1	1									2	1
CO4	3	2	1	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	15	60	25				100
CAT2	15	50	35				100
CAT3	15	50	35				100
ESE	15	55	30				100

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

18CSC51 - SOFTWARE ENGINEERING

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	PC	3	0	2	4

Preamble	This course is to promote the practice of software engineering concepts at a higher level of abstraction which is to be acquired by software engineers and developers. The course also introduces 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 – Unified Modeling Language - 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.		

List of Exercises / Experiments :

1.	Define the problem statement.
2.	Identify use cases and develop business use case model (System use case diagram).
3.	Identify the conceptual classes (boundary, controller and entity classes) and develop a domain model with UML Class diagram.
4.	Using the identified scenarios find the interaction between objects and represent them using UML Interaction diagrams.
5.	Draw the State Chart diagram and UML Activity diagram.
6.	Develop Interface pattern.
7.	Identify the User Interface and domain objects. Draw the UML package diagram.
8.	Implement the User Interface (presentation) layer using thin client with HTML/Java/JSP/Servlet
9.	Implement the Business layer (domain object) using JDBC adapter / EJB.
10.	Implement the Data layer using JDBC mapper.

Lecture:45, Practical:30, Total:75

TEXT BOOK:

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

REFERENCES:

1. Ali Bahrami, "Object Oriented Systems Development", 1st Edition, Tata McGraw-Hill, New Delhi, 2008.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	analyze the 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 different software design techniques for a given problem	Applying (K3)
CO5	make use of various software testing techniques to test the software systems	Applying (K3)
CO6	design and implement projects using OO concepts	Applying (K3), Precision (S3)
CO7	use the UML analysis and design diagrams in various applications	Applying (K3), Precision (S3)
CO8	apply appropriate design patterns for the real world 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	3	1										1	
CO2	3	2	1						2				2	2
CO3	2	1	3						2				2	1
CO4	3	2	1										2	1
CO5	3	2	1										2	1
CO6	3	2	1	1	1								2	1
CO7	3	2	1	1	1								2	1
CO8	3	2	1	1	1								2	1

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

ASSESSMENT PATTERN - THEORY

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

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

18CSL51 - NETWORK LABORATORY

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	PC	0	0	2	1
Preamble	It provides an exposure to implement the various services offered by network layers and to measure the network performance. Also provide the knowledge to develop client/server applications using TCP and UDP.						

List of Exercises / Experiments :

1.	Simulation of network topologies (bus, ring, star and mesh) using NS2 Simulator.
2.	Write a AWK script to measure the network performance using NS2 Simulator
3.	Write a simple program to calculate various delays such as propagation delay, transmission delay, total delay and end-to-end delay.
4.	Write a program to implement bit stuffing and byte stuffing.
5.	Write a program to implement error detection techniques (parity check and checksum).
6.	Write a program to implement CRC.
7.	Write a simple program to find the classes of an IP address.
8.	Implementation of ARP and RARP.
9.	Demonstration of OSPF routing protocol.
10.	Write a socket program to implement chat application using UDP.
11.	Write a socket program to implement Go-Back-N Protocol using TCP.
12.	Implementation of DNS Protocol using UDP/TCP socket program

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Linux / GCC Compiler
2.	NS2 Simulator

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	make use of the performance parameters to measure the network performance and implement the services offered by data link layer.	Applying (K3), Precision (S3)
CO2	identify the classes of IP address and demonstrate the various routing protocols.	Applying (K3), Precision (S3)
CO3	develop various UDP/TCP client-server applications using socket programming.	Applying (K3), Precision (S3)

Mapping of COs with POs and PSOs

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

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

18CSL52 - WEB TECHNOLOGY LABORATORY

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Object Oriented Programming	5	PC	0	0	2	1
Preamble	The core experiments of this course include introduction to HTML, CSS, JavaScript, server side and client-side JS Frameworks like Node JS and Angular.						

List of Exercises / Experiments :

1.	Design a web page using HTML tags and host it in github repository.
2.	Design an attractive webpage using style sheets.
3.	Design a responsive website using Bootstrap.
4.	Design a webpage to create simple interactive CGPA calculator using Event Handling.
5.	Design a Web application using HTTP Request and HTTP Response
6.	Develop simple login page by performing event handling using GET and POST method.
7.	Design a simple calculator using “Modules” in Node.js.
8.	Design a webpage to maintain personal information using CRUD operations in MongoDB.
9.	Design a Payroll Management System using typescript.
10.	Design a web application using components, modules and router in Angular.
11.	Design a reactive form to maintain personal information and perform validation using Angular.
12.	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

18GEL51 - 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	80	2

Preamble	This subject is to enhance the employability skills and to develop career competency	
Unit - I	**Soft Skills – I**	**20**
Soft skills and its importance: Pleasure and pains of transition from an academic environment to work environment-Need for change-Fear, stress and competition in the professional world-Importance of positive attitude- Self motivation and continuous knowledge upgradation-Self-confidence. Professional grooming and practices: Basics of corporate culture-Key pillars of business etiquette- Basics of etiquette-Introductions and greetings-Rules of the handshake, earning respect, business manners-Telephone etiquette- Body Language.		
Unit - II	**Quantitative Aptitude & 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**						

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

18GET51 - UNIVERSAL HUMAN VALUES
(Common to all BE//BTech branches)

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	MC	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:**	**9**
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:**	**9**
Human Begin 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:**	**9**
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:**	**9**
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:**	**9**
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: 45

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	understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society.	Understanding (K2)
CO2	distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co–existence of Self and Body.	Understanding (K2)
CO3	understand 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.	Understanding (K2)
CO4	understand the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.	Understanding (K2)
CO5	distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						1		3						
CO2								2						
CO3						1		3						
CO4								2						
CO5								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, 3 – 50 marks & ESE – 100 marks)**

18CST61 - PRINCIPLES OF COMPILER DESIGN

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Theory of Computation	6	PC	3	0	0	3

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

Total:45

TEXT BOOK:

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

REFERENCES:

1. Srikant Y.N. & Priti Shankar, "The Compiler Design Handbook: Optimizations and Machine Code Generation", 2nd Edition, CRC Press, 2007.
2. Keith Cooper & Linda Torczon, "Engineering a Compiler", 2nd Edition, Morgan Kauffman Publishers, 2004.

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

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1								3	1
CO2	3	2	1	1	1								2	2
CO3	3	2	1	1									2	1
CO4	3	2	1	1									2	1
CO5	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	25	65				100
CAT2	5	25	70				100
CAT3	40	40	20				100
ESE	20	30	50				100

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

18CST62 - MACHINE LEARNING

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	6	PC	3	0	0	3

Preamble	This course focuses on developing algorithms to find patterns or make predictions from empirical data. The course also gives an introduction to the most important core techniques such as supervised, unsupervised learning algorithms and reinforcement learning.	
Unit - I	**Introduction:**	**9**
Learning Problems – Designing a Learning System – Perspectives and Issues in Machine Learning – Concept Learning – task – search – finding maximally specific Hypotheses – version spaces and candidate elimination algorithm – inductive bias.		
Unit - II	**Prediction:**	**9**
Linear Regression – Non Linear Regression – Decision Tree Learning: Decision Tree Representation – Problems – basic decision tree learning algorithms – hypotheses search – Issues – Artificial Neural Networks: Introduction – Representations – Problems – Perceptrons – Multilayer networks and Back Propagation Algorithm – example.		
Unit - III	**Supervised Learning:**	**9**
Bayesian Learning: Bayes Theorem – Concept Learning – Maximum Likelihood and Least-Squared Error Hypothesis – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Example. Instance Based Learning: Introduction – k-Nearest Neighbour Learning – Locally Weighted Regression – Radial Basis Functions – Case-Based Reasoning.		
Unit - IV	**Unsupervised Learning:**	**9**
K – Means – K Medoids – Genetic Algorithms: Introduction – Example – Hypothesis Space Search – Genetic Programming- Models of Evolution and Learning – Parallelizing Genetic Algorithms.		
Unit - V	**Learning Sets of Rules:**	**9**
Learning sets of rules: Introduction – sequential covering algorithms – First order rules – FOIL – Induction as Inverted deduction – inverting resolution – Reinforcement Learning: Introduction – Markov Decision Processes - Values- SARSA vs Q-Learning		

Total:45

TEXT BOOK:

1. Tom M. Mitchell, "Machine Learning", 1st Edition, McGraw-Hill Education, India, 2013.

REFERENCES:

1. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", 2nd Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
2. Jiawei Han & MichelineKamber, "Data Mining Concepts and Techniques", 3rd Edition, Elsevier, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	identify the perspectives of machine learning and formulating hypothesis	Applying (K3)
CO2	apply regression, decision tree and Artificial neural networks for real world problems	Applying (K3)
CO3	design a parametric and non –parametric algorithms for solving a given problem	Applying (K3)
CO4	employ the principles of unsupervised learning and genetic algorithm for optimization	Applying (K3)
CO5	make use of the algorithm for learning rules and outline reinforcement 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										3	1
CO2	3	2	1										3	1
CO3	3	2	1										3	1
CO4	3	2	1										3	1
CO5	3	2	1										3	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- 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	20	30	50				100
ESE	20	20	60				100

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

18CST63 - MOBILE COMMUNICATION AND IOT

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Computer Networks	6	PC	3	0	0	3

Preamble	The course explores the working principles of different telecommunication systems. Also, the course describes various communication protocols for IoT, IoT levels and design methodologies and illustrates the development of simple real time IoT applications and performing data analytics	
Unit - I	**Wireless communication:**	**9**
Wireless transmission – Frequencies for radio transmission – Signals – Antennas – GSM – GPRS – Satellite systems Wireless Networks: Wireless LAN – Infrared Vs Radio Transmission – Infrastructure Networks and Adhoc Networks – IEEE 802.11– Bluetooth – Introduction to 3G, 4G and 5G.		
Unit - II	**Introduction to Internet of Things:**	**9**
Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT Communication Models – IoT Communication APIs – IoT enabling Technologies – IoT Levels and Templates – Domain Specific IoT – IoT and M2M – IoT Platform Design methodologies.		
Unit - III	**Python for IoT and Introduction to Raspberry Pi:**	**9**
Python packages for IoT-Introduction to Raspberry Pi – Interfaces (serial, SPI, 12C) Programming – Python program with Raspberry Pi (interfacing external devices) – controlling output – reading input from pins – connecting IoT to Cloud (ThingSpeak).		
Unit - IV	**Data Analytics for IoT:**	**9**
Apache Hadoop – Hadoop MapReduce for batch data analysis – Apache Oozie, Apache Spark – Apache Storm for real time data analysis – Tools for IoT: Chef – Puppet Case Studies.		
Unit - V	**Fog Computing:**	**9**
Requirements of IoT – Architecture of Fog – Working of Fog – Advantages of Fog – Applications and Challenges of Fog.		

Total:45

TEXT BOOK:

1. Schiller Jochen, "Mobile Communications", 2nd Edition, Pearson Education, 2009 for Units I.
2. Arshdeep Bahga & Vijay Madisetti, "Internet of Things - A Hands-on Approach", Universities Press, 2015 for Units II,III, IV.

REFERENCES:

1. Jeeva Jose, "Internet of Things", Khanna Publishing, 2018 for Unit V.
2. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", 1st Edition, CRC Press, 2012

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	Determine a suitable communication technology for a given communication scenario	Applying (K3)
CO2	analyze the various IoT levels and choose an appropriate level and also develop design methodologies for a given application	Analyzing (K4)
CO3	outline the role of Python packages for IoT applications and develop simple IoT applications using Raspberry Pi and Python	Applying (K3)
CO4	Demonstrate the data analytics in IoT using appropriate tools	Applying (K3)
CO5	Make use of the fog computing in IoT 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										2	2
CO2	3	3	2										2	2
CO3	3	2	1										2	2
CO4	3	2	1		1								2	2
CO5	3	2	1										2	2

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

ASSESSMENT PATTERN - THEORY

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

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

18CSL61 - COMPILER DESIGN LABORATORY

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Problem solving and Programming	6	PC	0	0	2	1
Preamble	This course introduces the basic working principles of open source compiler construction tools like LEX and YACC. And also programmatic simulation of various phases of compilers.						

List of Exercises / Experiments :

1.	Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.). Create a symbol table, while recognizing identifiers.
2.	Design NFA from the given Regular expression
3.	Calculate ε-Closure of all the states in the given NFA
4.	Using LEX, implement finite automata that accepts string with even number of zeros and even number of ones odd number of a's
5.	Using LEX, generate the given pattern using finite automata starting with 'a' and ends with 'a' pattern anbn Identify the tokens in the C program
6.	Find FIRST and FOLLOW of the given Grammar
7.	Implement Predict parser of the given grammar
8.	Calculate Leading and Trailing for the operator Grammar
9.	Design a parser using YACC Tool for the given pattern starting with 'a' and ends with 'a' pattern anbmCm Arithmetic Calculator
10.	Generate three address codes for a simple program
11.	Implement simple code optimization techniques (Constant folding, Strength reduction and Algebraic transformation)
12.	Implement back-end of the compiler for which the three address code is given as input and the 8086 assembly language code is produced as output.

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Linux /Windows Operating System
2.	C / C++ / Java Compiler/ YACC and LEX tool

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	experiment LEX tool to recognize tokens in the given source program.	Applying (K3), Precision (S3)
CO2	design a parser for the given grammar.	Applying (K3), Precision (S3)
CO3	make use of YACC tool to perform syntax analysis.	Applying (K3), Precision (S3)

Mapping of COs with POs and PSOs

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

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

18CSL62 - MACHINE LEARNING LABORATORY

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Python Programming and Frameworks	6	PC	0	0	2	1
Preamble	This course focuses on providing hands-on experience in designing and implementing Machine Learning Algorithms for providing solutions to the given problems.						

List of Exercises / Experiments :

1.	Study of tools like WEKA, Rapid Miner and the UCI repository datasets.
2.	Perform data manipulation using numpy and pandas and data visualization using matplotlib.
3.	Write a python program to implement linear models to approximate the given data.
4.	Write a python program to find the attribute with maximum information gain and gain ratio for the given data.
5.	Write a python program to implement multi-layer perceptron algorithm and enhancing it to other variations.
6.	Write a python program to implement Naive Bayesian classification and predict the class label for the given data.
7.	Write a python program to implement k-NN algorithm for the given data.
8.	Write a python program to implement k-means clustering algorithm for the given data and visualize and interpret the result.
9.	Write a python program to implement Genetic operators.
10.	Write a python program to implement Q-Learning algorithm for the given data.
11.	Build a classification model in Azure ML framework using appropriate dataset.
12.	Build a clustering model in Azure ML framework using appropriate dataset.

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual
2.	Weka / Rapid Miner /Azure / Python

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply information theoretic approach for computing maximum information gain and gain ratio for the given data	Applying (K3), Precision (S3)
CO2	implement supervised and unsupervised learning algorithms in Machine Learning	Applying (K3), Precision (S3)
CO3	model the solutions for the given problem using Genetic Algorithms and reinforcement learning	Applying (K3), Precision (S3)

Mapping of COs with POs and PSOs

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

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

18CSL63 - MOBILE COMMUNICATION AND IOT LABORATORY

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Computer Networks	6	PC	0	0	2	1
Preamble	This course demonstrate the working of various communication technologies like GSM, ZigBee, Wifi and BLE . Various environmental conditions like temperature, humidity etc will be sensed and transmitted using these technologies. This course also explores the development of simple real time IoT applications using Raspberry Pi, sending the sensed values using SMS and mail and uploading the values onto cloud.						

List of Exercises / Experiments :

1.	Experiments on GSM / GPRS Basic AT Commands, Voice calls / Voice communication, Phone Book, SMS
2.	Experiments using ZigBee Data communication between co-ordinator and device module
3.	Experiments using WiFi Point-to-Point Communication between two nodes in the network
4.	Experiments on interfacing BLE mote
5.	LED controlling using Raspberry Pi
6.	Simulating traffic light controller
7.	Sensor integration with Raspberry Pi
8.	Web page integration with Raspberry Pi
9.	Measuring sensor value and uploading the content onto cloud for analysis
10.	Sensing and Sending the sensor value via SMS
11.	Sending images and video via Gmail
12.	Mini Project

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual
2.	Development kits for GSM/GPRS, ZigBee, WIFI, Bluetooth, IoT.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	demonstrate the basic working principles of different communication systems like GSM, WiFi, ZigBee and Bluetooth	Applying (K3), Precision (S3)
CO2	develop simple real time IoT applications using sensors and upload onto cloud.	Applying (K3), Precision (S3)
CO3	design IoT applications for sending SMS and images/video via Mail	Applying (K3), Precision (S3)

Mapping of COs with POs and PSOs

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

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

18GEL61 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	80	2

Preamble	This subject is to enhance the employability skills and to develop career competency	
Unit - I	**Soft Skills – I**	**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)**

18CSP61 - PROJECT WORK I PHASE I

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	6	EC	0	0	4	2

Total: 60

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	formulate specific problem statements for ill-defined real life problems with reasonable assumptions and constraints.	Creating (K6), Precision (S3)
CO2	perform literature search in the area of interest.	Evaluating (K5), Precision (S3)
CO3	conduct experiments, design and analysis, solution iterations and document the results.	Evaluating (K5), Precision (S3)
CO4	perform error analysis and synthesise the results and arrive at scientific conclusions.	Evaluating (K5), Precision (S3)
CO5	document the results in the form of technical report and give oral presentation	Creating (K6), Precision (S3)

Mapping of COs with POs and PSOs

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

18MBT71 - ENGINEERING ECONOMICS AND MANAGEMENT

(Common to All Engineering And Technology Branches except Chemical Engineering)

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

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

Total:45

TEXT BOOK:

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

REFERENCES:

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

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

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

18GEP71 – COMPREHENSIVE TEST AND VIVA
(Common to all BE/BTech branches)

Programme & Branch	All BE/BTech branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	7	EC	0	0	0	2

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	demonstrate knowledge in their respective programme domain.	Applying (K3)
CO2	defend any type of interviews, viva-voce, and aptitude tests conducted for career progression	Applying (K3)
CO3	exhibit professional etiquette and solve related engineering problems	Applying (K3)

Mapping of COs with POs and PSOs

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

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

18CSP71 - PROJECT WORK I PHASE II

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	7	EC	0	0	8	4

Total: 120

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	formulate specific problem statements for ill-defined real life problems with reasonable assumptions and constraints.	Creating (K6), Precision (S3)
CO2	perform literature search in the area of interest.	Evaluating (K5), Precision (S3)
CO3	conduct experiments, design and analysis, solution iterations and document the results.	Evaluating (K5), Precision (S3)
CO4	perform error analysis and synthesise the results and arrive at scientific conclusions.	Evaluating (K5), Precision (S3)
CO5	document the results in the form of technical report and give oral presentation	Creating (K6), Precision (S3)

Mapping of COs with POs and PSOs

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

18CSP81 - PROJECT WORK II

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	8	EC	0	0	12	6

Total: 180

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	formulate specific problem statements for ill-defined real life problems with reasonable assumptions and constraints.	Creating (K6), Precision (S3)
CO2	perform literature search in the area of interest.	Evaluating (K5), Precision (S3)
CO3	conduct experiments, design and analysis, solution iterations and document the results.	Evaluating (K5), Precision (S3)
CO4	perform error analysis and synthesise the results and arrive at scientific conclusions.	Evaluating (K5), Precision (S3)
CO5	document the results in the form of technical report and give oral presentation	Creating (K6), Precision (S3)

Mapping of COs with POs and PSOs

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

18CSE01 - MULTICORE ARCHITECTURE

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Computer Organization	6	PE	3	0	0	3

Preamble	This course provides an understanding of micro-architectural design of processors and various techniques like instruction level parallelism, data level parallelism, thread level parallelism used to obtain performance of computer system.	
Unit - I	**Fundamentals of Quantitative:**	**9**
Design and Analysis: Classes of Computers – Defining Computer Architecture – Trends in Technology - Trends in Power and Energy in Integrated Circuits – Trends in Cost –Dependability – Measuring, Reporting, and Summarizing Performance – Quantitative Principles of Computer Design		
Unit - II	**Instruction Level Parallelism:**	**9**
Concepts and Challenges – Basic Compiler Techniques for Exposing ILP – Reducing Branch Costs with Advanced Branch Prediction – Dynamic Scheduling - Advanced Techniques for Instruction Delivery and Speculation – Limitations of ILP		
Unit - III	**Data Level Parallelism:**	**9**
Introduction – Vector Architecture – SIMD Instruction Set Extensions for Multimedia – Graphics Processing Units – GPU Memory Hierarchy – Detecting and Enhancing Loop-Level Parallelism – comparison of GPU and a MIMD with Multimedia SIMD.		
Unit - IV	**Thread Level Parallelism:**	**9**
Introduction – Centralized Shared-Memory Architectures – Performance of Symmetric Shared-Memory Multiprocessors – Distributed Shared-Memory and Directory – Based Coherence –Synchronization The basics – Models of Memory Consistency Introduction – Performance and Energy Efficiency of Intel i7 **9**2 Processor.		
Unit - V	**Memory Hierarchy Design:**	**9**
Introduction – basics of memory hierarchies – memory technology and optimization – ten advanced optimization of cache Performance – Virtual Memory and Virtual Machines – Design of Memory Hierarchies		

Total:45

TEXT BOOK:

1. Hennessy J.L. & Patterson D.A., "Computer Architecture: A Quantitative Approach", 6th Edition, Morgan Kauffmann , 201**9**.

