KONGU ENGINEERING COLLEGE

(Autonomous Institution Affiliated to Anna University, Chennai)

PERUNDURAI ERODE – 638 060

TAMILNADU INDIA

REGULATIONS, CURRICULUM & SYLLABI - 2018

(CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION)

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

BACHELOR OF ENGINEERING DEGREE
IN
ELECTRONICS AND COMMUNICATION ENGINEERING

DEPARTMENT OF ELECTRONICS AND

COMMUNICATION 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 ELECTRONICS AND COMMUNICATION ENGINEERING

VISION

To be a centre of excellence for development and dissemination of knowledge in Electronics and Communication Engineering for the Nation and beyond

MISSION

Department of Electronics and Communication Engineering is committed to:

MS1: To impart industry and research based quality education for developing value based electronics and communication engineers

MS2: To enrich the academic activities by continual improvement in the teaching learning process

MS3: To infuse confidence in the minds of students to develop as entrepreneurs

MS4: To develop expertise for consultancy activities by providing thrust for Industry Institute Interaction

MS5: To endeavor for constant upgradation of technical expertise for producing competent professionals to cater to the needs of the society and to meet the global challenges

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduate of Electronics and Communication programme will:

PEO1: Succeed in industry and higher education by applying knowledge of mathematics, science and engineering principles

PEO2: Analyze, design and implement electronics based solutions to meet the real world problems, with constant update of domain knowledge

PEO3: Demonstrate Soft skills, Professional and Ethical values and an aptitude for lifelong learning needed for a successful professional career

MAPPING OF MISSION STATEMENTS (MS) WITH PEOs

MS\PEO	PEO1	PEO2	PEO3
MS1	3	3	3
MS2	3	3	2
MS3	3	3	3
MS4	3	3	2
MS5	2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial

PROGRAM OUTCOMES (POs)

Graduates of Electronics and Communication 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 Electronics and Communication will**:**	
PSO1	**Products Development :** Apply multidisciplinary knowledge and skills to develop products for providing solutions for the real world problems in Industry, Agriculture, Healthcare, Communication etc.
PSO2	**Development of Entrepreneurship:** Have an aptitude to take up the applied research to become Entrepreneurs in Electronics and Communication Engineering by combining the skills of project management and finance.

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	3	3	3	3	1	-	2	2	2	1	2	3	1
PEO2	3	3	3	3	3	3	3	3	1	2	3	3	3	3
PEO3	-	1	2	-	-	3	3	3	3	3	3	3	3	3

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 / Industrial Training, Internship and Entrepreneurships/ Start ups. Performance in each course of study shall be evaluated based on (i) Continuous Assessments (CA) throughout the semester and (ii) End Semester Examination (ESE) at the end of the semester except for the courses which are evaluated based on continuous assessment only. Each course shall be evaluated for a maximum of 100 marks as shown below:

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

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

7.3 Theory Courses

For all theory courses out of 100 marks, the continuous assessment shall be 50 marks and the end semester examination shall be for 50 marks. However, the end semester examinations shall be conducted for 100 marks and the marks obtained shall be reduced to 50. The continuous assessment tests shall be conducted as per the schedule laid down in the academic schedule. Three tests shall be conducted for 50 marks each and reduced to 30 marks each. The total of the continuous assessment marks and the end semester examination marks shall be rounded off to the nearest integer.

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

Sl. No.	Type	Max. Marks	Remarks
1.	Test - I	30	Average of best two
	Test - II	30	
	Test - III	30	
2.	Tutorial	15	Should be of Open Book/Objective Type. Average of best 4 (or more, depending on the nature of the course, as may be approved by Principal)
3.	Assignment / Paper Presentation in Conference / Seminar / Comprehension / Activity based learning / Class notes	05	To be assessed by the Course Teacher based on any one type.
	Total	50	Rounded off to the one decimal place

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

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

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

7.4 Theory Cum Practical Courses

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

7.5 Practical Courses

For all practical courses 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 (vide clause 7.3) applicable for a credit candidate of that course. Only if the candidate obtains a performance grade, the course will be listed in the semester Grade Sheet and in the Consolidated Grade Sheet along with the grade SF (Satisfactory). Performance grade will not be shown for the audit course.

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

7.16 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 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.

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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	4	3	1		2		3		13	**7.7**
BS	11	11	4	4					30	**17.8**
ES	6	4	6	3					19	**11.2**
PC		3	12	13	16	12	4		60	**35.5**
PE				3		3	6	3	15	**8.9**
OE					4	4	3	3	14	**8.3**
EC					2	2	8	6	18	**10.7**
Semesterwise Total	21	21	23	23	24	21	24	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.	18GET51	Universal Human Values	2	0	0	2	V
6.	18MBT71	Engineering Economics and Management	3	0	0	3	VII
Total Credits to be earned						**13**	

BASIC SCIENCE (BS)							
S. No.	**Course Code**	**Course Name**	**L**	**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.	18CYC24	Environmental Science and Fuel Cells	3	0	2*	3.5	II
7.	18MAC31	Mathematics III	3	1*	2*	4	III
8.	18MAC41	Probability Theory and Random Process	3	1	0	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	1
2.	18CSC11	Problem Solving and Programming	2	0	2	3	1
3.	18MEC11	Engineering Drawing	2	0	2	3	2
4.	18MEL11	Engineering Practices Laboratory	0	0	2	1	2
5.	18ECC32	Object Oriented Concepts and Programming with C++	3	0	2	4	3
6.	18ECT33	Sensors and its applications	2	0	0	2	3
7.	18CST46	Data Structure with Python	2	0	0	2	4
8.	18CSL44	Data Structure with Python Laboratory	0	0	2	1	4
Total Credits to be earned						**19**	

PROFESSIONAL CORE (PC)								
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**	**Domain/ Stream**
1.	18ECT21	Circuit Analysis and Network Synthesis	3	0	0	3	2	EL
2.	18ECT31	Digital Electronics	3	1	0	4	3	VD
3.	18ECC31	Solid State Devices and Circuits	3	0	2	4	3	EL
4.	18ECT32	Electromagnetics and Waveguides	3	0	0	3	3	CN
5.	18ECL31	Digital Electronics Laboratory	0	0	2	1	3	VD
6.	18ECT41	Signals and Systems	3	1	0	4	4	SIP
7.	18ECT42	Electronic Circuits	3	1	0	4	4	EL