REFERENCES:

1. Kai Hwang & Faye Briggs, "Computer Architecture and Parallel Processing", International Edition, McGraw-Hill, 2000.
2. Richard Y & Kain, "Advanced Computer Architecture: A Systems Design Approach",Prentice Hall, 2011.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	examine the performance of different architectures with respect to various parameters	Understanding (K2)
CO2	apply the effectiveness of different ILP techniques	Applying (K3)
CO3	explain the architecture of Vector/GPU processor and make use of loop level parallelism	Applying (K3)
CO4	explain different parallel processing architectures	Understanding (K2)
CO5	describe the Hierarchal design and optimization of cache, main and virtual memories	Understanding (K2)

Mapping of COs with POs and PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial, BT- 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	40	30				100
CAT3	40	60					100
ESE	30	40	30				100

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

18CSE02 - ARTIFICIAL INTELLIGENCE

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	6	PE	3	0	0	3

Preamble	This course focuses on using computers to investigate and validate theories of human cognition and at the same time engineer systems to perform tasks where humans excel at present. This is an introductory course in Artificial Intelligence (AI) which focuses on search methods, game playing, planning, constraint satisfaction and knowledge representation.	
Unit - I	**Definition, History, Intelligent Agents and Blind search:**	**9**
Definition – History – State of the art – Agents and Environments – Good behaviour and the concepts of rationality – Nature of environments – structure of intelligent agents. State space search: Simple search – Depth First Search (DFS) – Breadth First Search (BFS) – Comparison of DFS and BFS – Depth Bounded DFS – Depth First Iterative Deepening (DFID).		
Unit - II	**Informed Search Methods:**	**9**
Heuristic Search: Heuristic functions – Best First Search – Hill Climbing – Local maxima – Solution state space – Variable neighbourhood descent – Beam search – Taboo search. Brute force – Branch and Bound – Refinement search – Dijkstra's algorithm.		
Unit - III	**A* and Randomized Search Methods:**	**9**
Algorithm A* - Admissibility of A* - Iterative deepening A* – Recursive Best First Search. Escaping local maxima/minima – Iterated hill climbing – Simulated annealing – Genetic algorithms (GA) – Travelling Salesman Problem (TSP) – GA based methods for TSP.		
Unit - IV	**Game playing, Planning and Constraint Satisfaction:**	**9**
Board games – Game playing algorithms – Limitations of search. The STRIPS domain – Forward state space planning – Backward state space planning – Goal stack planning – Plan space planning – N-Queens problem – Constraint propagation – Scene labelling – Higher order consistency – Algorithm Backtracking – Look ahead strategies – Strategic retreat.		
Unit - V	**Prepositional Logic, First Order Logic and Inferencing:**	**9**
Formal logic – Propositional logic – Resolution in propositional logic – First Order Logic (FOL) – Incompleteness of forward chaining – Resolution refutation in FOL – Horn clauses and SLD resolution – Backward chaining.		

Total:45

TEXT BOOK:

1.	Khemani D, "A First Course in Artificial Intelligence", McGraw Hill Education , India, 2013.
2	Stuart Russell & Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Pearson Education, 2013. First Half of Ist Unit

REFERENCES:

1.	Elaine Rich, Kelvin Knight & Shivashankar B Nair, "Artificial Intelligence", 3rd Edition, McGraw Hill Education, India, 2017.

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

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	60	30				100
CAT2	10	20	70				100
CAT3	10	40	50				100
ESE	15	40	45				100

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

18CSE03 - MODELING AND SIMULATION

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	6	PE	3	0	0	3

Preamble	This is an introductory course on applications of computer simulation and modeling to real world simple and complex problems. Various modeling approaches for modeling process are presented in this course.	
Unit - I	**Modeling Process:**	**9**
Classification of modeling – Steps of modeling – System Dynamics: Unconstrained Growth and Decay – Constrained Growth – Drug Dosage – Force and Motion: Modeling Falling and Skydiving – Bungee Jumping – The Pendulum Clock – Rocket motion.		
Unit - II	**System Dynamics Models:**	**9**
Competition – Predator-Prey Model – Modeling the spread of SARS – Enzyme Kinetics.		
Unit - III	**Data Driven Models:**	**9**
Functions – Empirical Models – Simulating with Randomness: Simulations – Random numbers from various distributions – Random Walk.		
Unit - IV	**Cellular Automation:**	**9**
Diffusion – Spreading of Fire – Movement of Ants – High Performance Computing: Concurrent Processing – Parallel Algorithms.		
Unit - V	**Matrix Models:**	**9**
Matrices for Population Studies – Time after Time – Modeling with Markov Chains – The next Flu Pandemic.		

Total:45

TEXT BOOK:

1. Angela B. Shiflet & George W. Shiflet, "Introduction to Computational Science: Modeling and Simulation for the Sciences", 2nd Edition, Princeton University Press, 2014.

REFERENCES:

1. Jerry Banks, John S. Carson, Barry L. Nelson & David M. Nicol, "Discrete-Event System Simulation: Pearson New International Edition", 5th Edition, Pearson Education Limited, 2013.
2. Panneerselvam R & Senthilkumar P, "System Simulation, Modelling and Languages", PHI learning Pvt.Ltd, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	model system dynamics with and without constraints.	Applying (K3)
CO2	construct models for systems with interactions.	Applying (K3)
CO3	make use of randomness and data for modeling.	Applying (K3)
CO4	utilize cellular automation for modeling natural processes and explain concurrent processing and parallel algorithms.	Applying (K3)
CO5	apply matrix theory in problem solving.	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	30	45	25				100
CAT2	10	45	45				100
CAT3	25	45	30				100
ESE	20	40	40				100

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

18CSE04 - WIRELESS SENSOR NETWORKS

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Computer Networks	6	PE	3	0	0	3

Preamble	The course helps the learners to know the architecture, protocols for information gathering and energy management in wireless sensor network. This course also gives insight into challenges, various attacks and countermeasures for attacks in wireless sensor networks.	
Unit - I	**Wireless Sensor Networks Architecture:**	**9**
Sensors – Sensor Node Architecture – Sensor Network Architecture – Mote Technology – Comparison of MANET and WSN – Requirements of a WSN – Challenges for a WSN – WSN Applications – Wireless Sensor Networks Architecture: Introduction – Network Protocol Stack – Communication Standards – IEEE 802.11 – IEEE 802.15.4 – ZigBee – 6LoWPAN.		
Unit - II	**Information Gathering:**	**9**
Introduction – Routing – Flat-based Routing Algorithms – Sensor Protocols for Information Negotiation (SPIN) – Hierarchical Routing Algorithms – LEACH Routing Protocol – Information Gathering Based on Geographic Locations – Geographical Routing – Greedy Perimeter Stateless Routing – Landmark-based Routing – Data Aggregation – Content-based Naming.		
Unit - III	**Energy Management in WSN:**	**9**
Introduction – Duty Cycling – Independent Strategies – Dependent Strategies – Independent Sleep/Wakeup Schemes – Asynchronous Schemes – TDMA-based MAC Protocols – Contention-based MAC Protocols – Hybrid MAC Protocols – Data-driven Approaches – Energy-aware Routing Protocols – Hierarchical Energy-aware Routing – Location-based Routing – Data Aggregation-based Routing.		
Unit - IV	**Security in WSN:**	**9**
Introduction – Challenges in WSN – Attacks in WSN – Protection against Attacks – Key Management – Secure Routing in WSNs – Attacks on Routing Protocols – Countermeasures for Attacks – Intrusion Detection in WSN.		
Unit - V	**Operating Systems for WSNs:**	**9**
Introduction – Architecture – Execution Model – Scheduling – Power Management – Communication – Case Study on Popular Operating Systems. Programming WSNs – Introduction – TinyOS – Contiki- Castalia – NS-3.		

Total:45

TEXT BOOK:

1. Nandini Mukherjee, SarmisthaNeogy & Sarbani Roy, "Building Wireless Sensor Networks Theoretical & Practical Perspectives", 3rd Edition, CRC Press, Taylor & Francis Group, 2016.

REFERENCES:

1. HolgerKarl & Andreas Willig, "Protocol and Architecture for Wireless Sensor Networks", John Wiley & Sons,2006.
2. KazemSohraby, Daniel Minoli & TaiebZnati, "Wireless Sensor Networks Technology, Protocols and Applications", John Wiley & Sons, 2007.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain the fundamentals of wireless sensor networks.	Understanding (K2)
CO2	demonstrate various routing protocols for gathering information in Wireless sensor networks.	Applying (K3)
CO3	illustrate different schemes for energy management in wireless sensor networks.	Applying (K3)
CO4	summarize various challenges, attacks and countermeasures for attacks in wireless sensor networks.	Understanding (K2)
CO5	describe and install various operating systems used in wireless sensor networks.	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	1
CO2	3	2	1	1									3	1
CO3	3	2	1	1									3	1
CO4	2	1											2	1
CO5	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	20	60	20				100
CAT2	20	60	20				100
CAT3	20	80					100
ESE	20	60	20				100

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

18CSE05 - DATA WAREHOUSING AND DATA MINING

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	6	PE	3	0	0	3

Preamble	This course provides a comprehensive knowledge about building a data warehouse and how to perform data mining using various techniques.	
Unit - I	**Introduction:**	**9**
Data warehouse – basic concepts – Modeling – Design and usage – Implementation – Data generalization by Attribute-oriented induction approach. Introduction – Kinds of Data and Patterns – Major issues in data mining.		
Unit - II	**Data Preprocessing:**	**9**
Data Objects and attribute types – Statistical description of data – Measuring data similarity and dissimilarity. Data preprocessing: Overview-Data cleaning – Data integration – Data reduction – Data transformation and discretization.		
Unit - III	**Association Rule Mining:**	**9**
Basic concepts – Frequent itemset mining methods: Apriori algorithm – A pattern growth approach for mining frequent itemsets – Pattern evaluation methods – Mining multilevel – multi dimensional space.		
Unit - IV	**Classification:**	**9**
Basic concepts – Decision Tree Induction – Bayes Classification Methods – Rule Based Classification – Model evaluation and selection – Support Vector Machines – Classification using frequent patterns – k-NN.		
Unit - V	**Clustering:**	**9**
Cluster analysis – Partitioning methods – Hierarchical methods – Density based methods – Grid based methods – Evaluation of Clustering Methods – Introduction to Outlier Analysis – Data Mining Applications.		

Total:45

TEXT BOOK:

1. Jiawei Han & Micheline Kamber, "Data Mining Concepts and Techniques", 3rd Edition, Elsevier, 2012.

REFERENCES:

1. Gupta G.K., "Introduction to Data Mining with Case Studies", Eastern Economy Edition, Prentice Hall of India, 2006.
2. Charu C. Aggarwal, "Data Mining: The Textbook", Kindle Edition, Springer, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	design a data warehouse.	Applying (K3)
CO2	apply and analysis of pre-processing techniques.	Applying (K3)
CO3	mine a correlation based frequent patterns in large data sets.	Applying (K3)
CO4	develop a supervised learning model.	Applying (K3)
CO5	build an unsupervised learning model.	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	30	30	20			100
CAT3	20	30	30	20			100
ESE	20	30	30	20			100

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

18CSE06 - BUILDING ENTERPRISE APPLICATIONS

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	6	PE	3	0	0	3

Preamble	This course offers an insight into enterprise application development and deployment.	
Unit – I	**Analysis and Modeling:**	**9**
Introduction to enterprise applications and their types – Software engineering methodologies – Life cycle of raising 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 – use case modeling – prototyping – Non functional requirements – requirements validation – planning and estimation.		
Unit - II	**Architecting and Designing:**	**9**
Concept of architecture – Views and viewpoints – Enterprise architecture – Logical architecture – Technical architecture and Design – Different technical layers – Object – Oriented Analysis and Design – Best practices – Data architecture and design – relational, XML, and other structured data representations.		
Unit - III	**Architectural Design:**	**9**
Infrastructure architecture and design – Building Blocks – Networking – Internetworking and Communication Protocols – IT Hardware and Software – Middleware – Policies for Infrastructure Management – Deployment Strategy – Architecture and 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 – construction of technical solutions layers – methodologies of code review – static code analysis – build and testing. Dynamic code analysis – code profiling and code coverage.		
Unit - V	**Testing and Rolling out Enterprise Applications:**	**9**
Testing an enterprise application – Testing levels and approaches – Testing environments – integration testing – performance testing – penetration testing – usability testing – globalization testing and interface testing – user acceptance testing – rolling out an enterprise application.		

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. Brett McLaughlin, "Building Java Enterprise Applications", 1st Edition, O"Reilly Media Publications,2002.
2. Soren Lauesen, "Software Requirements: Styles & Techniques", 1st Edition, Addison–Wesley Professional, 2002.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	demonstrate the concepts of enterprise analysis and business modeling.	Applying (K3)
CO2	design and document the application architecture.	Applying (K3)
CO3	determine the importance of application framework and designing other application components.	Applying (K3)
CO4	perform code review, code analysis and build process to implement enterprise applications.	Applying (K3)
CO5	demonstrate various testing strategies and deploy enterprise 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								1	2	1
CO2	3	2	1	1								1	2	1
CO3	3	2	1	1								1	2	1
CO4	3	2	1	1								1	2	1
CO5	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	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)**

18CSE07 - BLOCKCHAIN TECHNOLOGIES

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

Preamble	The widespread popularity of digital cryptocurrencies has led the foundation of Blockchain, which is fundamentally a public digital ledger to share information in a trustworthy and secure way. The concept and applications of Blockchain have now spread from cryptocurrencies to various other domains, including business process management, smart contracts, IoT and so on. This course provides a comprehensive introduction to the theoretical and practical aspects of blockchain technology.	
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, Cryptography and Technical Foundations:**	**9**
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 & Alternative Coins:**	**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 – Ether – 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.		

Total:45

TEXT BOOK:

1. Imran Bashir, "Mastering Blockchain Distributed ledgers, decentralization and smart contracts Explained", Packt Publishing, 2017.

REFERENCES:

1. Brenn Hill, Samanyu Chopra & Paul Valencourt, "Blockchain Quick Reference: A guide to exploring decentralized blockchain application development", Packt, 2018.
2. Andreas Antonopoulos, "Mastering Bitcoin: Programming the open blockchain", 2nd Edition, O'Reilly Media, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	outline the history and different applications of blockchain	Understanding (K2)
CO2	illustrate decentralization and practical aspects of cryptography	Understanding (K2)
CO3	present bitcoin technology, alternative coins and smart contracts	Understanding (K2)
CO4	develop a distributed application using Ethereum	Applying (K3)
CO5	deploy 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	2	1											2	
CO2	2	1											2	
CO3	2	1											2	
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	50	50					100
CAT2	30	50	20				100
CAT3		50	50				100
ESE	30	45	25				100

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

18CSE08 - CLOUD COMPUTING

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

Preamble	This course gives the idea of evolution of cloud computing and its services available today, which may led to the design and development of simple cloud service. It also focuses on key challenges and issues around cloud computing.	
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 for the 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 & Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Reprint Edition, Morgan Kauffmann , 2017.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain the concepts, characteristics and benefits of Distributed System Models and apply the same for internet computing	Applying (K3)
CO2	describe the importance of virtualization along with their technologies and apply in virtual resource management	Applying (K3)
CO3	use and Examine different cloud computing services	Applying (K3)
CO4	analyze the components of Cloud Programming and Software Environments	Applying (K3)
CO5	develop strategies for Ubiquitous Clouds and the 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										3	1
CO2	3	2	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	10	70	20				100
CAT2	10	70	20				100
CAT3	10	70	20				100
ESE	4	40	56				100

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

18CSE09 - DECISION SUPPORT SYSTEMS

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Database Management Systems & Software Engineering	7	PE	3	0	0	3

Preamble	This course provides an introduction to the basic concepts, methodologies and technologies of Decision Support Systems, Data mining and Management Information Systems.	
Unit - I	**Decision Making, Modeling and Support:**	**9**
Introduction – Models – Phases of Decision Making Process: The Intelligence Phase – The Design Phase – The Choice Phase – The Implementation Phase – Support – Case Study: Decision and Risk Management.		
Unit - II	**Concepts, Methodologies and Technologies:**	**9**
DSS Configuration – Description – Characteristics and Capabilities – Classification – Components –The Data Management Subsystem –The Model Management Subsystem – The User Interface (Dialog) Subsystem – The Knowledge-Based Management Subsystem.		
Unit - III	**Modeling and Analysis:**	**9**
MSS Modeling –– Structure of Mathematical Models for Decision Support -- Certainty, Uncertainty, and Risk –– MSS Modeling with Spreadsheets –– Decision Analysis with Decision Tables and Decision Trees.		
Unit - IV	**Data Mining and Data Warehousing:**	**9**
Data Mining Concepts--Applications – Process – Data Warehousing Architecture – Data Integration, Extraction, Transformation and Load Processes.		
Unit - V	**Management Support Systems:**	**9**
Emerging Trends and Impacts – RFID – Reality Mining – Virtual Worlds – Social Networking – Cloud Computing and BI.		

Total:45

TEXT BOOK:

1. Efraim Turba, Ramesh Sharda & Dursun Delen "Decision Support System and Business Intelligent Systems", 9th Edition, Pearson , International, 2017.

REFERENCES:

1. Efrem Mallach, "Decision Support System and Data Warehouse Systems", 1st Edition, McGraw-Hill, 2000.
2. Janakiraman V.S. & Sarukesi K., "Decision Support Systems", 1st Edition, Prentice Hall of India, 2008.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explore and apply the different phases, Methodologies and Technologies to develop decision support systems	Applying (K3)
CO2	apply knowledge of designing DSS/IS for specific problems	Applying (K3)
CO3	identify the MSS modeling for real time decision support systems	Applying (K3)
CO4	use different data mining techniques for decision support systems	Applying (K3)
CO5	prepare the need for computerized support of managerial 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										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	30	45	25				100
CAT2	20	55	25				100
CAT3	25	55	20				100
ESE	27	48	25				100

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

18CSE10 - SOCIAL NETWORK ANALYSIS

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

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

Total:45

TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	summarize statistical properties of Social Networks and apply random walk approaches for social network analysis	Applying (K3)
CO2	make use of statistical methods for classification and community discovery in Social Networks	Applying (K3)
CO3	carry out social influence and expert location in Social Networks	Applying (K3)
CO4	apply statistical methods for link prediction and describe privacy preservation methods in Social Networks	Applying (K3)
CO5	summarize visualization and apply text mining techniques in Social Networks	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18CSE11 - AGILE METHODOLOGIES

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

Preamble	This course helps in learning many kinds of agile methodologies first by grounding in agile's underlying principles, then by describing four specific and well used agile methods: Scrum, Extreme Programming (XP), Lean, and Kanban.	
Unit - I	**Agile Principles:**	**9**
What is Agile? – Understanding the Agile Values – Silver Bullet Methodology – Agile to the Rescue – A fractured perspective - Agile Manifesto and Purpose behind each practice – Agile Elephant – Where to start with a new Methodology – 12 principles of Agile Software – The Customer is always Right – Delivering the project – Communicating and Working Together – Project Execution – Constantly improving the project and the team – Agile Project.		
Unit - II	**Scrum and Self-Organizing Teams:**	**9**
Basic pattern for a Scrum Project – Rules of Scrum – Command-and-Control Team – Self-Organizing Teams – Scrum Values – Daily Scrum – Sprints, Planning and Retrospectives.		
Unit - III	**Scrum Planning and Collective Commitment:**	**9**
User stories – Conditions of Satisfaction – Story Points and Velocity – Burndown Charts – Planning and Running a Sprint – GASP – Scrum Values Revisited – Practices Do Work Without the Values – Company Culture Compatible with Scrum Values.		
Unit - IV	**XP and Incremental Design:**	**9**
Primary Practices of XP – The XP values help the team change their mindset – An effective mindset starts with the XP values – Understanding the XP principles – Feedback Loops – Code and Design – Make Code and Design Decisions at the Last Responsible Moments – Incremental Design and the Holistic XP.		
Unit - V	**Lean, Kanban and Agile Coach:**	**9**
Lean Thinking – Commitment, Options Thinking and Set Based Development – Create Heroes and Magical Thinking – Eliminate Waste – Value Stream Map – Deliver As Fast As Possible – Visualize work in progress – Pull Systems – The Principles of Kanban – Improving Your Process with Kanban – Measure and Manage Flow – Little's Law – Emergent Behavior with Kanban – The Agile Coach – Shuhari – The Principles of Coaching.		

Total:45

TEXT BOOK:

1. Andrew Stellman & Jennifer Greene, "Learning Agile: Understanding Scrum, XP, Lean and Kanban", 1st Edition, O'Reilly Media Inc, 2015.

REFERENCES:

1. Robert C. Martin, "Agile Software Development: Principles, Patterns, and Practices", Pearson Prentice Hall, 2011.
2. Eric Brechner, "Agile Project Management with Kanban", 1st Edition, Microsoft Press, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply agile's core values and principles to deliver a software project	Applying (K3)
CO2	utilize the scrum\'s emphasis on project management and self-organization.	Applying (K3)
CO3	experiment with practices like user stories, story points, project velocity and visualization tools.	Applying (K3)
CO4	design an architecture using XP practices and pair programming for a given problem	Applying (K3)
CO5	make use of appropriate methods to ensure fast delivery of software and to manage software flow.	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	
CO2	3	2	1						1		1		3	1
CO3	3	2	1								1		3	
CO4	3	2							1		1		3	
CO5	3	2	1						1		1		3	

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	45	25				100
CAT2	10	45	45				100
CAT3	25	45	30				100
ESE	20	40	40				100

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

18CSE12 - HUMAN COMPUTER INTERFACE

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

Preamble	Enable the students to design user interfaces for system based on the capabilities of computer technology and the needs of human factors.	
Unit - I	**Usability of Interactive Systems and Universal Usability:**	**9**
Introduction – Usability Goals and Measures – Usability Motivations – Universal Usability: Diverse cognitive and perceptual abilities – Personality differences – Cultural and international diversity – Users with disabilities – Accommodating hardware and software diversity – Goals –Guidelines – Golden rules of Interface design – Principles – Theories.		
Unit - II	**Development Processes and Evaluating Interface Designs:**	**9**
Managing design processes – Organizational Design to Support Usability – Four Pillars of Design – Development Methodologies – Scenario Development – Social Impact Statement for Early Design Review. Evaluating Interface Designs: Expert Reviews – Usability Testing and Laboratories –Survey Instruments – Acceptance Tests – Evaluation during Active Use – Controlled Psychologically Oriented Experiments.		
Unit - III	**Interaction Styles:**	**9**
Direct Manipulation and Virtual Environments – Introduction – Examples of Direct Manipulation – Discussion of Direct Manipulation – 3D Interfaces – Tele-operation – Virtual and Augmented Reality. Menu Selection, Form Filling and Dialog Boxes – Command and Natural Languages – Case Study.		
Unit - IV	**Interaction Devices:**	**9**
Introduction – Keyboards and Keypads – Pointing Devices – Speech and Auditory Interfaces – Displays Small and Large. Collaboration and Social Media Participation: Goals of Collaboration and Participation – Asynchronous Distributed Interfaces – Synchronous Distributed Interfaces – Face-to-Face Interfaces.		
Unit - V	**Design Issues, Information Search and Information Visualization:**	**9**
Quality of Service – Models of Response Time Impacts – Expectations and Attitudes – User Productivity – Variability in Response Time. Information Search: Searching in Textual Documents and Database Querying – Multimedia Document Searches – Advanced Filtering and Search Interface. Information Visualization: Data Type by Task Taxonomy – Challenges for Information Visualization.		

Total:45

TEXT BOOK:

1. Ben Shneiderman, Catherine Plaisant, Maxine S. Cohen & Steven M. Jacobs, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", 5th Edition, Addison Wesley, 2010.

REFERENCES:

1. Alan Cooper, Robert Reinmann,David Cronin & Christopher Noessel, "About Face –The Essentials of Interaction Design", 4th Edition, Wiley , 2014.
2. Helen Sharpand Yvonne Rogress, "Interaction Design beyond Human Computer Interaction", 4th Edition, John Wiley, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	identify the usability and design principles for effective interface designs	Applying (K3)
CO2	examine the methodologies in development process and the Interface design based on application needs	Applying (K3)
CO3	choose an appropriate interaction style for a given real world problem	Applying (K3)
CO4	make use of appropriate interaction devices to establish the social connections.	Applying (K3)
CO5	identify the design issues and challenges in processing the information	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	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	15	50	35				100
CAT2	10	40	50				100
CAT3	15	85					100
ESE	8	56	36				100

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

18CSE13 - CRYPTOGRAPHY AND NETWORK SECURITY

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

Preamble	This course describes the explosive growth in computer systems and their interconnections via networks, has increased the dependence of both organizations and individuals on the information stored and communicated using these 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, 2017.

REFERENCES:

1. Behrouz A. Ferouzan & Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata Mc Graw Hill, 2015.
2. Charles P Fleeger, "Security in Computing", 5th Edition, Prentice Hall of India, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply various Cryptographic Techniques and 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	make use of Hashing and Digital Signature techniques to solve the problems.	Applying (K3)
CO4	demonstrate the various mutual trust and User authentication mechanisms.	Applying (K3)
CO5	determine the appropriate Security Protocols and standards for the given application.	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2										2	1
CO2	3	2	2										2	1
CO3	3	2	2										2	1
CO4	3	2	2										1	1
CO5	3	2	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	50	35				100
CAT2	15	55	30				100
CAT3	20	50	30				100
ESE	25	40	35				100

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

18CSE14 - DEEP LEARNING

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

Preamble	This course provides an introduction to the basics of machine learning, neural networks, and Deep learning techniques. This course also helps to understand and solve few real world problems.	
Unit - I	**Overview of Machine Learning::**	**9**
Learning Algorithms – Capacity, Overfitting and Underfitting – Hyperparameters and Validation Sets – Estimators, Bias and Variance – Bayesian Estimates – Maximum Likelihood Estimation – Supervised Learning Algorithms – Unsupervised Learning Algorithms – Stochastic Gradient Descent – Building a Machine Learning Algorithm – Challenges Motivating Deep Learning.		
Unit - II	**Deep Feed forward Networks ::**	**9**
Example: Learning XOR – Gradient-Based Learning – Hidden Units – Architecture Design – Back-Propagation and Other Differentiation Algorithms – Random or Unsupervised Features.		
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	**Convolutional Networks::**	**9**
The Convolution Operation – Motivation – Pooling – Variants of the Basic Convolution Function – Structured Outputs Efficient Convolution Algorithms. Applications: Computer Vision.		
Unit - V	**Sequence Modeling: Recurrent and Recursive Nets::**	**9**
Recurrent Neural Networks – Bidirectional RNNs – Encoder-Decoder Sequence-to-Sequence Architectures – Deep Recurrent Networks – Recursive Neural Networks – The Long Short-Term Memory and other Gated RNNs. Applications: Natural Language Processing.		

Total:45

TEXT BOOK:

1. Ian Goodfellow, YoshuaBengio, and Aaron Courvill, "Deep Learning", MIT Press, USA, 2016.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply the concepts of machine learning algorithms to solve simple problems	Applying (K3)
CO2	solve simple problems using the concepts of deep neural networks	Applying (K3)
CO3	use 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	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	20	30	50				100
CAT2	20	30	50				100
CAT3	15	50	35				100
ESE	20	40	40				100

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

18CSE15 - PARALLEL COMPUTING ARCHITECTURE AND PROGRAMMING

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

Preamble	This course deals with Computer architecture of uniprocessor and multiprocessor systems with an emphasis on parallel programming to achieve high performance.	
Unit - I	**Parallel Architectures:**	**9**
Motivation – Modern scientific method – Evolution of supercomputing – Modern parallel computers – Seeking concurrency – Data clustering – Programming Parallel computers. Parallel Architectures: Introduction – Interconnection networks – Processor Arrays – Multiprocessors – Multicomputer – Flynn's Taxonomy.		
Unit - II	**Parallel Algorithm Design:**	**9**
Introduction – Task/Channel model – Foster's Design methodology – Boundary value problem – finding the maximum – The n-Body problem – Adding data input. Message-Passing Programming: Message-passing model – Message-passing interface – Circuit satisfiability – Introducing collective communication – Benchmarking parallel performance.		
Unit - III	**The Sieve of Eratosthenes:**	**9**
Sequential algorithm – Sources of parallelism – Data Decomposition options – Developing the parallel algorithm – Analysis of parallel Sieve algorithm – documenting the parallel program. Floyd's Algorithm: The All-Pairs shortest path problem – Creating arrays at run time – Designing the parallel algorithm – Point-to-point communication – Documenting the Parallel program.		
Unit - IV	**Performance Analysis:**	**9**
Speedup and efficiency – Amdhal's Law – Gustafsan-Barsis's Law – The Karp-Flatt Metric – The Isoefficiency Metric. Sorting: Quick sort – A parallel quick sort – Hyper quick sort – parallel sorting by regular sampling.		
Unit - V	**Shared-Memory Programming:**	**9**
The Shared-memory model – Parallel for loops – Declaring private variables – Critical sections – Reductions – Performance Improvement – More general data parallelism – Functional parallelism. Combining MPI and OPenMP: Conjugate – Jacobi method.		

Total:45

TEXT BOOK:

1. Michael J. Quinn, "Parallel Programming in C with MPI and OpenMP", McGraw Hill Education, India, 2013.

REFERENCES:

1. David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture: A Hardware/ Software Approach", Morgan Kaufmann, Elsevier, 2013.
2. Munshi Aaftab,Gaster R. Benedict, "OpenCL Programming Guide", Addision-Wesley, 2011.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	make use of the fundamental concept of the modern parallel architecture to build a simple parallel computer	Applying (K3)
CO2	design parallel algorithms and message passing interface methods	Applying (K3)
CO3	develop parallel algorithms for sieve and Floyd's algorithm in various problems	Applying (K3)
CO4	study the performance of parallel algorithms using sorting algorithm	Applying (K3)
CO5	utilize the shared memory programming concept to improve parallelism	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									2	1
CO2	3	2	1	1									2	1
CO3	3	2	1	1									2	1
CO4	3	2	1	1									2	1
CO5	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	15	50	35				100
CAT2	15	50	35				100
CAT3	15	50	35				100
ESE	15	50	35				100

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

18CSE16 - GAME THEORY AND ITS APPLICATIONS

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming, Design and Analysis of Algorithms	7	PE	3	0	0	3

Preamble	This course on game theory deals with mathematical modeling of strategic interaction among rational and irrational agents. Game theory finds application in economics computer science, auction and negotiation.	
Unit - I	**Games:**	**9**
Games: 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.		

Total:45

TEXT BOOK:

1. David Easley and Jon Kleinberg, " Networks, Crowds and Markets: Reasoning about a highly Connected World", Cambridge University, 2010 for Unit I.
2. Matsumoto A., Szidarovszky F, "Game Theory and Applications", Springer, 2016 for Units II, III, IV, V.

REFERENCES:

1. E.M.Barron, "Game Theory: An Introduction", Wiley, 2009.
2. Leon Petrosjan, Valdimir V.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 games to the real world problems with the illustration of game strategies and Nash Equilibria	Applying (K3)
CO2	Solve the problems of Non-cooperative static games and present its optimized solution	Applying (K3)
CO3	apply the concept of Equilibria and dynamic games to identify the certainty of games.	Applying (K3)
CO4	solve Problems in cooperative games and relate 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										2	2
CO2	3	2	1										2	2
CO3	3	2	1										2	2
CO4	3	2	1										2	2
CO5	3	2	1										2	2

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

ASSESSMENT PATTERN - THEORY

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

18CSE17 - SOFTWARE QUALITY AND TESTING

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

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

Total:45

TEXT BOOK:

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

REFERENCES:

1. Limaye M.G, "Software Testing - Principles, Techniques and Tools", 1 Edition, Tata McGraw-Hill, 2009.
2. Mordechai Ben-Menachem, Garry S. Marliss, "Software Quality", 2 Edition, Vikas Publishing House Pvt. Ltd.,, New Delhi, 2014.

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

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1										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	30	50	20				100
CAT2	20	50	30				100
CAT3	20	50	30				100
ESE	25	30	45				100

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

18CSE18 - BIG DATA ANALYTICS

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

Preamble	Provides basic knowledge about Big data, its framework, storage in databases and Stream processing with SPARK and KAFKA	
Unit - I	**Big Data:**	**9**
Big data : 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**
Hadoop: Hadoop 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	**CouchDB:**	**9**
Overview : Document Storage- ACID Properties- Compaction- Views- Security and Validation- Distributed Updates and Replication- Implementation – Reason of using CouchDB - Building Blocks for Larger Systems - CouchDB Replication. Eventual Consistency: The CAP Theorem- Local Consistency - Validation- Distributed Consistency- Incremental Replication. cURL - Security : Authentication - Authentication Database - Authorization - The Core API		
Unit - IV	**HIVE and PIG:**	**9**
HIVE and PIG: 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	**SPARK and KAFKA:**	**9**
Apache SPARK and KAFKA: Stream processing with SPARK: Introduction – SPARK architecture- SPARK Eco system – SPARK for Big Data Processing – SPARK applications – Apache KAFKA – KAFKA Architecture – Use cases.		

Total:45

TEXT BOOK:

1. Seema Acharya and Subhashini Chellappan,"Big Data and Analytics", 2nd Edition, Wiley, 2019.

REFERENCES:

1. Dr.Anil Maheshwari,"Big Data", 1st Edition, McGraw Hill Education, 2017
2. EMC Education Services,"Data science and Big data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", John Wiley and Sons, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	describe the concepts, characteristics of big data and apply for real applications	Applying (K3)
CO2	implement MapReduce programs in Hadoop framework	Applying (K3)
CO3	utilize CouchDB to solve real world problems	Applying (K3)
CO4	develop solutions for big data problems using Hive and Pig	Applying (K3)
CO5	recognize the need for stream processing and discuss Spark and Kafka architecture and apply it in real case scenarios.	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	
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								2	1

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

ASSESSMENT PATTERN - THEORY

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

18CSE19 - SOFTWARE DEFINED NETWORKS

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

Preamble	This course explores the programmability of the computer network. It also provides an insight on programmability protocols, interfaces, controllers and its applications in various environment like data centers and service provider networks.	
Unit - I	**Introduction to SDN:**	**9**
Introduction: Basic packet switching terminology – The modern data center – Traditional switch architecture – Autonomous and dynamic forwarding table. 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 – Getting started with mininet and experimenting with mininet.		
Unit - II	**SDN and OpenFlow:**	**9**
How SDN works? – Fundamental characteristics of SDN – SDN operation – SDN devices – SDN controllers – Alternate SDN methods. The OpenFlow specification: OpenFlow overview – OpenFlow 1.0 and OpenFlow basics - OpenFlow 1.1 Additions - OpenFlow 1.2 Additions - OpenFlow 1.3 Additions – OpenFlow Limitations. NetApp Development: Simple forwarding in OpenDayLight controller.		
Unit - III	**SDN Interfaces:**	**9**
Alternative definitions of SDN: Potential drawbacks of open SDN – SDN via APIs- SDN via hypervisor based overlays – SDN via opening up the device – Network Functions virtualization – Alternatives overlap and ranking. SDN open source: Open source licensing issues – OpenFlow source code – Switch implementation – Controller implementations – Orchestration and Network virtualization – Simulation, Testing and Tools – OpenStack – Applying SDN open source		
Unit - IV	**SDN in the Data center:**	**9**
Data center definition – Data center demands – Tunneling technologies for the data center – Path technologies in the data center – SDN and shortest path complexity – Ethernet fabrics in the data center – SDN use cases in the data center – Open SDN versus Overlays in the data center – Real-world data center implementation.		
Unit - V	**SDN environments and applications:**	**9**
SDN in other environment – Wide area networks – Service provider and carrier networks – Campus networks – Hospitality networks – Mobile networks – In-Line network functions – Optical networks. SDN Applications: Reactive versus Proactive applications – A simple reactive Java application – Creating network virtualization tunnels – offloading flows in the data center – Access control for the campus – Traffic engineering for the service providers. NetApp Development: A simple Firewall.		

Total:45

TEXT BOOK:

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

REFERENCES:

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

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

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1		1								1	1
CO2	3	2	1		1								2	2
CO3	3	1	1										1	1
CO4	3	2	2	1									1	1
CO5	3	2	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	30	60				100
CAT2	10	15	75				100
CAT3	10	15	75				100
ESE	10	20	70				100

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

18CSE20 - INFORMATION SECURITY

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

Preamble	This course deals with the important of security in information system. It covers wide spectrum of topics from legal and ethical issue, risk management, technologies available, and implementation in the context of information security	
Unit - I	**Introduction to Information Security and The Need for Security:**	**9**
History – CNSS Security Model – Components – Security in the System life Cycle – Security Professionals and the organization – Communities of Interest. Information Security: Threat and Attacks – Compromises to Intellectual Property – Deviations in Quality of Service-Espionage – Force of Nature – Human Error – Information Extortion – Sabotage – Software Attacks – Technical Hardware failures – Technical Software failures		
Unit - II	**Legal, Ethical, and Professional Issues in Information Security and Planning for Security:**	**9**
Law and Ethics in Information Security – Relevant U.S. Laws – International Laws and Legal Bodies – Ethics and Information Security – Codes of Ethics at Professional Organizations – Key U.S. Federal Agencies – Planning for Security – Information Security Policy, Standards, and Practices – The Information Security Blueprint –Security Education, Training, and Awareness Program		
Unit - III	**Risk Management:**	**9**
Risk Identification: Planning and Organizing the Process – Identifying, Inventorying and Categorizing Assets – Classifying and Prioritizing Threats – Specifying Asset Vulnerabilities; Risk Assessment : Planning and Organizing Risk Assessment – Determining the Loss Frequency – Calculating Risk – Assessing Risk Acceptability – The FAIR Approach to Risk Assessment – Risk Control – Quantitative Versus Qualitative Risk Management Practices – Recommended Risk Control Practices.		
Unit - IV	**Security Technology:**	**9**
Firewalls and VPNs – Access Control Mechanisms – Biometrics – Access Control Architecture Models; Firewalls: processing Modes – architecture – Selecting the Right Firewalls – Configuring and Managing Firewalls – Content Filters – Protecting Remote Connections – Intrusion Detection and Prevention Systems – Honeypots, Honeynets, and Padded Cell Systems – Scanning and Analysis Tools.		
Unit - V	**Implementing Information Security and Security &Personnel:**	**9**
Information Security Project Management- Technical Aspects of Implementation – Nontechnical Aspect of Implementation – Information System Security Certification and Accreditation – Credentials for Information Security Professionals – Employment Policies and Practices – Security Considerations for Temporary Employees, Consultants, and Other Workers – Internal Control Strategies – Privacy and the Security of Personnel data.		

Total:45

TEXT BOOK:

1. Michael E. Whitman and Herbert J. Mattord, "Principles of Information Security", 5 Edition, Cengage Learning, India, 2015.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain need for security and determine the types of threats/attacks for given application	Applying (K3)
CO2	explain legal, ethical and professional issues in information security and determine the security policies, standards and practices	Applying (K3)
CO3	demonstrate various risks involved in information security and carry out risk assessment	Applying (K3)
CO4	make use of various security technologies to protect the information from intruder	Applying (K3)
CO5	implement various information security models to protect the information	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	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	40	50	10				100
CAT2	30	50	20				100
CAT3	40	50	10				100
ESE	20	60	20				100

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

18CSE21 - INTELLIGENT SYSTEMS

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

Preamble	This is an introductory intelligent systems course that will cover theoretical issues, applications and implementation techniques. The purpose of this course is to familiarize you with the basic techniques of intelligent systems.	
Unit - I	**Problem Solving and Searching::**	**9**
Evolution of Modern Computational Intelligence – Problem Solving by Search – Informed Search – Iterative Search – Adversarial Search.		
Unit - II	**Logic and Knowledge Base Systems::**	**9**
Knowledge Representation and Reasoning – Rule-Based Expert Systems – Managing Uncertainty in Rule Based Expert Systems		
Unit - III	**Fuzzy and Neural Systems:**	**9**
Fuzzy Expert Systems – Artificial Neural Networks – Advanced Artificial Neural Networks.		
Unit - IV	**Learning from Data:**	**9**
Machine Learning – Decision Trees – Evolutionary Algorithms – Evolutionary Meta heuristics.		
Unit - V	**Bio-Inspired Intelligence::**	**9**
Swarm Intelligence – Hybrid Intelligent Systems – Models of HCI Architectures – Neuro-fuzzy systems – Evolutionary Fuzzy Systems – Evolutionary Neural Networks – Hybrid Evolutionary Algorithms.		

Total:45

TEXT BOOK:

1. Crina Grosan and Ajith Abraham, "Intelligent Systems – A modern approach (Intelligent Systems Reference Library Volume 17)", Springer, Verlag Berlin Heidelberg, 2011.