8.	18ECT43	Microprocessor and Microcontroller	3	0	0	3	4	ES
9.	18ECL41	Electronic Circuits Laboratory	0	0	2	1	4	EL
10.	18ECL42	Microprocessor and Microcontroller Laboratory	0	0	2	1	4	ES
11.	18ECT51	Analog and Digital Communication	3	0	0	3	5	CN
12.	18ECT52	Linear Integrated Circuits	3	0	0	3	5	EL
13.	18ECT53	Digital Signal Processing	3	0	0	3	5	SIP
14.	18ECT54	Control Engineering	3	1	0	4	5	SIP
15.	18ECL51	Analog and Digital Communication Laboratory	0	0	2	1	5	CN
16.	18ECL52	Linear Integrated Circuits Laboratory	0	0	2	1	5	EL
17.	18ECL53	Digital Signal Processing Laboratory	0	0	2	1	5	SIP
18.	18ECT61	VLSI Design	3	0	0	3	6	VD
19.	18ECT62	Data Communication and Internetworking	3	0	0	3	6	CN
20.	18ECT63	Microwave and Optical Communication	3	0	0	3	6	CN
21.	18ECL61	VLSI Design Laboratory	0	0	2	1	6	VD
22.	18ECL62	Data Communication and Internetworking Laboratory	0	0	2	1	6	CN
23.	18ECL63	Microwave and Optical Communication Laboratory	0	0	2	1	6	CN
24.	18ECT71	Antennas and Wave Propagation	3	0	2	4	7	CN
Total Credits to be earned						**59**		

PROFESSIONAL ELECTIVE COURSES								
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**	**Domain/ Stream**
		Elective 1						
1.	18ITE01	Java Programming	3	0	0	3	4	SD
2.	18ECE01	Transmission Lines and Networks	3	0	0	3	4	CN
3.	18ECE02	Electronic Instrumentation	3	0	0	3	4	EL
4.	18ECE03	Computer Architecture and Interfacing	3	0	0	3	4	EL
5.	18ECE04	Medical Electronics	3	0	0	3	4	EL
6.	18ECE05	Electrical Machines	3	0	0	3	4	EL
		Elective 2						
7.	18ECE07	Automotive Electronic Systems	3	0	0	3	6	EL
8.	18ECE08	Digital Image Processing	3	0	0	3	6	SIP
9.	18ECE09	Microcontroller Based Automation	3	0	0	3	6	ES
10	18ECE10	Soft Computational Techniques	3	0	0	3	6	SIP
11	18ECE11	Satellite Communication	3	0	0	3	6	CN

12	18ECE12	Electronics Circuit Board Design	2	0	2	3	6	EL
13.	18ECE13	Natural Language Processing	3	0	0	3	6	SD
		Elective 3						
14.	18ECE14	Principles of Machine Learning	3	0	0	3	7	SD
15.	18ECE15	Mobile Communication	3	0	0	3	7	CN
16.	18ECE16	Nano Science and Nano Technology	3	0	0	3	7	VD
17.	18ECE17	Display Devices	3	0	0	3	7	EL
18.	18ECE18	Embedded IoT	3	0	0	3	7	ES
19.	18ECE19	Wireless Networks	3	0	0	3	7	CN
20.	18ECE20	Computer Vision	3	0	0	3	7	SD
		Elective 4						
21.	18ECE21	Optimization Techniques	2	0	2	3	7	SIP
22.	18ECE22	Cognitive Radio Networks	3	0	0	3	7	CN
23.	18ECE23	Real Time Operating system	3	0	0	3	7	ES
24.	18ECE24	ASIC Design	3	0	0	3	7	VD
25.	18ECE25	Network Information Security	3	0	0	3	7	CN
26.	18ECE26	Remote Sensing	3	0	0	3	7	SIP
27.	18ECE27	Software Quality Assurance and Testing	3	0	0	3	7	SD
28.	18GEE01	Fundamentals of Research	3	0	0	3	7	GE
		Elective 5						
29.	18MBE49	Entrepreneurship Development	3	0	0	3	8	GE
30.	18ECE28	Computer Design Automation for VLSI Circuits	3	0	0	3	8	VD
31.	18ECE29	RF Communications	3	0	0	3	8	CN
32.	18ECE30	Radar Engineering	3	0	0	3	8	CN
33.	18ECE31	RISC Architecture	3	0	0	3	8	ES
34.	18ECE32	Opto Electronics	3	0	0	3	8	EL
35.	18ECE33	DSP Processor and its Applications	3	0	0	3	8	SIP
36.	18ECE34	Blockchain Technologies	3	0	0	3	8	SD
Total Credits to be earned						**15**		

EMPLOYABILITY ENHANCEMENT COURSES (EC)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	18GEL51/ 18GEI 51	Professional Skills Training I / Industrial Training I	0	0	0	2	V
2.	18GEL 61/ 18GEI 61	Professional Skills Training II / Industrial Training II	0	0	0	2	VI

3.	18GEP71	Comprehensive Test and Viva	0	0	0	2	VII
4.	18ECP61	Project Work I Phase I	0	0	4	2	VI
5.	18ECP71	Project Work I Phase II	0	0	8	4	VII
6.	18ECP81	Project Work II	0	0	12	6	VIII
Total Credits to be earned						**18**	

***** Domain/Stream Abbreviations: : EL – Electronics, VD- VLSI Design, CN- Communication & Networks, SIP – Signal & Image Processing, ES – Embedded Systems, SD – Software Development,

OPEN ELECTIVE COURSES OFFERED TO OTHER DEPARTMENTS (OE)

S. No.	Course Code	Course Name	L	T	P	C	Sem
1.	18ECO01	PCB Design and Fabrication	3	0	2	4	V
2.	18ECO02	Neural Networks and Fuzzy Logic for Engineering Applications	3	0	2	4	V
3.	18ECO03	Principles of Quantum Computing	3	0	2	4	VI
4.	18ECO04	Electronic Hardware and Troubleshooting	2	0	2	3	VII
5.	18ECO05	Principles of Communication Techniques	3	0	0	3	VII
6.	18ECO06	Bioinspired Computing Technologies	2	0	2	3	VIII

OPEN ELECTIVE COURSES OFFERED BY OTHER DEPARTMENTS (OE)

S. No.	Course Code	Course Name	L	T	P	C	OFFERED BY
		SEMESTER V					
7.	18MAO01	Mathematical Foundations of Machine Learning	3	1	0	4	MATHS
8.	18PHO01	Thin film Technology	3	1	0	4	PHYSICS
9.	18CYO01	Corrosion Science and Engineering	3	1	0	4	CHEMISTRY
10.	18CEO01	Remote Sensing and its Applications	3	0	2	4	CIVIL
11.	18MEO01	Renewable Energy Sources	3	0	2	4	MECH
12.	18MTO01	Design of Mechatronics Systems	3	1	0	4	MTS
13.	18AUO01	Automotive Engineering	3	0	2	4	AUTO
14.	18EEO01	Electrical Wiring and Lighting	3	1	0	4	EEE
15.	18EEO02	Solar and Wind Energy Systems	3	1	0	4	EEE
16.	18EIO01	Neural Networks and Deep Learning	3	1	0	4	EIE
17.	18CSO01	Data Structures and its Applications	3	0	2	4	CSE
18.	18CSO02	Formal Languages and Automata Theory	3	1	0	4	CSE
19.	18CSO03	Computational Science for Engineers	3	1	0	4	CSE
20.	18ITO01	Python Programming	3	0	2	4	IT
21.	18ITO02	Advanced Java Programming	3	0	2	4	IT
22.	18CHO01	Polymer Technology	3	1	0	4	CHEM