REFERENCES:

1. Robert J. Schalkoff, "Intelligent Systems Principles, Paradigms and Pragmatics", 1st Edition, Jones and Bartlett Publishers, LLC,2011.
2. N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Illustrated Edition, Oxford University Press, 2005.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	Applu various search techniques and heuristics for solving problems	Applying (K3)
CO2	make use of logic in knowledge representation and reasoning	Applying (K3)
CO3	identify the role of fuzzy and neural systems in building intelligent systems	Applying (K3)
CO4	utilize the machine learning techniques using datasets	Applying (K3)
CO5	apply bio-inspired algorithms and build hybrid intelligence 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	1
CO2	3	2	1	1									3	1
CO3	3	2											3	
CO4	3	2											3	
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	30	45	25				100
CAT2	10	45	45				100
CAT3	25	45	30				100
ESE	20	40	40				100

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

18CSE22 - SOFTWARE PROJECT MANAGEMENT

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

Preamble	This course offers an insight into detailed project management activities including project evaluation, planning, estimation, monitoring and control activities especially for software projects.	
Unit - I	**Introduction to Software Project Management:**	**9**
Introduction – Importance – Types of project – Activities – Plans, methods and methodologies – Ways of Categorizing software projects – Stakeholders – Setting objectives – Business case – Project success and failure – Management and management control – Traditional vs. Modern project management practices. Project Evaluation: Introduction – A business case – Project Portfolio Management – Evaluation of Individual Projects – Cost Benefit Evaluation Techniques – Risk Evaluation – Programme management – Managing the allocation of resources within programme – Strategic programme management – Creating a programme – Aids – Reservations – Benefits.		
Unit - II	**Project Planning::**	**9**
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 FP – FP Mark II - COSMIC FFP – COCOMO II.		
Unit - III	**Activity Planning::**	**9**
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 Project Duration – Identifying critical activities – Activity on Arrow Networks. Risk Management: Risk – Categories of Risk – Framework – Risk Identification – Risk Assessment – Risk Planning – Risk management – Applying PERT Technique – Monte Carlo Simulation – Critical chain concepts.		
Unit - IV	**Monitoring and Control::**	**9**
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**
Introduction – Understanding Behaviour – Organizational Behaviour – A Background – Selecting The Right Person For The Job – Instruction in the best methods – Motivation – The OldhamHackman 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", 5 Edition, Tata McGraw Hill, New Delhi, 2011.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	take part in the process of software project management and analyse the projects.	Analyzing (K4)
CO2	prepare the project plan and calculate the efforts required.	Applying (K3)
CO3	plan, schedule and sequence the activities and determine the risks.	Applying (K3)
CO4	develop visualization charts to monitor the progress of projects and to control the risks involved.	Applying (K3)
CO5	apply the methods of managing people and organising teams while developing a software 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	2	2							2		3	1
CO2	3	2	1	1							2		3	1
CO3	3	2	1	1							2		3	1
CO4	3	2	1	1							2		3	1
CO5	3	2	1						2		2		3	1

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

ASSESSMENT PATTERN - THEORY

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

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

18CSE23 - DATA VISUALIZATION TECHNIQUES

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

Preamble	Data visualization techniques are used to communicate complex information in a way that is easier to interpret by turning information into visually engaging images and stories. Data visualization is a key to clear-cut reports and dashboards.	
Unit - I	**Introduction::**	**9**
Visualization – visualization process – role of cognition – Pseudocode conventions – Scatter plot - Data foundation : Types of data - Structure within and between records - Data preprocessing – Human perceptions and information processing – Visualization foundations.		
Unit - II	**Spatial and Geospatial, Time oriented data and Multivariate data:**	**9**
One, two, three dimensional data – Dynamic data – Combining techniques – Visualization of spatial data – Visualization of point data – Visualization of line data – Visualization of area data – Issues in Geospatial data Visualization – Characterizing and visualizing Time oriented data – Point, Line ad region based techniques for multivariate data.		
Unit - III	**Tree, Graph, Networks, Text and Document::**	**9**
Displaying hierarchical structure – Displaying Arbitrary Graphs/Networks – Other issues. Visualization techniques for Tree – Graph and Networks – Levels of text representation – Vector space model – Single Document Visualization – Document collection visualization- Extended text visualization.		
Unit - IV	**Designing Effective Visualization::**	**9**
Steps in Designing Visualization – problems in Designing Effective Visualization – Comparing and evaluating visualization techniques – Visualization Systems.		
Unit - V	**Information Dashboard Design::**	**9**
Characteristics of dashboards – Key goals in visual design process – Dashboard display media – Designing dashboards for usability – Meaningful organization – Maintaining consistency – Aesthetics of dashboards – Testing for usability – Case Studies: Sales dashboard – Marketing analysis dashboard.		

Total:45

TEXT BOOK:

1.	Matthew O. Ward. , Georges Grinstein and Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2ndEdition, CRC Press, 2015 for Units I,II,III,IV.
2.	Stephen Few, "Information Dashboard Design: The Effective Visual Communication of Data", O'Reilly, 2006 for Unit V.

REFERENCES:

1.	Stephen Few, "Now you see it: Simple Visualization Techniques for Quantitative Analysis", Analytics Press, 2009.
2.	Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.

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

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	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	55	20				100
CAT2	20	30	50				100
CAT3	20	40	40				100
ESE	20	40	40				100

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

18GEE01 - FUNDAMENTALS OF RESEARCH

Programme & Branch	All BE/BTech branches	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	7	PE	3	0	0	3

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

Total: 45

TEXT BOOK:

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

REFERENCES:

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

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

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18MBE49 - ENTREPRENEURSHIP DEVELOPMENT

(Common to All BE/BTech Engineering and Technology Branches)

Programme & Branch	All BE/BTech branches	Sem.	Category	L	T	P	Credit
Prerequisites	Engineering Economics and Management	8	EC	3	0	0	3

Preamble	The purpose of this course to create entrepreneurial awareness among engineering students.	
Unit - I	**Entrepreneurship Concepts:**	**9**
Entrepreneurship & Entrepreneur- Role in Economic Development - Factors affecting Entrepreneurship- Creativity and Innovation - Entrepreneurship vs Intrapreneurship- Entrepreneurial Motivation factors – Types of Entrepreneurship &Entrepreneurs - Characteristics of Entrepreneurs -Entrepreneurship Development in India		
Unit - II	**Entrepreneurial Ventures and Opportunity Assessment:**	**9**
New venture creation – Bootstrapping,Minipreneurship, Start-ups, Acquiring, Franchising & Social venturing - Venture development stages - Models of market opportunity- Opportunity assessment: Critical Factors In Opportunity Assessment, Idea vs Opportunity, Evaluation process, Global opportunities for entrepreneurs.		
Unit - III	**Business Plan:**	**9**
Designing Business Model- Business Model Canvas- Objectives of a Business Plan - Business Planning Process – Structure of a Business Plan – Technical, Marketing, Financial Feasibility assessment - Competitive analysis - Common errors in Business Plan formulation - Presentation of the Business Plan: The 'Pitch'- case studies		
Unit - IV	**Financing and Accounting:**	**9**
Forms of entrepreneurial capital – Sources of Financial capital: debt financing- Commercial banks and other sources, equity financing: Initial Public offering (IPO), Private placement - Venture capitalists - Angel investors-New forms of financing: Impact investors, Micro-financing, Peer-to-Peer Lending, Crowd funding - Natural capital. Preparing Financial Budget, Break even analysis, Taxation-Direct and indirect taxes, Insolvency and Bankruptcy.		
Unit - V	**Small Business Management:**	**9**
Definition of Small Scale Industries: Strengths and Weaknesses, Sickness in Small Enterprises: Symptoms -Causes and remedies-Indian Startup Ecosystem – Institutions supporting small business enterprises, Business Incubators – Government Policy for Small Scale Enterprises - Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger, FDI and Sub-Contracting		

Total:45

TEXT BOOK:

1. Donald F. Kuratko, "Entrepreneurship: Theory, Process, Practice", 11th Edition, Cengage Learning, Boston, 2020.

REFERENCES:

1. Robert D. Hisrich, Michael P. Peters & Dean A. Shepherd, Sabyasachi Sinha, "Entrepreneurship", 11th Edition, McGraw Hill, Noida, 2020.
2. Charantimath Poornima M., "Entrepreneurship Development and Small Business Enterprises", 3rd Edition, Pearson Education, Noida, 2018.
3. Gordon E. & Natarajan K., "Entrepreneurship Development", 6th Edition, Himalaya Publishing House, Mumbai, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	understand the importance of entrepreneurship and demonstrate the traits of an entrepreneur	Applying (K3)
CO2	identify suitable entrepreneurial ventures and business opportunity	Applying (K3)
CO3	assess the components of business plan	Analyzing (K4)
CO4	appraise the sources of finance and interpret accounting statements	Applying (K3)
CO5	interpret the causes of sickness of small scale enterprises and its remedies	Understanding (K2)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18CSE24 - CYBER FORENSICS

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Computer Networks	8	PE	3	0	0	3

Preamble	This course imparts fundamental principles and techniques for digital forensics investigation and security management.	
Unit - I	**Computer Forensics and Investigations::**	**9**
Understanding computer forensics – Preparing a Computer investigations – 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	**Data Acquisition::**	**9**
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	**Processing Crime and Incident Scenes::**	**9**
Identifying Digital Evidence – Collecting Evidence in Private Sector Incident Scenes – Processing Law Enforcement Crime Scenes – Preparing for a Search – Securing a Computer Incident or Crime Scene – Seizing Digital Evidence at the Scene – Storing Digital Evidence –Obtaining a Digital Hash – Reviewing a Case.		
Unit - IV	**Computer Forensics Tools, Analysis and Validation::**	**9**
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	**Recovering Graphics Files, Email Investigations::**	**9**
Recognizing a Graphics File – Understanding Data Compression – Locating And Recovering Graphic Files – Identifying Unknown File Formats – Understanding Copyright Issues – Investigating Email Crimes And Violations – Understanding Email Servers – Using Specialized Email Forensics Tools.		

Total:45

TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	demonstrate digital forensic investigation with a systematic approach	Applying (K3)
CO2	carry out acquisition of data using various tools	Applying (K3)
CO3	Illustrate the seizure of digital evidence in a crime scene	Applying (K3)
CO4	make uses of forensic tools in forensic examination	Applying (K3)
CO5	analyze the recovery of graph files and investigating E-mail crimes	Analyzing (K4)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	70	20				100
CAT2	10	50	40				100
CAT3		20	40	40			100
ESE	5	20	55	20			100

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

18CSE25 - DATA SCIENCE

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	8	PE	3	0	0	3

Preamble	This course helps students to understand the concepts of data science and its lifecycle. The course also focusses on application of machine learning techniques for analyzing big data and different ways for storing big data.	
Unit - I	**Data Science in a Big Data World::**	**9**
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::**	**9**
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	**Big Data::**	**9**
Distributing Data Storage and Processing with Frameworks: Hadoop – Spark – Case Study: Assessing Risk with Loaning Money.		
Unit - IV	**NoSQL::**	**9**
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	**Test Mining and Text Analytics::**	**9**
Test Mining in Real World – Text Mining Techniques: Bag of Words – Stemming and Lemmatization – Decision Tree Classifier – Case Study: Classifying Reddit Posts.		

Total:45

TEXT BOOK:

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

REFERENCES:

1. John Wiley and Sons , "Data Science and Big data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", EMC Education Services, 2015.
2. Joel Grus, "Data Science from the Scratch", O'Reilly, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	make use of the concepts of data science for building applications	Applying (K3)
CO2	utilize machine learning techniques for solving problems with large data	Applying (K3)
CO3	experiment with Hadoop and Spark framework for data science applications	Applying (K3)
CO4	apply the data science process to solve real world problem by 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										3	1
CO2	3	2	1	1									3	1
CO3	3	2	1										3	1
CO4	3	2	1										3	1
CO5	3	2	1										3	1
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

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

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

18CSE26 – BUSINESS INTELLIGENCE AND ITS APPLICATIONS

Programme & Branch	B.E. – Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	8	PE	3	0	0	3

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

Total:45

TEXT BOOK:

1.	Prasad R.N. and Seema Acharya, "Fundamentals of Business Analytics", 2nd Edition, Wiley-India Publication, 2016.
2	Ramesh Sharda, DursunDelen and Efraim Turban, "Business Intelligence, Analytics, and Data Science: A Managerial Perspective", 4th Edition, Pearson Education, 2017.

REFERENCES:

1.	Sherman,Rick , " Business Intelligence Guidebook: from data integration to Analytics", 1st Edition Elsevier Publications, 2015.
2	Larissa T.Moss and Shaku Atre," Business Intelligence Roadmap The Complete Project Life cycle for Decision support Applications" , First Edition, Pearson Publications, 2016

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	compare OLTP with OLAP systems and design dimensional model	Applying (K3)
CO4	apply different software design techniques for a given problem	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										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	15	45	40				100
CAT2	15	40	45				100
CAT3	15	40	45				100
ESE	10	45	45				100

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

18CSE27 - PREDICTIVE DATA ANALYTICS

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	8	PE	3	0	0	3

Preamble	This course provides the fundamental concepts of predictive data analytics and provides knowledge on the applications of predictive data analytics to solve real world problems.	
Unit - I	**Overview of Predictive Analytics::**	**9**
Predictive Analytics – Predictive Analytics vs. Business Intelligence – Predictive Analytics vs. Statistics – Predictive Analytics vs. Data Mining – Challenges in Using Predictive Analytics. Setting up the Predictive Modeling project: Predictive Analytics Processing Steps: CRISP-DM – Defining Data for Predictive Modeling – Defining the Target Variable – Defining Measures of Success for Predictive Models.		
Unit - II	**Data Understanding::**	**9**
Single Variable Summaries – Data Visualization in One Dimension – Histograms – Multiple Variable Summaries – Data Visualization, Two or Higher Dimensions. Data Preparation: Variable Cleaning – Feature Creation.		
Unit - III	**Descriptive Modeling::**	**9**
Data Preparation Issues with Descriptive Modeling – Principal Component Analysis – Clustering Algorithms. Interpreting Descriptive Models: Standard Cluster Model Interpretation.		
Unit - IV	**Predictive Modeling::**	**9**
Decision Trees – Logistic Regression – Neural Networks – K-Nearest Neighbor –Naive Bayes – Linear Regression – Other Regression Algorithms. Assessing Predictive Models: Batch Approach to Model Assessment.		
Unit - V	**Model Ensembles::**	**9**
Motivation for Ensembles – Bagging – Boosting – Improvements to Bagging and Boosting – Interpreting Model Ensembles. Model Deployment: General Deployment Considerations – Case Study.		

Total:45

TEXT BOOK:

1. Dean Abbott, "Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst, John Wiley & Sons, Inc., 2014.

REFERENCES:

1. John D.Kelleher, Brain Mac Namee, Aoife D'Arcy, "Fundamentals of Machine Learning for Predictive Data Analytics", MIT Press, 2015.
2. Gopal M, "Applied Machine Learning", McGraw Hill Education, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explore the processing steps of predictive analysis for solving real time problems	Applying (K3)
CO2	make use of data for modeling project	Applying (K3)
CO3	utilize various descriptive modeling algorithms	Applying (K3)
CO4	implement different types of predictive modeling algorithms	Applying (K3)
CO5	apply predictive analytics concepts to real world 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	1
CO2	3	2	1										3	1
CO3	3	2	1										3	1
CO4	3	2	1										3	1
CO5	3	2	1										3	1

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	45	40				100
CAT2	15	45	40				100
CAT3	15	45	40				100
ESE	4	40	56				100

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

18CSO01 - DATA STRUCTURES AND ITS APPLICATIONS
(Offered by Department of Computer Science Engineering)

Programme & Branch	All BE/BTech Branches except Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	5	OE	3	0	2	4

Preamble	This course is indented to introduce the concept of elementary data structures and notion of algorithms to novice learner from cross disciplines in Engineering and Technology.	
Unit - I	**List:**	**9**
Data Structures - Abstract Data Types (ADT) - List ADT and Array Implementation - Linked List - Doubly Linked List - Circular Linked List – Application : Polynomial Addition		
Unit - II	**Stack and Queues:**	**9**
Stack ADT – Array and Linked List implementation of Stacks - Application: Infix to Postfix Conversion - Postfix Expression Evaluation - Queue ADT – Array and Linked List implementation of Queues - Applications		
Unit - III	**Trees:**	**9**
Trees-Preliminaries – Binary Trees –Binary Tree Traversals - The Search Tree ADT – Binary Search Trees–Priority Queues (Heaps) - Application: Expression Tree		
Unit - IV	**Graphs:**	**9**
Graphs – Definitions – Elementary Graph Operations – Shortest-Path Algorithms – Unweighted Shortest Paths – Dijkstra's Algorithm – Minimum Spanning Tree – Prim's Algorithm- Kruskal's Algorithm – Applications		
Unit - V	**Sorting and Hashing:**	**9**
Sorting - Preliminaries – Insertion Sort – Quicksort – Mergesort – Heapsort – Hashing – General Idea – Hash Function – Separate Chaining – Linear Probing		

List of Exercises / Experiments :

1.	Implementation of C programs using pointers
2.	Implementation of singly linked list and its operations
3.	Implementation of doubly linked list and its operations
4.	Implementation of Stack and its operations
5.	Implementation of Queue and its operations
6.	Implementation of Stack and Queue using Singly Linked List
7.	Convert a given In-fix Expression into Post-fix Expression using Stack ADT
8.	Evaluate the Post-fix Expression using Stack ADT
9.	Implementation of Binary Search Tree traversals
10.	Implementation of sorting algorithms: Insertion and Quick sort

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Weiss M. A., "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education Asia, New Delhi, 2016.

REFERENCES:

1.	Horowitz Sahni, Andreson Freed, "Fundamentals of Data Structures in C", 2nd Edition, Universities Press, Hyderabad, 2011.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	use List ADT for given problems	Applying (K3)
CO2	construct Stack and Queue ADTs using arrays and linked lists	Applying (K3)
CO3	construct Tree ADT and study different operations on them	Applying (K3)
CO4	make use of Graph ADT for standard problems	Applying (K3)
CO5	implement standard sorting and Hashing Techniques	Applying (K3)
CO6	identify the appropriate data structure for solving the given problem	Applying (K3), Precision (S3)
CO7	use a data structure to implement another data structure	Applying (K3), Precision (S3)
CO8	synthesize operations like searching, insertion, deletion and traversing on various data structures	Applying (K3), Precision (S3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18CSO02 - FORMAL LANGUAGES AND AUTOMATA THEORY
(Offered by Department of Computer Science Engineering)

Programme & Branch	All BE/BTech Branches except Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Discrete Mathematics	5	OE	3	1	0	4

Preamble	The course helps the learners to know the models of computation, along with their variants in the context of formal languages and their recognizers and to familiarize students with the foundations and principles of computer science. This can be applied in designing compilers and pattern recognition system.	
Unit - I	**Finite Automata & Regular Languages:**	**9+3**
Introduction to Automata Theory - Languages and Computational Problems - Finite state automata - Deterministic and Non-deterministic finite automata - Equivalence between NFA and DFA - Finite Automata with Epsilon transitions – Conversion of NFA into DFA – Equivalence and minimization of automata.		
Unit - II	**Regular Expressions and Languages:**	**9+3**
Regular expression –Pattern Matching - Equivalence of finite automata and regular expressions –Proving languages not to be regular (Pumping Lemma) –Closure properties of regular languages.		
Unit - III	**Context Free Grammar and Languages:**	**9+3**
Grammars - Production systems - Chomsky hierarchy - Context-Free Grammar (CFG)–Parse trees–Ambiguity in grammars and languages – Definition of the pushdown automata(PDA) – Pushdown automata –Acceptance by empty store and final state - Equivalence of pushdown automata and CFG-CFG to PDA - Deterministic Pushdown Automata.		
Unit - IV	**Context Free Languages and Turing Machines:**	**9+3**
Normal forms for CFG – Chomsky Normal Form and Greibach Normal Form – Pumping lemma for CFL –Closure properties of Context Free Languages. Turing machines: Basic model – definition and representation – Instantaneous Description – Language acceptance by TM – Variants of Turing Machine –TM as Computer of Integer functions –Programming techniques for Turing machines (subroutines) - Recursively enumerable sets and recursive sets - Context sensitive languages and linear bounded automata.		
Unit - V	**Undecidability:**	**9+3**
A language that is not Recursively Enumerable (RE) – An undecidable problem that is RE – Undecidable problems about Turing machine – Post's correspondence problem – Rice's theorem; decidability of membership, emptiness and equivalence problems of languages.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Hopcroft J.E., Motwani R. and Ullman J.D., "Introduction to Automata Theory, Languages and Computations", 3rd Edition, Pearson Education, New Delhi, 2008.

REFERENCES:

1. Kamala Krithivasan and Rama R., "Introduction to Formal Languages, Automata Theory and Computation", 1st Edition, Pearson Education, 2009.
2. Martin J., "Introduction to Languages and the Theory of Computation", 4th Edition, Tata McGraw-Hill, New Delhi, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply induction and contradiction methods for theorem proving.	Applying (K3)
CO2	design finite automata and regular expression for regular languages.	Applying (K3)
CO3	develop and normalize context free grammar for context free languages and demonstrate the recognition of context free languages using push down automata.	Applying (K3)
CO4	construct Turing Machine to accomplish specific task and argue formally about its correctness.	Applying (K3)
CO5	make use of Turing machines to distinguish decidable/ undecidable problems and compare different classes of problems.	Applying (K3)

Mapping of 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	1									2	1
CO5	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	7	26	67				100
CAT2	7	26	67				100
CAT3	7	26	67				100
ESE	7	26	67				100

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

18CSO03 - COMPUTATIONAL SCIENCE FOR ENGINEERS
(Offered by Department of Computer Science Engineering)

Programme & Branch	All BE/BTech Branches except Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	5	OE	3	1	0	4

Preamble	This is an introductory course on applications of computer simulation and modeling to real world simple and complex problems.	
Unit - I	**Modeling Process:**	**9+3**
Classification of modeling – Steps of modeling – System Dynamics: Unconstrained Growth and Decay - Constrained Growth – Drug Dosage.		
Unit - II	**Force and Motion:**	**9+3**
Modeling Falling and Skydiving – Bungee Jumping – The Pendulum Clock – Rocket motion.		
Unit - III	**System Dynamics Models:**	**9+3**
Competition – Predator-Prey Model – Modeling the spread of SARS – Enzyme Kinetics .		
Unit - IV	**Data Driven Models:**	**9+3**
Functions – Empirical Models – Simulating with Randomness: Simulations – Random numbers from various distributions – Random Walk.		
Unit - V	**Matrix Models:**	**9+3**
Matrices for Population Studies – Time after Time – Modeling with Markov Chains – The next Flu Pandemic.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Angela Shiflet, George B., Shiflet W., "Introduction to Computational Science: Modeling and Simulation for the Sciences", 2nd Edition, Princeton University Press, 2014.

REFERENCES:

1. Jerry Banks, John S. Carson, Barry L. Nelson, David M. Nicol, "Discrete-Event System Simulation: Pearson New International Edition", 5th Edition, Pearson Education Limited, 2013.
2. Panneerselvam R., Senthilkumar P., "System Simulation, Modelling and Languages", Eastern Economy Edition, PHI Learning Pvt. Ltd., 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	model system dynamics with and without constraints	Applying (K3)
CO2	formulate system dynamics involved in force and motion	Applying (K3)
CO3	construct models for systems with interactions	Applying (K3)
CO4	make use of randomness and data for modeling	Applying (K3)
CO5	apply matrix theory in problem solving	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	50	20				100
CAT2	10	50	40				100
CAT3	25	45	30				100
ESE	20	40	40				100

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

18CSO04 - WEB ENGINEERING

(Offered by Department of Computer Science and Engineering)

Programme & Branch	All BE/BTech Branches except Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Problem solving and programming	6	OE	3	0	2	4

Preamble	This course provides fundamental knowledge of networks and also provides skills necessary for developing web applications.	
Unit - I	**Basics of Computer Networks:**	**9**
Data Communications – Networks – Internet – Protocols and standards – Layered tasks – Layers in the OSI Model – TCP/IP Protocol suite – Addressing. Network Layer – IPv4Addresses: Address Space – Notations – Classful Addressing – Classless Addressing- Network Address Translation (NAT) – IPv6 Addresses: Structure – Address Space.		
Unit - II	**HTML and CSS :**	**9**
HTML 5 – Basic Tags – Input Tags – Page Structure Elements – Cascading Style Sheet: Inline Styles – Embedded Style Sheets – Conflicting Styles – Linking External Style Sheets – Positioning Elements – Background – Element Dimensions – Box Model and Text Flow – Media types and Media queries – Drop – Down Menus.		
Unit - III	**Client Side Scripting – Java Script:**	**9**
Introduction – Control Statements – Functions: Function Definition – Random Number Generation: Scaling and Shifting Random Number – Displaying Random Images – Scope Rules – Global Functions – Recursion – Recursion vs Iterations. – Arrays: Declaring and Allocating Arrays – Random Image Generator using Array – Sorting and Searching Array – Java Script Objects: Introduction – Math Object – String Object – Date Object – Boolean and Number Objects – Document Objects – Document Object Model: DOM Nodes and Trees – Traversing and Modifying a DOM Tree – DOM Collections – Dynamic Style – Events – Event Handling: Load Event – Mousemove – Mouseover and Mouseout - Form Processing Events.		
Unit - IV	**Database Concepts, MySQL and WebServer :**	**9**
Relational Database Concepts – Basic SQL – SELECT – INSERT – UPDATA – DELETE – MySQL – Setting Up a MySQL User Account – Creating Databases in MySQL – Web Servers – Introduction – HTTP Transactions – Multitier Application Architecture – Client-Side Scripting versus Server-Side Scripting Accessing Web Servers – XAMPP Installation – Running the Examples Using Apache HTTP Server.		
Unit - V	**Server Side Scripting PHP :**	**9**
Introduction – Data Type Conversion – Operators – Arrays – Strings Comparisons – String Processing: Searching for Expressions – Representing Patterns – Finding Matches – Character Classes – Finding Multiple Instance of a Pattern – Regular Expressions – Form Processing – Database Connectivity – Session Tracking.		

List of Exercises / Experiments :

1.	Design a web page using HTML tags and host it in github repository.
2.	Create a HTML document to implement types of CSS.
3.	Design a web page with menu layout. Apply the various formatting using CSS.
4.	Design a Registration page and perform form validation using JavaScript.
5.	Write a JavaScript program to use Objects and Collections.
6.	Design an webpage to create simple interactive CGPA calculator using DOM
7.	Write a program using PHP and HTML to create a registration form and display the details entered by the user.
8.	Create a website for student mark maintenance system using PHP and MySQL
9.	Create a website to illustrate Session Tracking in PHP.
10.	Develop and deploy online reservation system using Java script, CSS, PHP, MySQL with Session Tracking.

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Forouzan, Behrouz. A , "Data Communication and Networking", 5th Edition, Tata McGraw – Hill, 2013 for Unit I.
2.	Paul Deitel, Harvey M.Deitel and Abbey Deitel, "Internet and World Wide Web - How To Program", 5th Edition, Prentice Hall, 2011 for Units II,III,IV,V.

REFERENCES:

1.	Xavier C, "World Wide Web Design with HTML", 2nd Edition, Tata McGraw Hill, New Delhi, 2012.
2.	Godbole A.S. and Kahate A., "Web Technologies", 3rd Edition, Tata McGraw-Hill, New Delhi, 2013.

	COURSE OUTCOMES: On completion of the course, the students will be able to	**BT Mapped (Highest Level)**
CO1	outline the fundamental concepts of computer networking and internet.	Understanding (K2)
CO2	design static web pages using HTML and CSS	Applying (K3)
CO3	develop interactive web pages using JavaScript	Applying (K3)
CO4	apply SQL Queries to create and manipulate relational databases	Applying (K3)
CO5	develop web application using PHP with database connectivity and session tracking	Applying (K3)
CO6	develop interactive web pages using HTML, CSS, JavaScript	Applying (K3), Precision (S3)
CO7	validate the HTML form data using Java script	Applying (K3), Precision (S3)
CO8	develop a web application to maintain information in a database using server-side scripting.	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	2	1	2											
CO2	3	2	2	1										
CO3	3	2	2	1										
CO4	3	2	2	1										
CO5	3	2	2	1										
CO6	3	2	2	1										
CO7	3	2	2	1										
CO8	3	2	2	1										

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

ASSESSMENT PATTERN - THEORY

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

18CSO05 - FOUNDATIONS OF DATA ANALYTICS

(Offered by Department of Computer Science and Engineering)

Programme & Branch	All BE/BTech Branches except Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	6	OE	3	1	0	4

Preamble	This course provides an understanding of the basics of data analytics and provides knowledge of various statistical analysis methods and regression models.	
Unit - I	**Introduction:**	**9+3**
Introduction: Modeling: graphical models, algebraic models, spread sheet models – seven step modeling process. Introduction to Statistics – Normal and Non- normal distributions.		
Unit - II	**Data Analysis:**	**9+3**
Data Analysis: Exploratory Analysis: Distribution of single variable – basic concepts – categorical variables, numerical variables – time series data outliers – missing values. Finding relationships among variables		
Unit - III	**Decision Making Under Uncertainty:**	**9+3**
Decision Making Under Uncertainty: Elements of decision analysis – Bayes' rule – Multistage decision problems – Incorporating attitudes towards risk.		
Unit - IV	**Regression Analysis:**	**9+3**
Regression Analysis: Estimating relationships- Graphing Relationships- Indicators of linear relationships – Simple Linear Regression- Multiple Regression- Statistical Inference: Model- Inferences about Regression coefficients- Multicollinearity- Include/Exclude Decisions- Stepwise Regression – The partial F test – Outliers		
Unit - V	**Data Visualization:**	**9+3**
Time Series Analysis and Forecasting: Forecasting methods – Testing for randomness – Regression based trend models – Random walk model – Autoregression models – Moving averages – Exponential smoothing.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Albright S Christian, Winston Wayne L and Zappe Christopher, "Data analysis and Decision Making", South Western College Publication, 2010

REFERENCES:

1. James R Evans, "Statistics, Data analysis and Decision modeling", Prentice Hall, 2012.
2. Andrew Gelman and Jennifer Hill, "Data Analysis Using Regression and Multilevel/Hierarchical Model", Cambridge University Press, 2006.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	utilize the modeling process and statistical methods for data analysis	Applying (K3)
CO2	explore and prepare the data for analysis	Applying(K3)
CO3	make use of various elements of decision analysis under uncertainty	Applying (K3)
CO4	apply various regression models for solving a given problem	Applying (K3)
CO5	use various forecasting methods and time series analysis for prediction	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	50	30				100
CAT2	15	50	35				100
CAT3	15	50	35				100
ESE	10	40	50				100

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

18CSO05 - FOUNDATIONS OF DATA ANALYTICS

(Offered by Department of Computer Science and Engineering)

Programme & Branch	All BE/BTech Branches except Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	6	OE	3	1	0	4

Preamble	To understand the basics of data analytics and to provide knowledge of various statistical analysis methods and regression models	
Unit - I	**Introduction::**	**9+3**
Data science – Basic skills of a data scientist – Role of Data Scientist. Data analysis: Decision making – modeling: graphical models – algebraic models – spread sheet models – seven step modeling process. Data Wrangling: Introduction – Common Data Formats – Sanity Checking of Data Dealing with missing data.		
Unit - II	**Data Analysis::**	**9+3**
Introduction to Statistics – Normal and Non- normal distributions. Exploratory Analysis: Distribution of single variable – basic concepts – categorical variables, numerical variables – time series data outliers – missing values. Finding relationships among categorical variables and numerical variables.		
Unit - III	**Decision Making Under Uncertainty::**	**9+3**
Elements of decision analysis – Bayes' rule – Multistage decision problems – Incorporating attitudes towards risk.		
Unit - IV	**Regression Analysis::**	**9+3**
Estimating relationships – statistical inference – forecasting methods – testing for randomness – regression based trend models – random walk models – autoregression models – moving averages – exponential smoothing.		
Unit - V	**Data Visualization::**	**9+3**
Introduction – Different data types – Data scales – Multivariate data. Applications: Technology: Map reduce paradigm – NOSQL – ggplot. Domains: Time Series Analysis – Topic Modeling – Recommender System.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Albright S Christian, Winston Wayne L and Zappe Christopher, "Data analysis and Decision Making", NA Edition, South Western College Publication, 2010.

REFERENCES:

1. James R Evans, "Statistics, Data analysis and Decision modeling", Prentice Hall, 2012.
2. Andrew Gelman and Jennifer Hill, "Data Analysis Using Regression and Multilevel/Hierarchical Model", Cambridge University Press, 2006.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	outline the basics of data science	Understanding (K2)
CO2	apply the statistical analysis methods	Applying (K3)
CO3	make use of elements of decision making	Applying (K3)
CO4	apply various regression models	Applying (K3)
CO5	use visualization techniques and various technologies of data analytics	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	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	15	50	35				100
CAT3	15	50	35				100
ESE	10	40	50				100

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

18CSO06 - NATURE INSPIRED OPTIMIZATION TECHNIQUES

(Offered by Department of Computer Science and Engineering)

Programme & Branch	All BE/BTech Branches except Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	6	OE	3	1	0	4

Preamble	The course helps the learners to understand the algorithms that are inspired by naturally occurring phenomena. The focus is on abstracting nature inspired techniques which influence computing, study the Swarm Intelligence and Immuno-computing techniques and familiarize the DNA Computing and Quantum computing.	
Unit - I	**Introduction:**	**9**
Philosophy of Natural Computing – Three Branches:Overview – Conceptualization –Individuals – Entities and agents – Parallelism – Distributivity – Interactivity – Adaptation – Feedback – Self-Organization – Complexity – Emergence and Reductionism – Bottom-up Vs Top-Down – Determination – Chaos and Fractals.		
Unit - II	**Computing Inspired By Nature:**	**9**
Evolutionary Computing – Hill Climbing and Simulated Annealing – Evolutionary biology – Darwin's Dangerous Idea – Genetics Principles – Standard Evolutionary Algorithm – Genetic Algorithms – Selection-Crossover – Mutation – Neurocomputing – Artificial neurons – network architecture – learning approaches – Hebbian learning – Single layer perceptron – Multi-layer perceptron- Self organization maps – discrete Hopfield network.		
Unit - III	**Swarm Intelligence:**	**9**
Introduction – Ant Colonies – Ant Foraging Behavior – Ant Colony Optimization – Simple ACO and scope of ACO algorithms – Ant Clustering Algorithm (ACA) – Swarm Robotics – Foraging for food – Social Adaptation of Knowledge – Particle Swarm Optimization (PSO) – Scope of PSO – social systems to particle swarm.		
Unit - IV	**Immuno Computing:**	**9**
Introduction – Immune System – Physiology and main components – Pattern Recognition and Binding – adaptive immune response – Self/Non-self discrimination – Immune Network Theory – Danger Theory – artificial immune systems – Evaluating Interaction – Immune Algorithms – Bone Marrow Models – Negative selection algorithms – Clonal selection and affinity maturation – Artificial Immune Networks.		
Unit - V	**Computing With New Natural Materials:**	**9**
DNA Computing – Basic concepts – DNA Molecule – Filtering models – Adleman's experiment – Test tube programming language – Formal models – Universal DNA Computers – Scope of DNA Computing – From Classical to DNA Computing – Quantum computing – Introduction – basic concepts from quantum theory – principles from quantum mechanics.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Leandro Nunes de Castro, " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007.

REFERENCES:

1. Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, 2008.
2. Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply fundamental concepts of Natural Inspired Systems.	Applying (K3)
CO2	manipulate the evolutionary and neuro Computing techniques inspired by nature.	Applying (K3)
CO3	implement collective intelligence of biological systems to computing.	Applying (K3)
CO4	develop immune systems behavior to computing and optimization.	Applying (K3)
CO5	make use of the characteristics of DNA computing and Quantum Computing.	Applying (K3)

Mapping of 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	17	46	37				100
CAT2	17	30	53				100
CAT3	17	30	53				100
ESE	15	30	55				100

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

18CSO07 - INTRODUCING DATA SCIENCE

(Offered by Department of Computer Science and Engineering)

Programme & Branch	All BE/BTech Branches except Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	6	OE	3	1	0	4

Preamble	This course help students to understand the concepts of data science and its lifecycle for analyzing big data and to solve real world problems in different scenarios.	
Unit - I	**Data Science in a Big Data World:**	**9**
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:**	**9**
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	**Big Data:**	**9**
Distributing Data Storage and Processing with Frameworks: Hadoop – Spark – Case Study: Assessing Risk with Loaning Money.		
Unit - IV	**NoSQL:**	**9**
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	**Test Mining and Text Analytics:**	**9**
Test Mining in Real World – Text Mining Techniques: Bag of Words – Stemming and Lemmatization – Decision Tree Classifier – Case Study: Classifying Reddit Posts.		

Total:45

TEXT BOOK:

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

REFERENCES:

1. John Wiley and Sons , "Data Science and Big data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", EMC Education Services, 2015.
2. Joel Grus, "Data Science from the Scratch", O'Reilly, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	outline the concepts of data science for building applications	Understanding (K2)
CO2	utilize machine learning techniques for solving problems with large data	Applying (K3)
CO3	recognize the usage of Hadoop and Spark in data science	Applying (K3)
CO4	apply the data science process to solve real world problem by using NoSQL database	Applying (K3)
CO5	make use of text analytics techniques for building 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	2	1												
CO2	3	2	2	1										
CO3	3	2	2	1										
CO4	3	2	2	1										
CO5	3	2	2	1										

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	45	35				100
CAT2	20	20	60				100
CAT3	20	20	60				100
ESE	20	20	60				100

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

18CSO08 - ARTIFICIAL INTELLIGENCE AND ITS APPLICATIONS

(Offered by Department of Computer Science and Engineering)

Programme & Branch	All BE/BTech Branches except Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	7	OE	3	0	0	3

Preamble	The AI community is always focused on using computers to investigate and validate theories of human cognition and at the same time engineer systems to perform tasks where humans excel at present. This is an introductory course in Artificial Intelligence (AI) to students from multi disciplinary branches focusing on Intelligent agent design with applications.	
Unit - I	**Introduction, Intelligent Agents and Problem-solving::**	**9**
Definition – History – State of the art – Agents and Environments – Good behaviour and the concepts of rationality – Nature of environments – Structure of Agents – Problem-Solving Agents – Example problems – Searching for Solutions – Uninformed Search Strategies – Informed (Heuristic) Search Strategies – Heuristic Functions.		
Unit - II	**Logical Agents, First-Order Logic and Inference in First-Order Logic::**	**9**
Logic – Propositional Logic – Propositional Theorem Proving – Syntax and Semantics of First-Order Logic – Using First-Order Logic – Propositional vs. First-Order Inference – Unification and Lifting – Forward Chaining – Backward Chaining – Resolution.		
Unit - III	**Classical Planning and Planning and Acting in the Real World::**	**9**
Definition of Classical Planning –Algorithms for Planning as State-Space Search – Planning Graphs – Time, Schedules and Resources – Hierarchical Planning – Constraint Satisfaction Problems.		
Unit - IV	**Quantifying Uncertainty and Probabilistic Reasoning::**	**9**
Acting under Uncertainty – Basic Probability Notation – Inference Using Full Joint Distributions – Independence – Bayes Rule and Its Use – Representing Knowledge in an Uncertain Domain – Semantics of Bayesian Networks.		
Unit - V	**Applications::**	**9**
Language Models – Information Retrieval – Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot Hardware – Perception – Planning to Move – Moving.		

Total:45

TEXT BOOK:

1.	Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Pearson Education, NA, 2013.

REFERENCES:

1.	Khemani D, "A First Course in Artificial Intelligence", McGraw Hill Education Private Limited, India, 2013.
2.	Elaine Rich, Kelvin Knight and Shivashankar B Nair, "Artificial Intelligence", 3rd Edition, McGraw Hill Education Private Limited, India, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	paraphrase Artificial Intelligence, intelligent agents, and apply search to solve problems.	Applying (K3)
CO2	interpret the role of logics in AI.	Applying (K3)
CO3	apply the concepts of planning in problem solving.	Applying (K3)
CO4	address uncertainty in real world problems.	Applying (K3)
CO5	describe the applications of AI in different domains.	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	2	1	1										
CO5	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	40	50				100
CAT2	10	10	80				100
CAT3	10	40	50				100
ESE	10	40	50				100

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

18GEO03 - DESIGN THINKING FOR ENGINEERS

(Offered by Department of Computer Science and Engineering)

Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	7	OE	3	0	0	3

Preamble	In this course, systematic process of thinking which empowers even the most traditional thinker to develop new, innovative solutions to the problem at handare studied with an emphasis on bringing ideas to life based on how real users think, feel and behave.	
Unit - I	**Introduction::**	**9**
Introduction – Need for design thinking – Design and Business – The Design Process – Design Brief –Visualization – Four Questions, Ten Tools – Explore – STEEP Analysis – Strategic Priorities – Activity System – Stakeholder Mapping – Opportunity Framing.		
Unit - II	**Visualization:**	**9**
Introduction – Visualization – Journey Mapping – Value Chain Analysis – Mind Mapping – Empathize –Observations – Need Finding – User Personas.		
Unit - III	**Brainstorming:**	**9**
Introduction – Brainstorming – Concept Development – Experiment – Ideation – Prototyping – Idea Refinement.		
Unit - IV	**Assumption Testing:**	**9**
Introduction – Assumption Testing – Rapid Prototyping – Engage – Storyboarding.		
Unit - V	**Customer Co-Creation Learning Launch:**	**9**
Introduction – Customer Co-Creation Learning Launch – Leading Growth and Innovation – Evolve– Concept Synthesis – Strategic Requirements – Evolved Activity Systems – Quick Wins.		

Total:45

TEXT BOOK:

1. Jeanne Liedtka and Tim Ogilvie, "Designing for Growth: A Design Thinking Tool Kit for Managers", Columbia University Press, 2011.

REFERENCES:

1. Lee Chong Hwa, "Design Thinking The Guidebook", Design Thinking Master Trainers of Bhutan, 2017.
2. Jeanne Liedtka, Tim Ogilvie, and Rachel Brozenske, "The Designing for Growth FieldBook: A Step-by-Step Project Guide", Columbia University Press, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	outline the basic concepts of design thinking	Understanding (K2)
CO2	make use of the mind mapping process for designing any system	Applying (K3)
CO3	develop many creative ideas through structured brainstorming sessions.	Applying (K3)
CO4	develop rapid prototypes to bring the ideas into reality	Applying (K3)
CO5	plan the implementation of the any system considering the real time feedback	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	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	10	70	20				100
CAT2	10	30	60				100
CAT3	10	20	70				100
ESE	10	20	70				100

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

18CSO09 - APPLIED MACHINE LEARNING

(Offered by Department of Computer Science and Engineering)

Programme & Branch	All BE/BTech Branches except Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	8	OE	3	0	0	3

Preamble	To understand the fundamental concepts of machine learning and to provide knowledge to identify machine learning algorithms for real world applications.	
Unit - I	**Machine Learning Basics:**	**9**
Machine Learning for Predictive Data Analytics – Data to Insight to Decisions – Data Exploration: Data Quality Report – Know the Data– Identifying Data Quality Issues– Handling Data Quality Issues.		
Unit - II	**Information – Based Learning:**	**9**
: Fundamentals–Decision Trees – Shannon's Entropy Model – Information Gain- ID3 Algorithm. Similarity Based Learning: Fundamentals – The Nearest Neighbor Algorithm – Extensions and Variations.		
Unit - III	**Probability – Based Learning :**	**9**
Bayes' Theorem–Bayesian Prediction– Conditional Independence and Factorization – The Naive Bayes Model– Example – Error Based Learning: Simple Linear Regression – Measuring Error – Error Surface – Multivariable Linear Regression with Gradient Descent – Extensions and Variations.		
Unit - IV	**Multilayer Perceptron and Clustering:**	**9**
Multilayer Perceptron Introduction – The Perceptron – Training a Perceptron – Learning Boolean Functions – Multilayer Perceptron – Backpropagation Algorithm – K- Means Clustering – Example.		
Unit - V	**Evaluation:**	**9**
Fundamentals – Misclassification Rate on a Hold-out Test Set – Designing Evaluation Experiments – Performance Measures – Evaluating Model after Deployment – Case Study.		

Total:45

TEXT BOOK:

1. John D. Kellehar, Brian Mac Namee, Aoife D'Arcy, "Fundamentals of Machine Learning for Predictive Data Analytics , Algorithms, Worked Examples, and Case Studies", MIT Press, 2015.