23.	18CHO02	Introduction to Drugs and Pharmaceuticals Technology	3	1	0	4	CHEM
24.	18FTO01	Food Processing Technology	3	1	0	4	FT
25.	18FTO02	Baking Technology	3	0	2	4	FT
		SEMESTER VI					
26.	18MAO02	Graph Theory and its Applications	3	1	0	4	MATHS
27.	18MAO03	Number Theory and Cryptography	3	1	0	4	MATHS
28.	18CYO02	Instrumental Methods of Analysis	3	1	0	4	CHEMISTRY
29.	18CEO02	Disaster Management	3	1	0	4	CIVIL
30.	18MEO02	Design of Experiments	3	0	2	4	MECH
31.	18MTO02	Factory Automation	3	0	2	4	MTS
32.	18MTO03	Data Acquisition and Virtual Instrumentation	3	0	2	4	MTS
33.	18AUO02	Autonomous Vehicles	3	1	0	4	AUTO
34.	18EEO03	Energy Conservation and Management	3	1	0	4	EEE
35.	18EIO02	Digital Image Processing and Its Applications	3	1	0	4	EIE
36.	18EIO03	Industrial Automation	3	1	0	4	EIE
37.	18CSO04	Web Engineering	3	0	2	4	CSE
38.	18CSO05	Foundations of Data Analytics	3	1	0	4	CSE
39.	18CSO06	Nature Inspired Optimization Techniques	3	1	0	4	CSE
40.	18CSO07	Data Science	3	1	0	4	CSE
41.	18ITO03	Java Programming	3	1	0	4	IT
42.	18ITO04	Next Generation Databases	3	1	0	4	IT
43.	18CHO03	Bio Energy Resources	3	1	0	4	CHEM
44.	18CHO04	Fundamentals of Nanoscience and Nanotechnology	3	1	0	4	CHEM
45.	18FTO03	Processing of Milk and Milk Products	3	0	2	4	FT
46.	18FTO04	Processing of Fruits and Vegetables	3	0	2	4	FT
		SEMESTER VII					
47.	18MAO04	Advanced Linear Algebra	3	0	0	3	MATHS
48.	18MAO05	Optimization Techniques	3	0	0	3	MATHS
49.	18PHO02	Structural and Optical Characterization of Materials	3	0	0	3	PHYSICS
50.	18CYO03	Waste and Hazardous Waste Management	3	0	0	3	CHEMISTRY
51.	18CEO03	Introduction to Smart Cities	3	0	0	3	CIVIL
52.	18CEO04	Environmental Health and Safety	3	0	0	3	CIVIL
53.	18MEO03	Fundamentals of Ergonomics	3	0	0	3	MECH
54.	18MEO04	Principles of Management and Industrial Psychology	3	0	0	3	MECH

55.	18MTO04	3D Printing and Design	3	0	0	3	MTS
56.	18MTO05	Drone System Technology	3	0	0	3	MTS
57.	18AUO03	Alternate Fuels for Automobile	3	0	0	3	AUTO
58.	18EEO04	Micro Grid and Smart Grid	3	0	0	3	EEE
59.	18EEO05	Electrical Safety	3	0	0	3	EEE
60.	18EIO04	Biomedical Instrumentation and Applications	3	0	0	3	EIE
61.	18EIO05	PLC Programming and Its Applications	3	0	0	3	EIE
62.	18CSO08	Artificial Intelligence and its applications	3	0	0	3	CSE
63.	18ITO05	Business Continuity Planning	3	0	0	3	IT
64.	18ITO06	Mobile Application Development	3	0	0	3	IT
65.	18CHO05	Enzyme Engineering	3	0	0	3	CHEM
66.	18CHO06	Nuclear Engineering	3	0	0	3	CHEM
67.	18FTO05	Principles of Food safety	3	0	0	3	FT
68.	18FTO06	Food and Nutrition	3	0	0	3	FT
		SEMESTER VIII					
69.	18CEO05	Infrastructure Planning and Management	3	0	0	3	CIVIL
70.	18CEO06	Environmental Laws and Policy	3	0	0	3	CIVIL
71.	18MEO05	Safety Measures for Engineers	3	0	0	3	MECH
72.	18MEO06	Energy Conservation in Thermal Equipments	3	0	0	3	MECH
73.	18MTO06	Robotics	3	0	0	3	MTS
74.	18MTO07	Virtual and Augment Reality in Industry 4.0	3	0	0	3	MTS
75.	18AUO04	Automotive Electronics	3	0	0	3	AUTO
76.	18AUO05	Vehicle Maintenance	3	0	0	3	AUTO
77.	18EEO06	Electric Vehicle	3	0	0	3	EEE
78.	18EIO06	Measurements and Instrumentation	3	0	0	3	EIE
79.	18EIO07	Graphical Programming using Virtual Instrumentation	3	0	0	3	EIE
80.	18CSO09	Applied Machine Learning	3	0	0	3	CSE
81.	18CSO10	Fundamentals of Blockchain	3	0	0	3	CSE
82.	18CSO11	Fundamentals of Internet of Things	3	0	0	3	CSE
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 (Electronics and Communication 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)	18PHC24 Solid State Physics (3-0-2*-3.5)	18CYC24 Environmental Science and Fuel Cells (3-0-2*-3.5)	18MEC11 Engineering Drawing (2-0-2-3)	18ECT21 Circuit Analysis and Network Synthesis (3-0-0-3)	18MEL11 Engineering Practices Laboratory (0-0-2-1))				21
III	18MAC31 Mathematics III (3-1*-2*-4)	18ECT31 Digital Electronics (3-1-0-4)	18ECC31 Solid State Devices and Circuits (3-0-2-4)	18ECT32 Electro magnetics and Waveguides (3-0-0-3)	18ECC32 Object Oriented Concepts and Programming with C++ (3-0-2-4)	18ECT33 Sensors and Its Applications (2-0-0-2)	18ECL31 Digital Electronics Laboratory (0-0-2-1)	18EGL31 English for Workplace Communi cation (0-0-2-1)			23
IV	18MAT41 Probability Theory and Random Process (3-1-0-4)	18CST46 Data Structure with Python (2-0-0-2)	18ECT41 Signals and Systems (3-1-0-4)	18ECT42 Electronic Circuits (3-1-0-4)	18ECT43 Micro processor and Micro controller (3-0-0-3)	Professional Elective I (3-0-0-3)	18CSL44 Data Structure with Python Laboratory (0-0-2-1)	18ECL41 Electronic Circuits Laboratory (0-0-2-1)	18ECL42 Microprocesso r and Microcontrolle r Laboratory (0-0-2-1)		23
V	18ECT51 Analog and Digital Communi cation (3-0-0-3)	18ECT52 Linear Integrated Circuits (3-0-0-3)	18ECT53 Digital Signal Processing (3-0-0-3)	18ECT54 Control Engineering (3-1-0-4)	Open Elective I (3-1/0-0/2-4)	18ECL51 Analog and Digital Communi cation Lab (0-0-2-1)	18ECL52 Linear Integrated Circuits Laboratory (0-0-2-1)	18ECL53 Digital Signal Processing 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)	24
VI	18ECT61 VLSI Design (3-0-0-3)	18ECT62 Data Communi cation and Internet working (3-0-0-3)	18ECT63 Microwave and Optical Communi cation (3-0-0-3)	Professional Elective II (3-0-0-3)	Open Elective II (3-1/0-0/2-4)	18ECL61 VLSI Design Laboratory (0-0-2-1)	18ECL62 Data Communicatio n and Internet working Lab (0-0-2-1)	18ECL63 Microwave and Optical Communi cation Lab (0-0-2-1)	18GEL61/ 18GEI61 Professional Skills Training II / Industrial Training II (0-0-0-2)	18ECP61 Project Work I Phase I (0-0-4-2)	23
VII	18MBT71 Engineering Economics and Management (3-0-0-3)	18ECT71 Antennas and Wave Propagation (3-0-2-4)	Open Elective III (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)	18ECP71 Project Work I Phase II (0-0-8-4)				22
VIII	Open Elective IV (3-0-0-3)	Professional Elective V (3-0-0-3)	18ECP81 Project Work II (0-0-12-6)								12