REFERENCES:

1. EthemAlpaydin, "Introduction to Machine Learning", 3rd Edition, Prentice Hall, India, 2015.
2. Madan Gopal,, "Applied Machine Learning", McGraw-Hill Education, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	Outline the fundamental concept of machine learning	Understanding (K2)
CO2	utilize supervised and unsupervised learning algorithms to solve data analytics problem	Applying (K3)
CO3	solve real world problems associated with probability and error based learning	Applying (K3)
CO4	compute solutions to classification problems using multilayer perceptron	Applying (K3)
CO5	compare the performance of the model using various performance measures	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

18CSO10 - FUNDAMENTALS OF BLOCKCHAIN

(Offered by Department of Computer Science and Engineering)

Programme & Branch	All BE/BTech Branches except Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	8	OE	3	0	0	3

Preamble	The widespread popularity of digital cryptocurrencies has led the foundation of Blockchain, which is fundamentally a public digital ledger to share information in a trustworthy and secure way. The concept and applications of Blockchain have now spread from cryptocurrencies to various other domains, including business process management, smart contracts, IoT and so on. This course provides technical fundamentals of Blockchain, practical implications, and hands on development aspects of Blockchain applications.	
Unit - I	**Introduction::**	**9**
History – What is blockchain – Centralized vs. Decentralized Systems – Layers of Blockchain – Importance – Blockchain Uses and Use Cases – Laying the Blockchain Foundation – cryptography.		
Unit - II	**How Blockchain Works::**	**9**
Game Theory – Prisoner's Dilemma – Byzantine Generals' Problem – The Blockchain – Merkle Trees – Properties of Blockchain Solutions – Blockchain Transactions – Distributed Consensus Mechanisms – Blockchain Applications – scaling blockchain.		
Unit - III	**Bitcoin::**	**9**
The History of Money – Working with Bitcoins – The Bitcoin Blockchain – The Bitcoin Network – Bitcoin Scripts – Full Nodes Vs. SPVs – Bitcoin Wallets.		
Unit - IV	**Ethereum ::**	**9**
Bitcoin to Ethereum – Ethereum Blockchain – Ethereum Smart Contracts – Ethereum Virtual Machine and Code Execution – Ethereum Ecosystem – Swarm – Whisper – Dapp – Development Components.		
Unit - V	**Blockchain Application Development ::**	**9**
Decentralized Applications – Blockchain Application Development – Interacting with the Bitcoin Blockchain – Sending Transactions – Creating a Smart Contract – Executing Smart Contract Functions – Public Vs. Private Blockchains – Decentralized Application Architecture – Building an Ethereum DApp.		

Total:45

TEXT BOOK:

1. BikramadityaSinghal, GautamDhameja, Priyansu Sekhar Panda, "Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions", Apress, 2018.

REFERENCES:

1. Brenn Hill, Samanyu Chopra, Paul Valencourt, "Blockchain Quick Reference: A guide to exploring decentralized blockchain application development", Packt publishing, 2018.
2. Imran Bashir, "Mastering Blockchain Distributed ledgers, decentralization and smart contracts Explained", Packt Publishing, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	outline the history,background, and theoretical aspects of blockchain	Understanding (K2)
CO2	illustrate core components of Blockchain	Understanding (K2)
CO3	present Bitcoin's technical concepts	Understanding (K2)
CO4	exhibit Ethereum blockchain for different usecases	Applying (K3)
CO5	demonstrate the end-to-end development of a decentralized 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	2	1												
CO2	2	1												
CO3	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	50	50					100
CAT2	30	50	20				100
CAT3		50	50				100
ESE	30	45	25				100

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

18CSO11 - FUNDAMENTALS OF INTERNET OF THINGS

(Offered by Department of Computer Science and Engineering)

Programme & Branch	All BE/BTech Branches except Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	8	OE	3	0	0	3

Preamble	The course focuses on the fundamentals of IoT. The IoT Enabling Technologies are also discussed. In order to realise the purpose of IoT, the course includes Python programming for IoT. At the end of the course, the students will be able to develop real time IoT applications.	
Unit - I	**Introduction to Internet of Things:**	**9**
Definition and Characteristics of IoT – Physical design of IoT – Logical Design of IoT: IoT Functional Blocks – IoT Communication models and APIs – IoT Enabling Technologies –IoT Levels and Deployment 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-Weather Monitoring.		
Unit - III	**Python Packages for IoT:**	**9**
JSON – XML – HTTPLib and URLLib – SMTPLib. Introduction to Raspberry Pi and Cloud Offerings: Introduction to Raspberry Pi – Interfaces (serial, SPI, 12C) Programming – Python program with Raspberry Pi (interfacing external devices) – controlling output – reading input from pins – WAMP – Xively cloud for IoT – Amazon web services for IoT(Amazon EC2 and Auto Scaling).		
Unit - IV	**Data Analytics for IoT :**	**9**
Apache Hadoop – Hadoop MapReduce for batch data analysis – Apache Oozie, Apache Spark – Apache Storm for real time data analysis – Tools for IoT: Chef – Puppet – Case Studies.		
Unit - V	**IoT Use cases:**	**9**
Smart and Connected Cities – An IoT Strategy for Smarter Cities – Architecture – Use cases: Street Lighting – Smart Parking – Smart Traffic – Smart Home.		

Total:45

TEXT BOOK:

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things - A Hands-on Approach", Universities Press, 2015 for Units I,II,III,IV.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2017 for Unit IV.

REFERENCES:

1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain the physical/ logical design of IoT and choose an appropriate IoT level for the given applications and examine them.	Analyzing (K4)
CO2	summarize the fundamental concepts of M2M, role of SDN and NFV in IoT and develop design methodologies for a given application.	Applying (K3)
CO3	outline the concepts of Python with regard to Internet of Things and develop applications using Raspberry Pi.	Applying (K3)
CO4	identify the need for tools used in IoT data analytics and apply it based on the requirement of application.	Applying (K3)
CO5	describe the role of Internet of Things in different domains.	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2											
CO2	3	2	1											
CO3	3	2	1	1	2									
CO4	3	2	1		1									
CO5	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	35	15			100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	25	40	15			100

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

18MAO01 - MATHEMATICAL FOUNDATIONS OF MACHINE LEARNING

(Offered by Department of Mathematics)

Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	OE	3	1	0	4

Preamble	To impart the basic knowledge in linear algebra, decomposition of matrices, continuous optimization, linear regression and support vector machines which provide the foundations for machine learning and deep learning.	
Unit - I	**Vector Spaces:**	**9+3**
Definition – Subspaces – Linear dependence and independence – Basis and dimension – Row space, Column space and Null Space – Rank and nullity		
Unit - II	**Linear Transformations:**	**9+3**
Introduction – Kernel and range – Matrices of linear transformations – Change of basis – Rank and nullity.		
Unit - III	**Inner Product Spaces:**	**9+3**
Norms – Inner products – Length and Distance – Angle and Orthogonality – Orthonormal Basis – Gram-Schmidt Process – QR-Decomposition – Orthogonal Projection – Rotations.		
Unit - IV	**Matrix Decomposition And Continuous Optimization:**	**9+3**
Cholesky decomposition – Singular Value Decomposition, Continuous Optimization: Introduction – Unconstrained Optimization – Gradient Descent method – Constrained Optimization – Lagrange Multipliers method – Convex Optimization		
Unit - V	**Linear Regression And Support Vector Machines:**	**9+3**
Parameter Estimation – Maximum Likelihood estimation – Bayesian linear regression – Bayesian parameter estimation of Gaussian distribution, Support Vector Machines: Introduction – Margin and support vectors – Kernels – Primal support vector machine – Dual support vector machine.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Howard Anton and Chris Rorres, "Elementary Linear Algebra", 9th Edition, John Wiley and Sons, New Delhi, 2011 for Units I, II, III.
2. Deisenroth M.P., Faisal A.A. and Ong C.S., "Mathematics for Machine Learning", 1st Edition, Cambridge University Press, 2019 for Units IV, V.

REFERENCES:

1. David C. Lay, Steven R. Lay and Judith McDonald, "Linear Algebra and its Applications", 5th Edition, Pearson Education, New Delhi, 2016.
2. Ethem Alpaydin, "Introduction to Machine Learning(Adaptive Computation and Machine Learning series)", 4th Edition, MIT Press, USA, 2020.
3. Duda R.O., Hart E. and Stork D.G., "Pattern Classification", 2nd Edition, John Wiley and Sons, New Delhi, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand the concepts of vector spaces.	Understanding (K2)
CO2	apply the concepts of linear mappings in machine learning.	Applying (K3)
CO3	use the concept of inner product space and decompose the given matrix by means of orthonormal vectors.	Applying (K3)
CO4	apply the knowledge of factorisation of matrices and optimization techniques in clustering and classification of data.	Applying (K3)
CO5	describe the concepts of parameter estimation and support vector machine.	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	50	40				100
CAT2	10	20	70				100
CAT3	10	20	70				100
ESE	5	25	70				100

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

18MAO02 - GRAPH THEORY AND ITS APPLICATIONS

(Offered by Department of Mathematics)

Programme & Branch	All Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	6	OE	3	1	0	4

Preamble	To develop rigorous logical thinking and analytical skills by graph theoretic concepts which helps for solving real time engineering problems in networks, computer architecture, compiling techniques, model checking, artificial intelligence, software engineering, expert systems, software/hardware correctness problem.	
Unit - I	**Graphs:**	**9+3**
Introduction – Definition – Types of graphs – Degree of vertex – Walk, path and cycle – Isomorphism – Connected graph – Hamiltonian graph – Euler graph – Digraph – Representations of graphs: Adjacency matrix – Incidence matrix.		
Unit - II	**Trees:**	**9+3**
Introduction – Properties of trees – Pendant vertices in a tree – Distances and centers in a tree – Rooted and binary trees – Spanning tree – Construction of spanning tree: BFS algorithm – DFS algorithm – Tree traversal.		
Unit - III	**Graph Coloring:**	**9+3**
Vertex coloring – Chromatic number – Chromatic partitioning – Independent sets – Chromatic polynomial – Matching – Covering – Four color problem (statement only) – Simple applications.		
Unit - IV	**Basic Algorithms:**	**9+3**
Shortest paths – Shortest path algorithms: Dijkstra's algorithm – Warshall's algorithm – Minimum Spanning tree – Minimal spanning tree algorithms: Prim's algorithm – Krushkal's algorithm – Optimal assignment – Kuhn and Munkres algorithm – Travelling salesman problem: Two optimal algorithm – Closest Insertion Algorithm.		
Unit - V	**Network Flows and Applications:**	**9+3**
Flows and cuts in networks - Max-flow Min-cut Theorem – Algorithms: Flow Augmenting Path – Ford-Fulkerson Algorithm for Maximum Flow – Edmonds and Karp algorithm.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice Hall, New Delhi, 2010.

REFERENCES:

1. Douglas B.West, "Graph Theory", 2nd Edition, Prentice Hall, New Delhi, 2017.
2. Jonathan L. Gross & Jay Yellen, "Graph Theory and its Applications", 2nd Edition, CRC Press, New York, 2006.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain the types of graphs and illustrate isomorphism on graphs.	Understanding (K2)
CO2	use the concepts and properties of different types of trees in data structures.	Applying (K3)
CO3	estimate the chromatic partition, chromatic polynomial and matching of a given graph.	Applying (K3)
CO4	apply various graph theoretic algorithms to communication and network problems.	Applying (K3)
CO5	identify the maximal flow in network by means of algorithms.	Applying (K3)

Mapping of COs with POs and PSOs

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

18MAO03 - NUMBER THEORY AND CRYPTOGRAPHY

(Offered by Department of Mathematics)

Programme & Branch	All Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	6	OE	3	1	0	4

Preamble	To provide the skills for applying various number theoretic algorithms, congruences, primality tests in cryptography and network security and impart knowledge of basic cryptographic techniques.	
Unit - I	**Divisibility Theory and Canonical Decompositions:**	**9+3**
Division algorithm- Base-b representations – number patterns – Prime and composite numbers – Fibonacci and Lucas numbers – Fermat numbers – GCD – Euclidean Algorithm – Fundamental theorem of Arithmetic – LCM.		
Unit - II	**Theory of Congruences:**	**9+3**
Basic concepts – Properties of congruences – Linear congruences – Solution of congruences – Fermat's Little theorem – Euler's theorem – Chinese remainder theorem.		
Unit - III	**Number Theoretic Functions:**	**9+3**
Introduction – Functions τ and σ– Mobius function – Greatest integer function – Euler's Phi function – Euler's theorem – Properties of Euler's function – Applications to Cryptography.		
Unit - IV	**Primality Testing and Factorization:**	**9+3**
Primality testing: Fermat's pseudo primality test – Solvay-Strassen test – Miller-Rabin test – Fibonacci test – Lucas test – Integer factorization: Trial division – Pollard's Rho method – Quadratic sieve method.		
Unit - V	**Classical Cryptographic Techniques:**	**9+3**
Introduction – Substitution techniques – Transposition techniques – Encryption and decryption – Symmetric and asymmetric key cryptography – Steganography.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Thomas Koshy, "Elementary Number Theory with Applications", 2nd Edition, Academic Press, Elsevier, USA, 2007 for Units I, II, III.
2. William Stallings, "Cryptography and Network Security: Principles and Practice", 7th Edition, Pearson Education, New Delhi, 2019 for Units IV, V.

REFERENCES:

1. Ivan Niven, Herbert S. Zukerman & Hugh L. Montgomery, "An Introduction to the Theory of Numbers", Reprint Edition, John Wiley & Sons, New Delhi, 2008.
2. Bernard Menezes, "Cryptography and Network Security", 1st Edition, Cengage Learning India, New Delhi, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand various the concepts of divisibility and canonical decompositions.	Understanding (K2)
CO2	obtain knowledge in theory of congruences and solution of linear congruences.	Applying (K3)
CO3	use different number theoretic function suitably in cryptography.	Applying (K3)
CO4	apply various Primality test and factorisation algorithms to network security problems.	Applying (K3)
CO5	identify the suitable cryptographic techniques to handle real time security issues.	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18MAO04 - ADVANCED LINEAR ALGEBRA

(Offered by Department of Mathematics)

Programme & Branch	All Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	7	OE	3	0	0	3

Preamble	To provide the skills for applying linear equations, decomposition of matrices and linear transformations in real time engineering problems and impart knowledge of vector spaces.	
Unit - I	**Linear Equations:**	**9**
System of linear equations – Row reduction and echelon forms – Vector equations – Matrix equations – Solution sets of linear systems – Applications of Linear systems: Matrix operations – inverse of a matrix, Matrix factorization – Applications to computer graphics.		
Unit - II	**Vector Spaces:**	**9**
Definition – Subspaces – Linear dependence and independence – Basis and dimension – Row space, Column space and Null Space – Rank and nullity.		
Unit - III	**Inner Product Space:**	**9**
Inner products – Angle and Orthogonality in inner product spaces – Orthonormal Bases – Gram-Schmidt Process – QR-Decomposition – Orthogonal Projection – Least square technique.		
Unit - IV	**Linear Transformations:**	**9**
General linear transformation – Kernel and range – Matrices of linear transformations – Change of basis – Rank and nullity.		
Unit - V	**Eigenvalues and Eigenvectors:**	**9**
Definition – Orthogonal Diagonalization – Quadratic forms – Quadratic surfaces – Singular value decomposition – Applications.		

Total: 45

TEXT BOOK:

1. Howard Anton & Chris Rorres, "Elementary Linear Algebra", 11th Edition, John Wiley & Sons, USA, 2014.

REFERENCES:

1. David C. Lay, Steven R. Lay & Judith McDonald, "Linear Algebra and its Applications", 5th Edition, Pearson Education, New Delhi, 2016.
2. Gareth Williams, "Linear Algebra with Applications", 8th Edition, Jones & Barlett Learning, USA, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	use the concepts of matrices and vectors in the solution of a system of linear equations.	Applying (K3)
CO2	understand the concepts of vector spaces.	Understanding (K2)
CO3	understand the concept of inner product space and decompose the given matrix by means of orthonormal vectors.	Understanding (K2)
CO4	transform the system from one dimension to another and represent the pertinent linear transformation in matrix form.	Applying (K3)
CO5	apply the knowledge of quadratic forms and techniques of singular value decomposition for problems arising in power/control system analysis, signals and 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											
CO2	3	1												
CO3	3	1	1											
CO4	3	2	1											
CO5	3	2	2											

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

ASSESSMENT PATTERN - THEORY

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

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

18MAO05 - OPTIMIZATION TECHNIQUES

(Offered by Department of Mathematics)

Programme & Branch	All Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	7	OE	3	0	0	3

Preamble	To provide the skills for solving the real time engineering problems involving linear, non-linear, transportation and assignment problems and also impart knowledge in project management and game theoretic concepts.	
Unit - I	**Linear Programming:**	**9**
Introduction – Formulation of Linear Programming Problem – Advantages of Linear Programming methods – Limitations of Linear Programming models – Standard form of LPP – Graphical Method – Simplex Method – Artificial variable techniques – Big M Method.		
Unit - II	**Transportation Problem:**	**9**
Mathematical Formulation of Transportation Problem – Initial basic feasible solution – North West Corner Method – Least Cost Method – Vogel's approximation method – Optimal solution – MODI Method – Degeneracy – Unbalanced transportation problem – Maximization transportation problem.		
Unit - III	**Assignment Problem and Theory of Games:**	**9**
Assignment Problem: Mathematical model of Assignment problem – Hungarian Method – Unbalanced assignment problem. Theory of Games: Two-person zero-sum game – Pure strategies - Game with mixed strategies – Rules of Dominance – Solution methods: Algebraic method – Matrix method – Graphical method.		
Unit - IV	**Project Management:**	**9**
Basic Concept of network Scheduling – Construction of network diagram – Critical path method – Programme evaluation and review technique – Project crashing – Time-cost trade-off procedure.		
Unit - V	**Non-Linear Programming:**	**9**
Formulation of non–linear programming problem – Constrained optimization with equality constraints – Kuhn-Tucker conditions – Constrained optimization with inequality constraints.		

Total: 45

TEXT BOOK:

1. Kanti Swarup, Gupta P.K. & Man Mohan, "Operation Research", 14th Edition, Sultan Chand & Sons, New Delhi, 2014.

REFERENCES:

1. Sharma J.K., "Operations Research – Theory and Applications", 4th Edition, Macmillan Publishers India Ltd., New Delhi, 2009.
2. Gupta P.K. & Hira D.S., "Operations Research: An Introduction", 6th Edition, S.Chand and Co. Ltd, New Delhi, 2008.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	formulate and solve linear programming problems.	Applying (K3)
CO2	apply transportation algorithms in engineering problems.	Applying (K3)
CO3	use assignment and game theory concepts in practical situations.	Applying (K3)
CO4	handle the problems of Project Management using CPM and PERT.	Applying (K3)
CO5	solve various types of Non-linear Programming 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											
CO2	3	1	1											
CO3	3	1												
CO4	3	2	1											
CO5	3	2	1											

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	5	10	85				100
CAT2	5	10	85				100
CAT3	5	10	85				100
ESE	5	10	85				100

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

18PHO01 - THIN FILM TECHNOLOGY
(Offered by Department of Physics)

Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	OE	3	1	0	4

Preamble	This course aims to impart the essential knowledge on deposition, characterization and application of thin films in various engineering fields, and also provides motivation towards innovations.	
Unit - I	**Theories and models of thin film growth:**	**9+3**
Introduction - Theories of thin film nucleation: Impingement, Adsorption and Thermal accommodation - The capillarity model - The atomistic models - Structural consequences of thin film nucleation - The four stages of film Growth - The incorporation of defects during growth.		
Unit - II	**Vacuum technology:**	**9+3**
Principle and working of vacuum pumps: Roots pump, Rotary pump, Diffusion pump, Turbo molecular pump, Cryogenic-pump, Ion pump, Ti-sublimation pump - Measurement of Pressure: Bayet-Albert gauge, Pirani and Penning gauge - Cold cathode and hot cathode ionization gauges - Pressure controlling system (qualitative).		
Unit - III	**Deposition of thin films - Physical methods:**	**9+3**
Thermal evaporation – Electron beam evaporation – Pulsed laser deposition – Ion plating – DC sputtering – RF sputtering – Magnetron sputtering – Reactive sputtering - Molecular beam epitaxy - Demonstration of deposition of thin films by RF sputtering.		
Unit - IV	**Deposition of thin films – Chemical methods:**	**9+3**
Chemical vapor deposition – Sol-gel method - Chemical bath deposition - Hydro thermal methods – Electroplating deposition - Electroless deposition - Spray Pyrolysis - Spin coating.		
Unit - V	**Characterization and Applications of thin films:**	**9+3**
Characterization: X-ray diffraction, Energy dispersive X-ray analysis, Atomic probe microscopy, UV-vis spectroscopy, Four probe resistivity – Applications (qualitative): Thin film resistors, Thin film capacitors, Thin film diodes, Thin film transistors, Thin film solar cells, Thin film gas sensors, Thin films for information storage and Optical coatings.		

Lecture:45, Tutorial:15,Total:60

TEXT BOOK:

1. Maissel L.I. and Glang R., "Hand book of Thin Film Technology", McGraw Hill Inc., 1970 for Units I,II,III, IV.
2. Zhang S., Li L. and Kumar A., "Materials Characterization Techniques", CRC Press, 2009 for Unit V.