MAPPING OF COURSES WITH PROGRAM OUTCOMES(PRESS BACKSPACE TO REMOVE TICK)

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	18PHC24	Solid State Physics	✓	✓	✓	✓										
2	18CYC24	Environmental Science and Fuel Cells	✓	✓	✓	✓			✓							
2	18MEC11	Engineering Drawing	✓	✓	✓	✓						✓	✓	✓	✓	✓
2	18ECT21	Circuit Analysis and Network Synthesis	✓	✓	✓		✓								✓	✓
2	18MEL11	Engineering Practices Laboratory	✓	✓	✓	✓	✓				✓	✓	✓	✓		
3	18MAC31	Mathematics III	✓	✓	✓	✓	✓									
3	18ECT31	Digital Electronics	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓
3	18ECC31	Solid State Devices and Circuits	✓	✓	✓	✓	✓		✓		✓			✓	✓	✓
3	18ECT32	Electromagnetics and Waveguides	✓	✓	✓	✓									✓	✓
3	18ECC32	Object Oriented Concepts and Programming with C++	✓	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓
3	18ECT33	Sensors and Its Applications	✓	✓	✓	✓		✓	✓					✓	✓	✓
3	18ECL31	Digital Electronics Laboratory	✓	✓	✓	✓	✓				✓	✓		✓	✓	✓
3	18EGL31	English for Work Place Communication									✓	✓		✓		
4	18MAT41	Probability Theory and Random Process	✓	✓	✓	✓										
4	18CST46	Data Structure with Python	✓	✓	✓	✓	✓	✓			✓		✓		✓	
4	18ECT41	Signals and Systems	✓	✓	✓	✓		✓			✓	✓		✓	✓	✓
4	18ECT42	Electronic Circuits	✓	✓	✓	✓	✓				✓			✓	✓	

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
4	18ECT43	Microprocessor and Microcontroller	✓	✓	✓	✓	✓	✓				✓		✓	✓	✓
4	18CSL44	Data Structure with Python Laboratory	✓	✓	✓	✓	✓	✓			✓		✓		✓	
4	18ECL41	Electronic Circuits Laboratory	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓
4	18ECL42	Microprocessor and Microcontroller Laboratory	✓	✓	✓	✓	✓				✓		✓	✓	✓	✓
5	18ECT51	Analog and Digital Communication	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	18ECT52	Linear Integrated Circuits	✓	✓	✓	✓	✓	✓			✓			✓	✓	✓
5	18ECT53	Digital Signal Processing	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
5	18ECT54	Control Engineering	✓	✓	✓	✓	✓			✓	✓	✓		✓	✓	
5	18ECL51	Analog and Digital Communication Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
5	18ECL52	Linear Integrated Circuits Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓
5	18ECL53	Digital Signal Processing Laboratory	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓	✓
5	18GEL51/ 18GEI51	Professional Skills Training 1 / Industrial Training 1	✓	✓				✓	✓		✓	✓	✓	✓		✓
5	18GET51	Universal Human Values						✓	✓	✓	✓	✓				
6	18ECT61	VLSI Design	✓	✓	✓	✓									✓	
6	18ECT62	Data Communication and Internetworking	✓	✓	✓	✓	✓									
6	18ECT63	Microwave and Optical Communication	✓	✓	✓	✓										
6	18ECL61	VLSI Design Laboratory	✓	✓	✓	✓	✓								✓	
6	18ECL62	Data Communication and Internetworking Laboratory	✓	✓	✓	✓	✓									
6	18ECL63	Microwave and Optical Communication Laboratory	✓	✓	✓	✓	✓									
6	18GEL61/ 18GEI1	Professional Skills Training II / Industrial Training II	✓	✓				✓	✓		✓	✓	✓	✓		
6	18ECP61	Project Work I Phase I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7	18MBT71	Engineering Economics and Management	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
7	18ECT71	Antennas and Wave Propagation	✓	✓	✓	✓	✓								✓	✓
7	18GEP71	Comprehensive Test and Viva	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓
7	18ECP71	Project Work I Phase II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	18ECP81	Project Work II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Professional Elective Courses														
4	18ITE01	Java Programming	✓	✓	✓	✓									✓	

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
4	18ECE01	Transmission Lines and Networks	✓	✓	✓	✓					✓	✓	✓	✓	✓	
4	18ECE02	Electronic Instrumentation	✓	✓	✓	✓	✓							✓	✓	
4	18ECE03	Computer Architecture and Interfacing	✓	✓	✓									✓	✓	
4	18ECE04	Medical Electronics	✓	✓	✓			✓			✓	✓			✓	
4	18ECE05	Electrical Machines	✓	✓	✓	✓		✓			✓	✓		✓	✓	
6	18ECE07	Automotive Electronic Systems	✓	✓	✓	✓	✓									
6	18ECE08	Digital Image Processing	✓	✓	✓	✓									✓	✓
6	18ECE09	Microcontroller Based Automation	✓	✓	✓	✓									✓	✓
6	18ECE10	Soft Computational Techniques	✓	✓	✓	✓	✓								✓	✓
6	18ECE11	Satellite Communication	✓	✓	✓	✓									✓	✓
6	18ECE12	Electronics Circuit Board Design	✓	✓	✓	✓	✓				✓				✓	✓
6	18ECE13	Natural Language Processing	✓	✓	✓	✓	✓								✓	✓
7	18ECE14	Principles of Machine Learning	✓	✓	✓	✓	✓								✓	✓
7	18ECE15	Mobile Communication	✓	✓	✓	✓	✓								✓	✓
7	18ECE16	Nano Science and Nano Technology	✓	✓	✓	✓	✓									
7	18ECE17	Display Devices	✓	✓	✓	✓										
7	18ECE18	Embedded IoT	✓	✓	✓	✓									✓	✓
7	18ECE19	Wireless Networks	✓	✓	✓	✓	✓								✓	
7	18ECE20	Computer Vision	✓	✓	✓	✓									✓	✓
7	18ECE21	Optimization Techniques	✓	✓	✓	✓	✓	✓			✓	✓			✓	
7	18ECE22	Cognitive Radio Networks	✓	✓	✓	✓										
7	18ECE23	Real Time Operating system	✓	✓	✓	✓									✓	✓
7	18ECE24	ASIC Design	✓	✓	✓	✓									✓	✓
7	18ECE25	Network Information Security	✓	✓	✓	✓									✓	
7	18ECE26	Remote Sensing	✓	✓	✓	✓									✓	
7	18ECE27	Software Quality Assurance and Testing	✓	✓	✓	✓									✓	✓
7	18GEE01	Fundamentals of Research	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
8	18MBE49	Entrepreneurship Development		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	18ECE28	Computer Design Automation for VLSI Circuits	✓	✓	✓	✓									✓	✓
8	18ECE29	RF Communications	✓	✓	✓	✓	✓								✓	
8	18ECE30	Radar Engineering	✓	✓	✓	✓									✓	
8	18ECE31	RISC Architecture	✓	✓	✓	✓									✓	
8	18ECE32	Opto Electronics	✓	✓	✓	✓									✓	✓
8	18ECE33	DSP Processor and its Applications	✓	✓	✓	✓									✓	✓
8	18ECE34	Blockchain Technologies	✓	✓	✓	✓									✓	✓

		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	18EEO01	Electrical Wiring and Lighting	✓	✓	✓	✓	✓	✓								
5	18EEO02	Solar and Wind Energy Systems	✓	✓	✓	✓										
5	18EIO01	Neural Networks and Deep Learning	✓	✓	✓	✓	✓									
5	18CSO01	Data Structures and its Applications	✓	✓	✓	✓	✓									
5	18CSO02	Formal Languages and Automata Theory	✓	✓	✓	✓										
5	18CSO03	Computational Science for Engineers	✓	✓	✓	✓	✓									
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	✓	✓	✓	✓										

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
5	18FTO02	Baking Technology	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓		
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	18EEO03	Energy Conservation and Management	✓	✓	✓		✓									
6	18EIO02	Digital Image Processing and Its Applications	✓	✓	✓	✓	✓									
6	18EIO03	Industrial Automation	✓	✓	✓	✓	✓									
6	18CSO04	Web Engineering	✓	✓	✓	✓										
6	18CSO05	Foundations of Data Analytics	✓	✓	✓											
6	18CSO06	Nature inspired optimization techniques	✓	✓	✓	✓										
6	18CSO07	Introduction to Data Science	✓	✓	✓											
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	✓	✓	✓				✓							

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
7	18CEO04	Environmental Health and Safety	✓	✓	✓	✓										
7	18MEO03	Fundamentals of Ergonomics	✓	✓	✓	✓		✓	✓			✓		✓		
7	18MEO04	Principles of Management and Industrial Psychology			✓			✓	✓	✓	✓	✓				
7	18MTO04	3D Printing and Design	✓	✓	✓	✓	✓						✓	✓		
7	18MTO05	Drone System Technology	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓		
7	18AUO03	Alternate Fuels for Automobile	✓	✓												
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	18CSO08	Artificial intelligence 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	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	18CSO09	Applied Machine Learning	✓	✓	✓											
8	18CSO10	Fundamentals of Blockchain	✓	✓	✓	✓										
8	18CSO11	Fundamentals of Internet of Things	✓	✓	✓	✓	✓									
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. ELECTRONICS AND COMMUNICATION 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
18CYC24	Environmental Science and Fuel Cells	3	0	2*	3.5	50	50	100	BS
18MEC11	Engineering Drawing	2	0	2	3	50	50	100	ES
18ECT21	Circuit Analysis and Network Synthesis	3	0	0	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**

SEMESTER – III									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
18MAC31	Mathematics III	3	1*	2*	4	50	50	100	BS
18ECT31	Digital Electronics	3	1	0	4	50	50	100	PC
18ECC31	Solid State Devices and Circuits	3	0	2	4	50	50	100	PC
18ECT32	Electromagnetics and Waveguides	3	0	0	3	50	50	100	PC
18ECC32	Object Oriented Concepts and Programming with C++	3	0	2	4	50	50	100	ES
18ECT33	Sensors and Its Applications	2	0	0	2	50	50	100	ES
Practical / Employability Enhancement									
18ECL31	Digital Electronics 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					**23**				

***Alternate Weeks**

SEMESTER – IV									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
18MAT41	Probability Theory and Random Process	3	1	0	4	50	50	100	BS
18CST46	Data Structure with Python	2	0	0	2	50	50	100	ES
18ECT41	Signals and Systems	3	1	0	4	50	50	100	PC
18ECT42	Electronic Circuits	3	1	0	4	50	50	100	PC
18ECT43	Microprocessor and Microcontroller	3	0	0	3	50	50	100	PC
	Professional Elective I	3	0	0	3	50	50	100	PE
Practical / Employability Enhancement									
18CSL44	Data Structure with Python Laboratory	0	0	2	1	100	0	100	ES
18ECL41	Electronic Circuits Laboratory	0	0	2	1	100	0	100	PC
18ECL42	Microprocessor and Microcontroller Laboratory	0	0	2	1	100	0	100	PC
Total Credits to be earned					**23**				