REFERENCES:

1. Ohring M., "Material Science of Thin Films", Academic Press, 1992.
2. Goswami A., "Thin Film Fundamentals", New Age International Pvt. Ltd., 2003.
3. Chopra K.L., "Thin Film Phenomena", McGraw Hill Inc., 1969.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	utilize the appropriate theory and models to comprehend the thin film growth process.	Applying (K3)
CO2	apply the principle of vacuum pump to explain select methods to create vacuum and to make use of the principle of vacuum gauge to explain the measurement of vacuum by select methods.	Applying (K3)
CO3	describe the deposition of thin films by select physical methods using the principle of working of respective methods.	Applying (K3)
CO4	explain the deposition of thin films by select chemical methods using the principle of working of respective methods.	Applying (K3)
CO5	make use of select characterization techniques to comprehend the properties of thin films and also to illustrate the various device applications of thin films.	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18PHO02 - STRUCTURAL AND OPTICAL CHARACTERIZATION OF MATERIALS

(Offered by Department of Physics)

Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	7	OE	3	0	0	3

Preamble	This course aims to impart the essential knowledge on the characterization of materials using X-ray diffraction, Raman spectroscopy, UV-visible spectroscopy, Electron microscopy and Scanning tunneling microscopy and their application in various engineering fields, and also provides motivation towards innovations.	
Unit - I	**Introduction to Characterization Techniques and X-Ray Diffraction:**	**9**
Importance of materials characterization - Classification of characterization techniques - Destructive and non-destructive techniques - Crystalline materials - Reciprocal lattice - Theory of X-ray diffraction - Powder and Single crystal X-ray diffraction: Instrumentation, XRD pattern, Systematic procedure for structure determination, Particle size determination, Strain calculation - Applications of X ray diffraction measurements.		
Unit - II	**Raman Spectroscopy:**	**9**
Introduction – Pure rotational Raman spectra – Vibrational Raman spectra – Polarization of light and Raman effect – Structure determination – Instrumentation – Near-Infra-Red FT Raman Spectroscopy.		
Unit - III	**Electron Microscopy:**	**9**
Need of Electron Microscopy - Electron Specimen interaction: Emission of secondary electrons, Backscattered electrons, Characteristic X-rays, Transmitted electrons, Specimen interaction volume - Resolution - Scanning electron microscope and Transmission electron microscope: Schematic diagram, Short details of each component and working - Field Emission Gun - Field Emission Scanning electron microscope - Merits of Transmission electron microscope.		
Unit - IV	**Scanning Tunneling Microscopy:**	**9**
Introduction to quantum mechanical tunneling - Basic principles of scanning tunneling microscopy - Two modes of scanning - Interpreting scanning tunneling microscopic images -Applications of scanning tunneling microscopy.		
Unit - V	**Ultra Violet and Visible Spectroscopy:**	**9**
Regions of UV-Visible radiation - Colour and light absorption - The chromophore concept - Beer's and Lambert's laws – Theory of electronic transition - Frank Condon principle – Instrumentation and Working of UV vis spectrometer - Applications of UV visible spectroscopy.		

Total:45

TEXT BOOK:

1. Cullity B.D. and Stock S.R., "Elements of X-ray diffraction ", 3rd Edition, Pearson Education, India, 2003 for Units I,II,III,IV.
2. Banwell C.N., "Fundamentals of Molecular Spectroscopy", Tata McGraw-Hill Publications, New Delhi, 2007 for Unit V.

REFERENCES:

1. Holt D.B. and Joy D.C., "SEM micro characterization of semiconductors", Academic Press, New Delhi, 1989.
2. Willard H.H., Merritt L.L., John A. Dean and Settle F.A., "Instrumental Methods of Analysis", 7th Edition, CBS Publishers and Distributors, New Delhi.
3. Elton N. Kaufman, "Characterization of Materials (Volume1&2)", Wiley-Interscience, 2003.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply the concept of X-ray diffraction to determine the crystal structure and related structural parameters of materials.	Applying (K3)
CO2	make use of the concept of Raman effect and Raman spectroscopy to determine the crystal structure and related structural parameters of materials.	Applying (K3)
CO3	determine the micro-structural parameters of materials and to perform surface analysis of materials using the concept of matter waves and electron microscopy.	Applying (K3)
CO4	utilize the concept and phenomenon of quantum mechanical tunneling to interpret the surface image at the atomic level recorded using scanning tunneling microscopy.	Applying (K3)
CO5	apply the theory of UV-Vis spectroscopy to comprehend the working of UV-Vis spectrophotometer.	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	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	20	35	45				100
ESE	20	40	40				100

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

18CYO01 - CORROSION SCIENCE AND ENGINEERING

(Offered by Department of Chemistry)

Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	OE	3	1	0	4

Preamble	Corrosion science and engineering aims to equip the students to have wide range knowledge of corrosion and prevention methods in order to meet the industrial needs.	
Unit - I	**Corrosion and its units:**	**9+3**
Importance of corrosion prevention in various industries: direct and indirect effects of corrosion –free energy and oxidation potential criterion of uniform corrosion –Pilling Bedworth ratio and it consequences –units corrosion rate – mdd (milligrams per square decimeter per day) and mpy (Mils per year) –importance of pitting factor – Pourbaix diagrams of Mg, Al and Fe – and their limitations.		
Unit - II	**Mechanism of Corrosion:**	**9+3**
Localized corrosion: electro chemical mechanism Vs. chemical mechanism – Galvanic corrosion – Area effect in anodic and cathodic metal coatings, Organic coatings of bimetallic systems – prediction using emf Series and Galvanic series – Crevice corrosion – Mechanism of differential oxygenation corrosion – Auto catalytic mechanism of pitting due to crevice or differential oxygenation corrosion – Principles and procedures of cathodic protection: Sacrificial anodes and external cathodic current impression – stray current corrosion.		
Unit - III	**Types of Corrosion:**	**9+3**
Inter-granular corrosion: Stainless steels – cause and mechanism (Cr- Depletion theory) – Weld decay and knife line attack – Stress corrosion and fatigue corrosion – Theory of critical corrosion rate in corrosion fatigue. Cavitation damage – Fretting damage – Atmospheric corrosion – Bacterial corrosion – Marine corrosion –High temperature oxidation of metals – Ionic diffusion through protective oxides.		
Unit - IV	**Kinetics of Corrosion:**	**9+3**
Kinetic aspects of corrosion: Over potential activation and concentration over potentials – Exchange current density – Mixed potential theory – corrosion rates of Fe and Zn in air – free acid – effect of oxidizing agents – Phenomenon of passivation – Theories – effect of oxidizing agents and velocity of flow on passivating metals – effect of galvanic coupling of Fe and Ti respectively with Platinum – Noble metal alloying – anodic protection.		
Unit - V	**Prevention of Corrosion:**	**9+3**
Corrosion in inhibition: Inhibitors of corrosion – passivators, adsorbing inhibitors, V.P. inhibitors. Prevention of galvanic crevice, inter granular, Stress and fatigue corrosion at the design stage and in service conditions – control of catastrophic oxidation and Hydrogen disease -control of Bacterial corrosion – Langelier saturation Index and its uses. Corrosion prevention by Coatings – Surface pre-treatment – Hot dip, diffusion and cladded coatings – Phosphating and its uses.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Winston R. & Uhlig H.H., "Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering", 4th Edition, A John Wiley & Sons Inc. Publication, New Jersey, 2008.

REFERENCES:

1. McCafferty E., "Introduction to Corrosion Science", Springer, New York, 2010.
2. Fontanna, "Corrosion Engineering (Materials Science and Metallurgy Series)", McGraw Hill International Education, Singapore, 2005.
3. Pietro Pedeferri, "Corrosion Science and Engineering", Springer Nature Switzerland AG, Switzerland, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	illustrate the importance of direct and indirect corrosion to familiarize for industrial needs.	Understanding (K2)
CO2	demonstrate the mechanism of different types of corrosion with respect to the environment.	Applying (K3)
CO3	organize the various types and theory of corrosion to understand the corrosion problems.	Applying (K3)
CO4	utilize the theories and kinetics of corrosion to interpret with the real time applications.	Applying (K3)
CO5	summarize the corrosion prevention methods to avoid corrosion related issues.	Understanding (K2)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18CYO02 - INSTRUMENTAL METHODS OF ANALYSIS

(Offered by Department of Chemistry)

Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	6	BS	3	1	0	4

Preamble	Instrumental methods of analysis aim to prepare the students to have all-encompassing knowledge of spectral methods in order to identify the molecules and reaction mechanism for the process to enhance application towards the industries.	
Unit - I	**Absorption and Emission Spectroscopy:**	**9+3**
Basic concepts of Absorption and emission spectroscopy – representation of spectra – basic elements of practical spectroscopy – signal to noise ratio - techniques for signal to noise enhancement – resolving power – Fourier transform spectroscopy – evaluation of results – basic principles, instrumentation and applications of atomic absorption, atomic fluorescence and atomic emission spectroscopy.		
Unit - II	**IR, Raman and NMR Spectroscopy:**	**9+3**
Infrared spectroscopy – correlation of IR Spectra with molecular structure, instrumentation, samplings technique and quantitative analysis. Raman Spectroscopy – Classical and Quantum theory instrumentation, Structural analysis and quantitative analysis. Nuclear magnetic resonance spectroscopy – basic principles – pulsed Fourier transform NMR spectrometer – elucidation of NMR spectra and quantitative analysis.		
Unit - III	**Surface Studies:**	**9+3**
Surface study – x-ray emission spectroscopy (XES), electron spectroscopy for chemical analysis (ESCA) - UV photo electron spectroscopy (UPS)- X- ray photo electron spectroscopy (XPS) - Auger emission Spectroscopy (AES) - Transmission Electron microscopy (TEM) - Scanning Electron microscopy (SEM) - Surface tunneling microscopy (STEM) - Atomic force microscopy (AFM).		
Unit - IV	**Mass Spectroscopy:**	**9+3**
Mass spectroscopy – Ionization methods in mass spectroscopy – mass analyzer – ion collection systems - correlation of molecular spectra with molecular structure. Instrumentation design and application of Fourier transform mass spectroscopy (FT-MS)- Inductively coupled plasma mass spectroscopy (ICP-MS) - Secondary Ion Mass Spectroscopy (SIMS) and Ion microprobe mass analyzer (IMMA).		
Unit - V	**Thermal Analysis:**	**9+3**
Thermal analysis: principles and instrumentations and applications of thermogravimetry (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC), evolved gas detection, thermo mechanical analysis and Thermometric titrimetry.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Willard H.H., Merritt L.L., Dean J.A & Settle F.A., "Instrumental Methods of Analysis", 7th Edition, CBS Publishers & Distributors, New Delhi, 2012.

REFERENCES:

1. Chatwal G.R. & Anand Sham K., "Instrumental Methods of Chemical Analysis", 5th Edition, Himalaya Publishing House, Girgaon, Mumbai, 2019.
2. Srivastava A.K. & Jain P.C., "Instrumental Approach to Chemical Analysis", 4th Edition, S Chand and Company Ltd, New Delhi, 2012.
3. Sharma B.K., "Instrumental Method of Chemical Analysis", Krishna Prakashan Media Pvt. Ltd., Meerut, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	illustrate the basics of spectroscopy to understand the instrumentation of various spectral techniques.	Understanding (K2)
CO2	apply the IR, Raman and NMR for quantitative analysis of the sample.	Applying (K3)
CO3	apply the various techniques for the better understanding of surface morphology.	Applying (K3)
CO4	explain the principle, instrumentation of mass spectroscopy for the analysis of organic sample.	Understanding (K2)
CO5	illustrate the thermal analysis for the identification of thermal stability of the compounds.	Understanding (K2)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18CYO03 - WASTE AND HAZARDOUS WASTE MANAGEMENT

(Offered by Department of Chemistry)

Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	7	BS	3	0	0	3

Preamble	Waste and Hazardous waste management aims to equip the students to have a wide-range knowledge on waste management	
Unit – I	**Solid Waste Management:**	**9**
Solid wastes: Definition, types, sources, classification and composition of solid waste- Solid waste management system – Factors affecting solid waste management system – Solid waste processing technologies – incineration, combustion, stabilization, solidification, chemical fixation, encapsulation, composting, vermicomposting – Energy from waste –Biogasification –Anaerobic digestion, pyrolysis, refuse derived fuels; Landfill leachate and gas management, Landfill bioreactors – Recycling of household and commercial waste, recycling of paper, recycling of tire, recycling of plastics – Health and Environmental effects of Solid Waste – SWM: Indian scenario – Characteristics and quantity of various wastes.		
Unit – II	**Hazardous Waste Management:**	**9**
Hazardous waste Management: Identification and sources – characteristics and categorization – collection, segregation, packaging, labelling, transportation, processing (3R) – risk assessment and waste management treatment and disposal – storage and leak detection – site selection criteria, manifest system and records – Indian scenario – Responsibilities of various authorities. Radioactive Waste Management: Definition, sources, classification, collection, segregation, treatment and disposal.		
Unit – III	**E-Waste and Biomedical Waste Management:**	**9**
E-Waste Management: Definition, sources, classification, collection, segregation, treatment and disposal. Biomedical Waste Management : Types of wastes, major and minor sources of biomedical waste – categories and classification of biomedical waste – hazard of biomedical waste – need for disposal of biomedical waste – waste minimization – waste segregation and labelling – waste handling and collection- Treatment – autoclaving, Incineration, Chemical Disinfection – Disposal – Infection control Practices- status in India.		
Unit – IV	**Pollution from Major Industries and Management:**	**9**
Introduction- sources and characteristics – waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants – Wastewater reclamation concepts.		
Unit – V	**Solid Waste Management Legislation:**	**9**
Solid waste management plan – Solid Waste (Management and Handling) Rules, 2000, 2016 and amendments if any – Biomedical Waste (Management and Handling) Rules, 2016; Notification of Ash utilization 1999, 2003, 2009, 2015 and amendments if any – Plastic Waste Management Rules, 2016 – E-Waste Management Rules, 2016 – Bio-Medical Waste Management Rules, 2016 – Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 – Construction and Demolition Waste Management Rules, 2016.		

Total:45

TEXT BOOK:

1. John Pichtel, “Waste Management Practices: Municipal, Hazardous, and Industrial”, 2nd Edition, CRC Press, Boca Raton, Florida, 2014 for Unit II, III.
2. Sharma U.C. & Neetu Singh, “Environmental Science and Engineering, Volume 5: Solid Waste Management”, 2nd Edition, Studium Press, United State of America, 2017 for Unit I,IV,V.

REFERENCES:

1. VanGuilder & Cliff, "Hazardous Waste Management: An Introduction", Har Cdr Edition, Mercury Learning & Information, Herndon, VA, 2011.
2. Karen Hardt, "Solid Waste Management", 1st Edition, Callisto Reference, Germany, 2018.
3. Majeti Narasimha Vara Prasad, Meththika Vithanage & Anwesha Borthakur, "Handbook of Electronic Waste Management: International Best Practices and Case Studies", 1st Edition, Butterworth-Heinemann, United Kingdom, 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply the technical points that are required to set up a solid waste management system.	Applying (K3)
CO2	select the various disposal methods of hazardous wastes like radioactive wastes.	Understanding (K2)
CO3	organize the appropriate method for managing e-waste and biomedical wastes.	Applying (K3)
CO4	identify to plan minimization of industrial wastes.	Applying (K3)
CO5	relate the legal legislation to solid waste management.	Understanding (K2)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18GEO01 – GERMAN LANGUAGE LEVEL 1

(Offered by Department of Electronics and Communication Engineering)

Programme& Branch	All BE/BTech Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Basics of Language	5,6,7,8	HS	4	0	0	4

Preamble	To acquire the vocabulary as per the Common European framework of German language A1 level competence. This course will help to assimilate the basic grammar structures and gain vocabulary to understand and reciprocate in daily life situations on a broader sense. A thorough learner will be able to gain a comprehensive understanding of the German grammar and confidently articulate in day today situations.	
Unit - I	**Contacts (Kontakte):**	**12**
Understanding Letters, simple instructions, speaking about language learning, finding specific information in text, Acknowledging the theme and understanding conversations, Making appointments. Grammar – Preposition with Dative, Articles in Dative and Accusative possessive articles.		
Unit - II	**Accommodation (Die Wohnung):**	**12**
Understanding Accommodation advertisements, describing accommodation and directions, responding to an invitation, Expressing feelings, Colours. Grammar – Adjective with to be verb, Adjective with *sehr/zu*, Adjective with Accusative, prepositions with Dative		
Unit - III	**Working Environment Communication (ArbeitenSie):**	**12**
Daily Schedule, speaking about past, understanding Job openings advertisements, Opinions, Telephonic conversations, Speaking about Jobs. Grammar – Perfect tense, Participle II – regular and irregular verbs, Conjunctions – *und, oder, aber*.		
Unit - IV	**Clothes and Style (Kleidung und mode) :**	**12**
Clothes, Chats on shopping clothes, reporting on past, Orienting oneself in Supermarkets, Information and research about Berlin. Grammar – Interrogative articles and Demonstrative articles, Partizip II – separable and non-separable verbs, Personal pronouns in Dative, Verbs with Dative.		
Unit - V	**Health and Vacation (Gesundheit und Urlaub):**	**12**
Personal information, Human Body parts, Sports, Understanding instructions and prompts, health tips. Grammar – Imperative with *du/Ihr*, Modal verbs – sollen, müssen, nichtdürfen, dürfen. Suggestions for travel, Path, Postcards, weather, Travel reports, Problems in hotel, Tourist destinations. Grammar – Pronoun: *man*, Question words – *Wer, Wen, Was, Wem*, Adverbs – *Zuerst, dann, Später, ZumSchl*		

Total:60

TEXT BOOK:

1.	"Stefanie Dengler, Paul Rusch, Helen Schmitz, TanjaSieber, "Netzwerk Deutsch alsFremdsprache A1–ursbuch, Arbeitsbuch und Glossar with 2 CDs", Goyal Publishers, Delhi, 2015.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understanding letters and simple texts	Remembering (K1)
CO2	assimilating vocabulary on accommodation and invitation	Understanding (K2)
CO3	comprehend concept of time, telephonic conversation and job-related information	Understanding (K2)
CO4	understanding how to do shopping in a German store	Understanding (K2)
CO5	understanding body parts and how to plan personal travel	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								1	1	3		3		
CO2								1	1	3		3		
CO3								1	1	3		3		
CO4								1	1	3		3		
CO5								1	1	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	25	75					100
ESE	25	75					100

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

18GEO02 – JAPANESE LANGUAGE LEVEL 1

(Offered by Department of Electronics and Communication Engineering)

Programme& Branch	All BE/BTech Engineering & Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Basics of Language	5,6,7,8	HS	4	0	0	4

Preamble	To understand the basics of Japanese language which provides understanding of Hiragana, Katakana and 110 Kanjis and provides the ability to understand basic conversations and also enables one to request other person and also understand Casual form	
Unit - I	**Introduction to groups of verbs:**	**12**
tai form-Verb groups-te form-Give and ask permission to do an action-Present continuous form-Restrict other person from doing an action-nouns-Basic Questions		
Unit - II	**Introduction to Casual Form:**	**12**
nai form-Dictionary form-ta form-Polite style and Casual style differences-Conversation in plain style-Place of usage of Polite style and Casual style		
Unit - III	**Express opinions and thoughts:**	**12**
Introduction to new particle-Express someone one's thought-Convey the message of one person to another-Ask someone if something is right -Noun modifications		
Unit - IV	**Introduction to If clause and Kanjis:**	**12**
If clause tara form-Express gratitude for an action done by other person-Hypothetical situation-Particles to use in case of Motion verbs-110 Kanjis		
Unit - V	**Introduction to Counters:**	**12**
How to use numbers-How to use quantifiers-Past form of adjectives and Nouns-Way to say preference-Way of expression degrees of an action-Other necessary particles-How to use numbers-How to use quantifiers-Past form of adjectives		

Total:60

TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	read and understand typical expression in Hiragana and Katakana	Remembering (K1)
CO2	understand Polite form and Casual form of Japanese	Understanding (K2)
CO3	comprehend personal communication and express greetings	Understanding (K2)
CO4	understand the Kanjis in Japanese Script	Understanding (K2)
CO5	comprehend concept of time, counters and job-related information	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								1	1	3		3		
CO2								1	1	3		3		
CO3								1	1	3		3		
CO4								1	1	3		3		
CO5								1	1	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	25	75					100
ESE	25	75					100

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

18GEO03 - DESIGN THINKING FOR ENGINEERS

(Offered by Department of Computer Science and Engineering)

Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	7	OE	3	0	0	3

Preamble	In this course, systematic process of thinking which empowers even the most traditional thinker to develop new, innovative solutions to the problem at handare studied with an emphasis on bringing ideas to life based on how real users think, feel and behave.	
Unit - I	**Introduction::**	**9**
Introduction – Need for design thinking – Design and Business – The Design Process – Design Brief –Visualization – Four Questions, Ten Tools – Explore – STEEP Analysis – Strategic Priorities – Activity System – Stakeholder Mapping – Opportunity Framing.		
Unit - II	**Visualization:**	**9**
Introduction – Visualization – Journey Mapping – Value Chain Analysis – Mind Mapping – Empathize –Observations – Need Finding – User Personas.		
Unit - III	**Brainstorming:**	**9**
Introduction – Brainstorming – Concept Development – Experiment – Ideation – Prototyping – Idea Refinement.		
Unit - IV	**Assumption Testing:**	**9**
Introduction – Assumption Testing – Rapid Prototyping – Engage – Storyboarding.		
Unit - V	**Customer Co-Creation Learning Launch:**	**9**
Introduction – Customer Co-Creation Learning Launch – Leading Growth and Innovation – Evolve– Concept Synthesis – Strategic Requirements – Evolved Activity Systems – Quick Wins.		

Total:45

TEXT BOOK:

1. Jeanne Liedtka and Tim Ogilvie, "Designing for Growth: A Design Thinking Tool Kit for Managers", Columbia University Press, 2011.