***Alternate Weeks**

B.E. ELECTRONICS AND COMMUNICATION 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									
18ECT51	Analog and Digital Communication	3	0	0	3	50	50	100	PC
18ECT52	Linear Integrated Circuits	3	0	0	3	50	50	100	PC
18ECT53	Digital Signal Processing	3	0	0	3	50	50	100	PC
18ECT54	Control Engineering	3	1	0	4	50	50	100	PC
	Open Elective I	3	0	2	4	50	50	100	OE
Practical / Employability Enhancement									
18ECL51	Analog and Digital Communication Laboratory	0	0	2	1	100	0	100	PC
18ECL52	Linear Integrated Circuits Laboratory	0	0	2	1	100	0	100	PC
18ECL53	Digital Signal Processing 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					**24**				

*** 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									
18ECT61	VLSI Design	3	0	0	3	50	50	100	PC
18ECT62	Data Communication and Internetworking	3	0	0	3	50	50	100	PC
18ECT63	Microwave and Optical Communication	3	0	0	3	50	50	100	PC
	Professional Elective II	3	0	0	3	50	50	100	PE
	Open Elective II	3	1	0	4	50	50	100	OE
Practical / Employability Enhancement									
18ECL61	VLSI Design Laboratory	0	0	2	1	100	0	100	PC
18ECL62	Data Communication and Internetworking Laboratory	0	0	2	1	100	0	100	PC
18ECL63	Microwave and Optical Communication Laboratory	0	0	2	1	100	0	100	PC
18GEL61/ 18GEI61	Professional Skills Training II / Industrial Training II	---	---	---	2	100	0	100	EC
18ECP61	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. ELECTRONICS AND COMMUNICATION 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
18ECT71	Antennas and Wave Propagation	3	0	2	4	50	50	100	PC
	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 and Viva	---	---	---	2	100	0	100	EC
18ECP71	Project Work I Phase II	0	0	8	4	50	50	100	EC
Total Credits to be earned					**22**				

SEMESTER – VIII									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
	Professional Elective V	3	0	0	3	50	50	100	PE
	Open Elective IV	3	0	0	3	50	50	100	OE
Practical / Employability Enhancement									
18ECP81	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.	18ITE01	Java Programming	3	0	0	3	IV
2.	18ECE01	Transmission Lines and Networks	3	0	0	3	IV
3.	18ECE02	Electronic Instrumentation	3	0	0	3	IV
4.	18ECE03	Computer Architecture and Interfacing	3	0	0	3	IV
5.	18ECE04	Medical Electronics	3	0	0	3	IV
6.	18ECE05	Electrical Machines	3	0	0	3	IV
		Elective II					
7.	18ECE07	Automotive Electronic Systems	3	0	0	3	VI
8.	18ECE08	Digital Image Processing	3	0	0	3	VI
9.	18ECE09	Microcontroller Based Automation	3	0	0	3	VI
10	18ECE10	Soft Computational Techniques	3	0	0	3	VI
11	18ECE11	Satellite Communication	3	0	0	3	VI
12	18ECE12	Electronics Circuit Board Design	2	0	2	3	VI
13.	18ECE13	Natural Language Processing	3	0	0	3	VI
		Elective III					
14.	18ECE14	Principles of Machine Learning	3	0	0	3	VII
15.	18ECE15	Mobile Communication	3	0	0	3	VII
16.	18ECE16	Nano Science and Nano Technology	3	0	0	3	VII
17.	18ECE17	Display Devices	3	0	0	3	VII
18.	18ECE18	Embedded IoT	3	0	0	3	VII
19.	18ECE19	Wireless Networks	3	0	0	3	VII
20.	18ECE20	Computer Vision	3	0	0	3	VII
		Elective IV					
21.	18ECE21	Optimization Techniques	2	0	2	3	VII
22.	18ECE22	Cognitive Radio Networks	3	0	0	3	VII
23.	18ECE23	Real Time Operating system	3	0	0	3	VII
24.	18ECE24	ASIC Design	3	0	0	3	VII
25.	18ECE25	Network Information Security	3	0	0	3	VII
26.	18ECE26	Remote Sensing	3	0	0	3	VII
27.	18ECE27	Software Quality Assurance and Testing	3	0	0	3	VII
28.	18GEE01	Fundamentals of Research	3	0	0	3	VII

(Contd.)

		Elective V					
29.	18MBE49	Entrepreneurship Development	3	0	0	3	VIII
30.	18ECE28	Computer Design Automation for VLSI Circuits	3	0	0	3	VIII
31.	18ECE29	RF Communications	3	0	0	3	VIII
32.	18ECE30	Radar Engineering	3	0	0	3	VIII
33.	18ECE31	RISC Architecture	3	0	0	3	VIII
34.	18ECE32	Opto Electronics	3	0	0	3	VIII
35.	18ECE33	DSP Processor and its Applications	3	0	0	3	VIII
36.	18ECE34	Blockchain Technologies	3	0	0	3	VIII

OPEN ELECTIVE COURSES OFFERED TO OTHER DEPARTMENTS (OE)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	18ECO01	PCB Design and Fabrication	3	0	2	4	V
2.	18ECO02	Neural Networks and Fuzzy Logic for Engineering Applications	3	0	2	4	V
3.	18ECO03	Principles of Quantum Computing	3	0	2	4	VI
4.	18ECO04	Electronic Hardware and Troubleshooting	2	0	2	3	VII
5.	18ECO05	Principles of Communication Techniques	3	0	0	3	VII
6.	18ECO06	Bioinspired Computing Technologies	2	0	2	3	VIII
7.	18GEO01	German Language Level 1	4	0	0	4	V/ VI/ VII/ VIII
8.	18GEO02	Japanese Language Level 1	4	0	0	4	V/ VI/ VII / VIII
9.	18GEO05	German Language Level 2	4	0	0	4	V/ VI/ VII/ VIII
10.	18GEO06	German Language Level 3	3	0	0	3	V/ VI/ VII/ VIII
11.	18GEO07	German Language Level 4	3	0	0	3	V/ VI/ VII/ VIII
12.	18GEO08	Japanese Language Level 2	4	0	0	4	V/ VI/ VII / VIII
13.	18GEO09	Japanese Language Level 3	3	0	0	3	V/ VI/ VII / VIII
14.	18GEO10	Japanese Language Level 4	3	0	0	3	V/ VI/ VII / VIII

18EGT11 - ENGLISH FOR COMMUNICATION I

(Common to all Engineering and Technology Branches)

Programme & Branch	B.E. & Electronics and Communication 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. & Electronics and Communication 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. & Electronics and Communication 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	All BE/BTech branches	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. & Electronics and Communication 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. & Electronics and Communication 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	2													
CO2	2	2	2		2									
CO3		2	1											
CO4		2	1											
CO5		2	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. & Electronics and Communication 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						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							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. & Electronics and Communication 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. & Electronics and Communication 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.

***Alternate Weeks**

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.

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	3	2												
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	25	40	35				100
ESE	20	40	40				100

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

18CYC24 - ENVIRONMENTAL SCIENCE AND FUEL CELLS
(Common to ECE & EIE branches)

Programme & Branch	B.E. - Electronics and Communication 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, batteries, fuel cells, 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

Batteries and Fuel Cells: Introduction - types of batteries - primary batteries**-** lechlanche cell - secondary batteries **-** construction and working of lead acid and nickel-cadmium batteries - classification, description, principle, components and applications of alkaline fuel cells, phosphoric acid and molten carbonate – hydrogen - advantages of using hydrogen as alternate fuel.

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.

***Alternate Weeks**

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 / MANUAL:

1. Rakesh Johri, “E-waste: implications, regulations, and management in India and current global best practices”, The Energy and Resources Institute (TERI), 2013.
2. Charles H. Eccleston, “Environmental Impact Assessment: A Guide to Best Professional Practices”, CRC Press, 2017.
3. Palanisamy P.N., Manikandan P., Geetha A. and 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:	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:	apply the concepts of batteries, fuel cells and its applications in various field	Applying (K3)
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					2							
CO3	3	2	1	1			3							
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. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	2	ES	2	0	2	3

Preamble	To impart knowledge on orthographic, isometric projections, sectional views and development of surfaces by solving different application-oriented problems.	
Unit - I	**General Principles of Orthographic Projection:**	**9**
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)**

18ECT21 - CIRCUIT ANALYSIS AND NETWORK SYNTHESIS
(Common to Electronics and Communication Engineering & Mechatronics Engineering branches)

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	2	PC	3	0	0	3

Preamble: This course provides an insight on basic laws and theorems to solve different DC circuits and networks and to expose them to the rudiments of the course which is essential for subsequent courses.

UNIT – I		9

Circuit Elements and Kirchhoff's Laws: Voltage and Current - Power and Energy – Resistance Inductance and Capacitance Parameter - Energy Sources - Kirchhoff's Voltage Law - Voltage Division-Power in a series Circuit - Kirchhoff's Current Law - Parallel Resistance - Current Division - Power in a Parallel Circuit - Mesh Analysis - Nodal Analysis - Source Transformation Technique.

UNIT – II		9

Useful Theorems in Circuit Analysis: Star-Delta Transformation-Superposition Theorem-Thevenin Theorem-Norton Theorem-Maximum Power Transfer Theorem.

UNIT – III		9

Transient Analysis: Transient analysis of RL, RC and RLC circuits. **Resonance:** Resonance: Series Resonance-Impedance and Phase Angle of a Series Resonant Circuit-Voltages and Currents in a Series Resonant Circuit-Bandwidth of an RLC circuit-Quality Factor(Q) and its Effect on Bandwidth-Parallel Resonance-Resonant Frequency for a Tank Circuit- Q-Factor of Parallel Resonance.

UNIT – IV		9

Two Port Networks: Two-port Network-Open-Circuit Impedance (Z) Parameters-Short-Circuit Admittance (Y) Parameters-Transmission (ABCD) Parameters-Hybrid (H) Parameters-Inter-Relationships of different Parameters-Interconnection of Two-port Network-Lattice Network.

UNIT – V		9

Elements of Realizability and Synthesis of One-Port Networks: Hurwitz Polynomials- Frequency Response of Reactive One Ports - Synthesis of Reactive one ports by Foster's Method and Cauer Method-Synthesis of R-L Network by the Foster and Cauer Method- Synthesis of R-C Network by Foster and Cauer Method.

Total: 45

TEXT BOOK:

1. Sudhakar A. and Shyammohan S. Palli, "Circuits and Networks Analysis and Synthesis", 5th Edition, Tata McGraw-Hill, New Delhi, 2015.

REFERENCES:

1. Hayt W.H., Kemmerly J.E., Durbin S.M., "Engineering Circuit Analysis", 8th Edition, Tata McGraw-Hill, New Delhi, 2013.
2. Ravish R. Singh, "Electrical Networks", 14th Reprint, Tata McGraw-Hill, New Delhi, 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	identify the main circuit elements and apply Kirchhoff's Laws to calculate current, voltage and power in typical linear electric circuits using a analytical methods for DC and AC circuits	Applying (K3)
CO2:	reduce and analyse complicated circuits using network theorems	Analyzing (K4)
CO3:	analyse circuit transients for RL,RC and RLC circuits	Analyzing (K4)
CO4:	calculate bandwidth and Q factor of a parallel and series resonance circuits	Analyzing (K4)
CO5:	synthesize the parameters one and two port networks	Evaluating (K5)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	70				100
CAT2	10	20	50	20			100
CAT3	10	20	50	20			100
ESE	10	20	50	20			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. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	2	ES	0	0	2	1

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

18MAC31 - MATHEMATICS III

(Common to Civil Engineering, Mechanical Engineering, Mechatronics Engineering, Automobile Engineering, Electronics And Communication Engineering, Electrical And Electronics Engineering , Electronics And Instrumentation Engineering, Chemical Engineering & Food Technology Branches)

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	3	BS	3	1*	2*	4

Preamble	To provide the skills for solving the real time engineering problems involving partial differential equations and impart knowledge in Fourier transform and Z-Transform.	
Unit - I	**Fourier Series:**	**9**
Dirichlet's conditions – General Fourier series – Change of interval – Odd and even functions – Half range Sine series – Half range Cosine series – Harmonic analysis.		
Unit - II	**Partial Differential Equations:**	**9**
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Lagrange's linear equation – Solution of homogeneous linear partial differential equations of higher order with constant coefficients.		
Unit - III	**Applications of Partial Differential Equations:**	**9**
Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two dimensional heat equation (excluding insulated edges).		
Unit - IV	**Fourier Transform:**	**9**
Fourier Integral theorem (without proof) – Fourier transform pair – Properties (without proof) – Transforms of simple functions – Fourier Sine and Cosine transforms – Properties (without proof) – Convolution theorem and Parseval's identity (Statement and applications only).		
Unit - V	**Z –Transform:**	**9**
Definition – Z-transform of some basic functions – Elementary properties – Inverse Z- transform: Partial fraction method – Residue method – Convolution theorem – Applications of Z-transforms: Solution of difference equations.		

List of Exercises / Experiments :

1.	Expressing given function in terms of Fourier series.
2.	Harmonic Analysis of given data.
3.	Solving second order partial differential equations.
4.	Solution of One dimensional wave equation.
5.	Solution of Two dimensional heat equation.
6.	Determining Fourier and inverse Fourier transform of a given function.
7.	Computing Z- transform of a discrete sequence.
8.	Apply Z- transforms to obtain the solution of difference equations.

***Alternate Weeks**

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

TEXT BOOK:

1. Veerarajan T., "Transforms and Partial Differential Equations", 3rd Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2013.