REFERENCES:

1. Lee Chong Hwa, "Design Thinking The Guidebook", Design Thinking Master Trainers of Bhutan, 2017.
2. Jeanne Liedtka, Tim Ogilvie, and Rachel Brozenske, "The Designing for Growth FieldBook: A Step-by-Step Project Guide", Columbia University Press, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	outline the basic concepts of design thinking	Understanding (K2)
CO2	make use of the mind mapping process for designing any system	Applying (K3)
CO3	develop many creative ideas through structured brainstorming sessions.	Applying (K3)
CO4	develop rapid prototypes to bring the ideas into reality	Applying (K3)
CO5	plan the implementation of the any system considering the real time feedback	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	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	10	70	20				100
CAT2	10	30	60				100
CAT3	10	20	70				100
ESE	10	20	70				100

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

18GEO04 - INNOVATION AND BUSINESS MODEL DEVELOPMENT

(Offered by Department of Mechatronics Engineering)

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

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

Total:45

TEXT BOOK:

1. Rishikesha T.Krishnan, “8 Steps To Innovation: Going From Jugaad To Excellence”, Collins India, 2013.

REFERENCES:

1. Peter Drucker, “Innovation and Entrepreneurship”, Routledge CRC Press, London, 2014.
2. Eppinger, S.D. and Ulrich, K.T. “Product design and development”, 7th Edition, McGraw-Hill Higher Education, 2020.
3. Alexander Osterwalder, “Business model generation: A handbook for visionaries, game changers, and challengers”, 1st Edition, John Wiley and Sons; 2010.
4. Indian Innovators Association, “Patent IPR Licensing – Technology Commercialization – Innovation Marketing: Guide Book for Researchers, Innovators”, Notion Press, Chennai, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand innovation need and design thinking phases	Understanding (K2)
CO2	identify, screen and analyse ideas for new products based on customer needs	Analysing (K4)
CO3	develop and analyse the product concepts based on the customer needs and presents the overall architecture of the product.	Analysing (K4)
CO4	predict a structured business model for MVP	Applying (K3)
CO5	practice the procedures for protection of their ideas' IPR	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18GEO05 - GERMAN LANGUAGE LEVEL 2

(Offered by Department of Electronics and Communication Engineering)

Programme & Branch	All BE/BTech Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	German Language Level 1	5/6/7/8	HS	4	0	0	4

Preamble	This course aims to help the learner to acquire the vocabulary as per the Common European framework of German language A1 level competence. This course will help to assimilate the basic grammar structures and gain vocabulary to understand and reciprocate in daily life situations on a broader sense. A thorough learner will be able to gain a comprehensive understanding of the German grammar and confidently articulate in day today situations.	
Unit - I	**Contacts(Kontakte):**	**12**
Understanding Letters, simple instructions, speaking about language learning, finding specific information in text, Acknowledging the theme and understanding conversations, Making appointments. Grammar – Preposition with Dative, Articles in Dative and Accusative possessive articles.		
Unit - II	**Accomodation(Die Wohnung):**	**12**
Understanding Accommodation advertisements, describing accommodation and directions, responding to an invitation, Expressing feelings, Colours. Grammar – Adjective with to be verb, Adjective with *sehr/zu*, Adjective with Accusative, prepositions with Dative		
Unit - III	**Are you Working?(Arbeiten Sie):**	**12**
Daily Schedule, speaking about past, understanding Job openings advertisements, Opinions, Telephonic conversations, Speaking abou Jobs. Grammar – Perfect tense, Participle II – regular and irregular verbs, Conjunctions – *und, oder, aber*.		
Unit - IV	**Clothes and Style(Kleidung und mode):**	**12**
Clothes, Chats on shopping clothes, reporting on past, Orienting oneself in Supermarkets, Information and research about Berlin. Grammar – Interrogative articles and Demonstrative articles, Partizip II – separable and non-separable verbs, Personal pronouns in Dative, Verbs with Dative		
Unit - V	**Health and Vacation(Gesundheit und Urlaub):**	**12**
Personal information, Human Body parts, Sports, Understanding instructions and prompts, health tips. Grammar – Imperative with *du/Ihr*, Modal verbs – sollen, müssen, nicht dürfen, dürfen. Suggestions for travel, Path, Postcards, weather, Travel reports, Problems in hotel, Tourist destinations. Grammar – Pronoun: *man*, Question words – *Wer, Wen, Was, Wem*, Adverbs – *Zuerst, dann, Später, Zum Schl*		

Total: 60

TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand letters and simple texts	Remembering (K1)
CO2	assimilate vocabulary on Accommodation and invitation	Understanding (K2)
CO3	comprehend concept of time, telephonic conversation and job-related information	Understanding (K2)
CO4	understand how to do shopping in a German store	Understanding (K2)
CO5	understand body parts and how to plan personal travel	Understanding (K2)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18GEO06 - GERMAN LANGUAGE LEVEL 3

(Offered by Department of Electronics and Communication Engineering)

Programme & Branch	All BE/BTech Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	German Language Level 2	**5/6/7/8**	**HS**	**3**	**0**	**0**	**3**

Preamble	This course provides enriching information about various everyday situations in personal and professional life and enhances the vocabulary and speaking ability to respond to and also seek information in those situations. It also equips one to express opinions and negotiate appointments. With diligent learning one can capture all basic grammatical structure to answer confidently in everyday situations.	
Unit - I	**All about food (Rund Ums Essen):**	**9**
Understand information about person, Speak about food, Introduce self and others, Understand and explain a picture base story, To justify something, To speak about feelings, To express opinions, To answer questions on a text, To describe a restaurant. Grammar: Possessive Articles in Dative, Yes/No questions, Reflexive verbs, Sentence with 'weil'		
Unit - II	**School days (Nach der Schulzeit):**	**9**
Understand School reports, Speak and write comments about schooldays, To speak about habits, Understand and provide City-Tipps, To Understand School types in Germany and speak about it. Grammar: Modal verbs in Past tense, Positional Verbs, Two-way prepositions in Dativ and Akkusativ.		
Unit - III	**Media in everyday life (Medien in Alltag):**	**9**
To speak about advantages and disadvantages of Media, formulate comparisons, Express your own opinion, Talk about Movies, Understand and Write Movie reviews. Grammar: Comparative degree, Comparative Sentences with 'Als' and 'Wie', Subordinate clause with 'dass', Superlative degree.		
Unit - IV	**Feelings and expressions (Gefühle):**	**9**
Express thanks and congratulations, Talk about feelings, To understand information about festivals and speak about it, To describe a city, Express joy and regrets, Understand and write Blog entries, Write appropriate heading. Grammar: Subordinate Clause with 'Wenn', Adjectives to be used along with definite articles.		
Unit - V	**Profession and Travel (Beruf und Reisen):**	**9**
To have a conversation at ticket counter, To talk about leisure activities, To gather information from Texts, Introduce people, Express career preferences, Ideate the dream job, To prepare and make telephone calls, To understand text about Workplace. Ask for information, Express uncertainty, Understand and give directions, Understand a newspaper article, Say your own opinion, Talk about the way to work, Describe a statistic, Understand information about a trip, Talk about travel. Grammar: Adjective to be used along with indefinite articles, Prepositions, verb – 'werden', Subordinate clause – indirect questions, All units will include elements for reading, writing, speaking and listening.		

Total: 45

TEXT BOOK:

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

REFERENCES:

1. Rosa-Maria Dallapiazza , Eduard von Jan, Till Schonherr, "Tangram 2 (German)" , Goyal Publishers, Delhi, 2011.
2. https://www.dw.com/en/learn-german - Deutsche Welle , Geramany's International Broadcaster

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand German food style, restaurant and be able express oneself.	Remembering (K1)
CO2	understand German school system and discuss about habits and provide City-Tipps.	Understanding (K2)
CO3	analyze and compare media in everyday life.	Understanding (K2)
CO4	express feelings, describe a city and write blog entries.	Understanding (K2)
CO5	seek and provide information in a professional setup, give directions to others and talk about travel.	Understanding (K2)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18GEO07 - GERMAN LANGUAGE LEVEL 4

(Offered by Department of Electronics and Communication Engineering)

Programme & Branch	All BE/BTech Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	German Language Level 3	5/6/7/8	HS	3	0	0	3

Preamble	This course imparts knowledge about interacting with external world, understanding various cultural aspects, behaviour and addressing relationships in personal and professional front. It helps one to understand reports from various media and at work. Enhance learner's grammatical exposure and cover the core basic grammatical concepts which would lay the foundation to have a better hold of the language. With focused learning one should be able to read and respond to reports, write simple formal and informal letters and text messages and be able to engage in simple conversations in known situations.	
Unit - I	**Learning (Lernen):**	**9**
Understanding and describing learning problems, Understanding and giving advice, Giving reasons, Understanding reports about everyday work life, Talking about everyday working life, Understanding a radio report, Understanding and making a mini-presentation. Grammar: Conjunctions- denn,weil, Konjuntiv II: Sollte(suggestions), Genitive, Temporal prepositions – bis, über + Akkusativ,ab+dativ		
Unit - II	**Athletic (Sportlich):**	**9**
Expressing enthusiasm, hope, disappointment, Understanding and writing fan comments, Formulating follow-ups, Making suggestions and reacting, Making an appointment, Understanding a report about an excursion, Understanding difficult texts, Introducing a tourist attraction. Grammar: Conjunctions – deshalb, trotzdem, Verbs with Dativ and Akkusativ		
Unit - III	**Living Together (Zusammen Leben):**	**9**
To complain, apologize & give in, As for something, Understand experience reports, Report on the past, Talk about pets, Respond to information, Write and correct a story. Grammatik: Konjunctiv II- könnte, Subordinate clauses – als and Wenn.		
Unit – IV	**Good Entertainment (Gute Unterhaltung):**	**9**
Talk about music style, Buy concert tickets, Introduce a musician / band, Understand newspaper reports, Give more detailed information about a person, Understand information about painting, Understand description of a picture, Describe a picture. Grammatik: Interrogative Articles: Was fuer eine? , Pronouns – man/jemand/niemand and alles/etwas/nichts , Relative sentences in Nominativ.		
Unit - V	**Passage of time and Culture (Zeitablauf & Kultur):**	**9**
Talk about wishes, Express wishes, Give Suggestions, Understand a conversation, Plan something together, To ask others something, Understand a text, Exchange information, Talk about proverbs, write a story. Understand information about other cultures, Discuss about behavior, Express intentions, Use the appropriate salutation, Understand tips in a text, Talk about forms of addressing others, Give more information, Discuss about clichés and write about them. All units will include elements for reading, writing, speaking and listening. Grammatik: Konjunctiv II (Wishes, Suggestions), Verbs with prepositions, W- questions with prepositions, Relative sentences in Akkusativ, Subordinate clauses with damit and Um…Zu.		

Total: 45

TEXT BOOK:

1. Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber, "Netzwerk Deutsch als Fremdsprache A1–ursbuch, Arbeitsbuch", Goyal Publishers, Delhi, 2015.

REFERENCES:

1. Rosa-Maria Dallapiazza, Eduard von Jan, Till Schonherr, "Tangram 2 (German)", Goyal Publishers, Delhi, 2011.
2. https://www.dw.com/en/learn-german - Deutsche Welle, Geramany's International Broadcaster

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	leverage learning in Workplace, understanding reports and make presentation.	Remembering (K1)
CO2	reciprocate to different situations, make appointment and understand texts.	Understanding (K2)
CO3	handle relationships and respond appropriately to exchange information	Understanding (K2)
CO4	familiarize to various channels of entertainment	Understanding (K2)
CO5	know about various cultural aspects, usage of proverbs and cliches.	Understanding (K2)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18GEO08 - JAPANESE LANGUAGE LEVEL 2

(Offered by Department of Electronics and Communication Engineering)

Programme & Branch	All BE/BTech Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Japanese Language Level 1	5/6/7/8	HS	4	0	0	4

Preamble	The basic level of Japanese which provides understanding of Hiragana, Katakana and 110 Kanjis and provides the ability to understand basic conversations and also enables one to request other person and also understand Casual form	
Unit - I	**Introduction to groups of verbs:**	**12**
tai form-Verb groups-te form-Give and ask permission to do an action-Present continuous form-Restrict other person from doing an action-nouns-Basic Questions		
Unit - II	**Introduction to Casual Form:**	**12**
nai form-Dictionary form-ta form-Polite style and Casual style differences-Conversation in plain style-Place of usage of Polite style and Casual style		
Unit - III	**Express opinions and thoughts:**	**12**
Introduction to new particle-Express someone one's thought-Convey the message of one person to another-Ask someone if something is right -Noun modifications		
Unit - IV	**Introduction to If clause and remaining Kanjis:**	**12**
If clause tara form-Express gratitude for an action done by other person-Hypothetical situation-Particles to use in case of Motion verbs-50 Kanjis		
Unit - V	**Introduction to giving and receiving with te form and "when, even if" usages:**	**12**
Providing to and getting from differences - Understanding of situations and framing sentences using when and even if..etc.		

Total: 60

TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	differentiate groups of verbs and its forms	Remembering (K1)
CO2	understand Polite form and Casual form of Japanese	Understanding (K2)
CO3	comprehend personal communication and express greetings	Understanding (K2)
CO4	understand the Kanjis in Japanese Script and If clause	Understanding (K2)
CO5	comprehend concept of “even if”, “when” and job-related information	Understanding (K2)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18GEO09 - JAPANESE LANGUAGE LEVEL 3

(Offered by Department of Electronics and Communication Engineering)

Programme & Branch	All BE/BTech Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Japanese Language Level 2	5/6/7/8	HS	3	0	0	3

Preamble	The intermediate level of Japanese which provides understanding of all forms ofverbs, adverbs, conjunctions, etc. which includes 150 Kanji's and provides the ability to comprehend conversations encountered in daily life	
Unit - I	**Introduction to Potential verbs:**	**9**
Causes and Reasons-Favouring Expressions-Expressing a State-Potential Verb Sentences-Simultaneous actions-Verb Groups-te Form-Customary Actions-Nouns-Basic Questions and Kanji's.		
Unit - II	**Introduction to Transitive and Intransitive verbs:**	**9**
Consequence of verbs- Embarrassment about Facts- Consequence of Verbs with an Intentions-Affirmative Sentences- Conjunctions-Basic Questions and kanji's.		
Unit - III	**Introduction to Volitional forms:**	**9**
Expressions of Speakers Intention-Expressing Suggestion or Advice-Usage of Adverbs and Quantifiers-Basic Questions and kanji's.		
Unit - IV	**Introduction to Imperative and Prohibitive verbs:**	**9**
Commanding person- Interrogatives-Expressions of Third Person-Actions and its Occurrence - Possibilities of an Action-Changing of States Basic Questions and Kanji's.		
Unit - V	**Introduction to Conditional form and Passive verbs:**	**9**
Description of Requirement and Speaker's Judgement, HabitualActions, Directions and suggestions-Passive forms of Verbs-Basic Questions and Kanji's.		

Total: 45

TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	read and understand BasicVocabularies.	Remembering (K1)
CO2	understand Conversations used in daily life.	Understanding (K2)
CO3	comprehend personal communication and express greetings.	Understanding (K2)
CO4	understand the Kanji's in Japanese Script.	Understanding (K2)
CO5	comprehend Coherent conversations in everyday situations.	Understanding (K2)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18GEO10 - JAPANESE LANGUAGE LEVEL 4

(Offered by Department of Electronics and Communication Engineering)

Programme & Branch	All BE/BTech Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Japanese Language Level 3	5/6/7/8	HS	3	0	0	3

Preamble	The intermediate level of Japanese provides understanding of expressions of verbs, its pattern, Relationships which also includes 150 Kanji's and also provides the ability to understand relationship among the people.	
Unit - I	**Introduction to Reasoning:**	**9**
Causes and Sequences-Causes and Effects-Interrogative Patterns-Adjective as a Noun -Basic Questions and Kanji's.		
Unit - II	**Introduction to Exchanging of things:**	**9**
Expressions for Giving and Receiving of Things-Polite Expression of Request-Indicating a Purpose of Actions-Basic Quantifiers-Basic Questions and kanji's.		
Unit - III	**Introduction to States of an Action:**	**9**
Sentence Pattern to Indicate Appearance-Degree of Action and State-Adjectives as Adverbs- Convey information -Basic Questions and kanji's.		
Unit - IV	**Introduction to Causative Verbs:**	**9**
Causative Forms of Verbs-Asking Opportunity to do something-Hypothetical Questions-Judgement and Course of an actions-Basic Questions and Kanji's.		
Unit - V	**Introduction to Relationship in Social Status:**	**9**
Honorific expressions- Respectful expressions- Humble expressions-Polite expressions-Basic Questions and Kanji's.		

Total: 45

TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	read and Understand Relationship of a Person.	Remembering (K1)
CO2	understand Conversations Used in Everyday Activities.	Understanding (K2)
CO3	comprehend Contents at Near Natural Speed.	Understanding (K2)
CO4	understand the Kanji's in Japanese Script.	Understanding (K2)
CO5	comprehend Orally Presented Materials.	Understanding (K2)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18GEO11 - NCC Studies(Army Wing) – I

(Offered by Department of Electrical and Electronics Engineering)

Programme & Branch	All BE/BTech Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5 / 6	OE	3	0	2	4

Preamble	This course is designed especially for NCC Cadets. This course will help develop character, camaraderie, discipline, secular outlook, the spirit of adventure, sportsman spirit and ideals of selfless service amongst cadets by working in teams, learning military subjects including weapon training.	
Unit - I	**NCC Organisation and National Integration:**	**9**
NCC Organisation – History of NCC- NCC Organisation- NCC Training- NCC Uniform – Promotion of NCC cadets – Aim and advantages of NCC Training- NCC badges of Rank- Honours and Awards – Incentives for NCC cadets by central and state govt. National Integration- Unity in diversity- contribution of youth in nation building- national integration council- Images and Slogans on National Integration.		
Unit - II	**Basic physical Training and Drill:**	**9**
Basic physical Training – various exercises for fitness(with Demonstration)-Food – Hygiene and Cleanliness. Drill- Words of commands- position and commands- sizing and forming- saluting- marching- turning on the march and wheeling- saluting on the march- side pace, pace forward and to the rear- marking time- Drill with arms- ceremonial drill- guard mounting.(WITH DEMONSTRATION)		
Unit - III	**Weapon Training:**	**9**
Main Parts of a Rifle- Characteristics of 5.56mm INSAS rifle- Characteristics of .22 rifle- loading and unloading – position and holding- safety precautions – range procedure- MPI and Elevation- Group and Snap shooting- Long/Short range firing(WITH PRACTICE SESSION) - Characteristics of 7.62mm SLR- LMG- carbine machine gun.		
Unit - IV	**Social Awareness and Community Development:**	**9**
Aims of Social service-Various Means and ways of social services- family planning – HIV and AIDS- Cancer its causes and preventive measures- NGO and their activities- Drug trafficking- Rural development programmes - MGNREGA-SGSY-JGSY-NSAP-PMGSY-Terrorism and counter terrorism- Corruption – female foeticide -dowry –child abuse-RTI Act- RTE Act- Protection of children from sexual offences act- civic sense and responsibility		
Unit - V	**Specialized Subject (ARMY):**	**9**
Basic structure of Armed Forces- Military History – War heroes- battles of Indo-Pak war- Param Vir Chakra- Career in the Defence forces- Service tests and interviews-Fieldcraft and Battlecraft-Basics of Map reading including practical.		

Lecture :45, Practical:30, Total:75

TEXT BOOK:

1. "National Cadet Corps- A Concise handbook of NCC Cadets", Ramesh Publishing House, New Delhi, 2014.

REFERENCES:

1. "Cadets Handbook – Common Subjects SD/SW", published by DG NCC, New Delhi.
2. "Cadets Handbook- Specialized Subjects SD/SW", published by DG NCC, New Delhi.
3. "NCC OTA Precise", published by DG NCC, New Delhi.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	display sense of patriotism, secular values and shall be transformed into motivated youth who will contribute towards nation building through national unity and social cohesion.	Applying (K3)
CO2	demonstrate Health Exercises, the sense of discipline, improve bearing, smartness, turnout, develop the quality of immediate and implicit obedience of orders..	Applying (K3)
CO3	basic knowledge of weapons and their use and handling.	Applying (K3)
CO4	understanding about social evils and shall inculcate sense of whistle blowing against such evils and ways to eradicate such evils	Applying (K3)
CO5	acquaint, expose & provide knowledge about Army/Navy/ Air force and to acquire information about expansion of Armed Forces, service subjects and important battles.	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	-	-	-	-	-	-
CAT2	-	-	-	-	-	-	-
CAT3	-	-	-	-	-	-	-
ESE	The examination and award of marks will be done by the Ministry of Defence, Government of India which includes all K1 to K6 knowledge levels. The maximum marks for the End Semester Examination is 500 marks. It will be converted to 100 marks.						

18GEO12 - NCC STUDIES (AIR WING) – I
(Offered by Department of Information Technology)

Programme & Branch	All BE/BTech Engineering and Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5 / 6	OE	3	0	2	4

Preamble	This course is designed especially for NCC Cadets. This course will help develop character , camaraderie, discipline, secular outlook, the spirit of adventure, sportsman spirit and ideals of selfless service amongst cadets by working in teams, honing qualities such as self-discipline, self-confidence, self-reliance and dignity of labour in the cadets.	
Unit – I	**NCC Organization and National Integration:**	**9**
NCC Organization – History of NCC- NCC Organization- NCC Training- NCC Uniform – Promotion of NCC cadets – Aim and advantages of NCC Training- NCC badges of Rank- Honors' and Awards – Incentives for NCC cadets by central and state govt. History and Organization of IAF-Indo-Pak War-1971-Operation Safed Sagar. National Integration- Unity in diversity- contribution of youth in nation building- national integration council- Images and Slogans on National Integration.		
Unit – II	**Drill and Weapon Training:**	**9**
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.						