REFERENCES:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons Ltd., USA, 2019.
2. Duraisamy C., Vengataasalam S., Arun Prakash K. & Suresh M. , "Engineering Mathematics – III", 2nd Edition, Pearson India Education, New Delhi, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	express given function or data in terms of Fourier series	Applying (K3)
CO2	solve the given standard partial differential equations	Applying (K3)
CO3	apply Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations	Applying (K3)
CO4	use the mathematical principles of Fourier transforms which will provide the ability to formulate and solve some of the physical problems of engineering	Applying (K3)
CO5	apply Z transform techniques for analyzing linear time invariant systems	Applying (K3)
CO6	express the given data in Fourier series using MATLAB	Applying (K3), Manipulation (S2)
CO7	solve partial differential equations using PDE Modeler	Applying (K3), Manipulation (S2)
CO8	find Fourier and Z-Transforms using MATLAB built in functions	Applying (K3), Manipulation (S2)

Mapping of COs with POs and PSOs

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

18ECT31 - DIGITAL ELECTRONICS

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	3	PC	3	1	0	4

Preamble	To gain knowledge about the digital logic number systems, code conversion, Boolean algebra, Boolean function minimization using different minimization techniques, and also to design different combinational and sequential logic circuits.	
Unit - I	**Number systems:**	**9+3**
Number systems and their conversions :Binary, Decimal, Octal and Hexadecimal – Complements-Signed binary numbers- Binary arithmetic-Binary codes: Weighted and non-weighted codes: BCD, 2421, Gray code, ASCII.		
Unit - II	**Minimization Techniques:**	**9+3**
Boolean postulates and laws - De-Morgan's theorem - Principle of Duality- Boolean expression- Minimization of Boolean expressions - Minterm, Maxterm, Sum of Products (SOP), Product of Sums(POS)-Karnaugh map minimization-QuineMcCluskey method of minimization-Implementations of logic functions using universal gates-Comparison of TTL and CMOS characteristics.		
Unit - III	**Combinational Circuits:**	**9+3**
Design procedure – Half adder and subtractor – Full adder and subtractor – Parallel binary adder and subtractor – Carry look ahead adder – BCD adder - Multiplexer- Demultiplexer – Decoder - Encoder – Parity checker and generator – Code converters - Magnitude comparator.		
Unit - IV	**Sequential Circuits:**	**9+3**
Introduction, Flip flops: SR, JK, D and T –Level and Edge triggering - Realization of one flip flop using other flip flops- Design and analysis of synchronous sequential circuits: Characteristic and excitation tables and equations, State diagram, State table, State minimization and State assignment Design of synchronous counters - Johnson Counter - Ring Counters - Sequence detector - Ripple counter – Registers: Shift registers, Universal shift register.		
Unit - V	**Asynchronous Sequential Circuits:**	**9+3**
Analysis of asynchronous sequential circuits – Primitive state table – Minimization of primitive state table –State assignment – Excitation table - Cycles – Races –Hazards: Static Dynamic, Essential, Hazards elimination –Realization of combinational logic circuits using PLDs: PROM, PLA and PAL.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Morris Mano M, "Digital Design", 6th Edition, Pearson Education Pvt. Ltd, New Delhi, 2018.

REFERENCES:

1. Charles H. Roth, "Fundamentals of Logic Design", 6th Edition, Thomson Learning, New Delhi, 2013.
2. Salivahanan S & Arivazhagan S, "Digital Circuits and Design", 5th Edition, Oxford University Press, New Delhi, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	summarize number systems for digital logic design	Understanding (K2)
CO2	carryout simplifications on boolean expressions	Applying (K3)
CO3	apply digital principles to design combinational and sequential circuits	Applying (K3)
CO4	apply digital principles to analyse and design synchronous and asynchronous sequential circuits	Applying (K3)
CO5	realize boolean functions using PLDs	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18ECC31 - SOLID STATE DEVICES AND CIRCUITS

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Solid State Physics	3	PC	3	0	2	4

Preamble	To understand about the construction of power supply circuits, biasing of BJT, mid band analysis of BJT, low and high analysis of BJT amplifiers with experimental knowledge.	
Unit - I	**BJT and its Biasing:**	**9**
Construction and Principle of Operation - I/O characteristics of BJT in CE, CB and CC configurations-Need for biasing, Load line and Quiescent point, Variation of Quiescent point -Stability factors- Different types of biasing circuits- Method of stabilizing the Q point (Derivation for S only) - Bias Compensation Techniques		
Unit - II	**Midband Analysis of BJT:**	**9**
CE, CB and CC amplifiers-Midband analysis of CE,CB,CC (BJT) single stage amplifiers using small signal equivalent circuit(Accurate analysis only) - Miller's theorem- Analysis using Miller's Theorem - Methods of increasing input impedance using Darlington connection and Bootstrapping(Concept alone) - Multistage Amplifiers (CE-CB)		
Unit - III	**Frequency Response of Amplifiers:**	**9**
Low Frequency Analysis of BJT -Hybrid – π Equivalent Circuit of BJTs: Elements in the Hybrid π Model- CE Short Circuit Current Gain- Frequency response of multistage amplifiers: Calculation of overall upper and lower cutoff frequencies		
Unit - IV	**Field Effect Transistors:**	**9**
JFET and MOSFET – Construction – Principles of Operation and Characteristics.Differential Amplifiers: Basic Emitter Coupled Differential Amplifier circuit- Bisection Theorem- Differential and Common mode Gain -CMRR- Derivation of Transfer Characteristics, Transconductance.		
Unit - V	**Thyristorsand Power Supply Circuits:**	**9**
SCR, DIAC and TRIAC- Construction, working and characteristics – Diode Clippers and Clampers, Half wave and Full wave Bridge rectifiers with resistive load- Analysis for Vdc and ripple voltage with C, L, LC and CLC filters. Zener diode regulator -Transistor voltage regulators: Series and shunt- Line regulation and load regulation- Switched Mode Power Supplies: General Block diagram.		

List of Exercises / Experiments :

1.	Construction and working of Bridge rectifier using Diode
2.	Characteristics of Zener Diode
3.	Characteristics of SCR and TRIAC
4.	Characteristics of BJT (common Emitter Configuration) and Determination of h parameters
5.	Frequency response of Voltage Divider Bias circuit –BJT
6.	Simulation using PSPICE for the experiments 4 & 5
7.	Frequency response of differential amplifier
8.	Frequency response of Multistage amplifiers

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Jocob Millman, Christos C. Halkias & Satyabrata Jit, "Electronic Devices and Circuits", 4th Edition, McGraw-Hill, New Delhi, 2015.

REFERENCES:

1.	Salivahanan S & Sureshkumar N, "Electronic Devices and Circuits", 4th Edition, McGraw-Hill, New Delhi, 2017.
2.	Anil K. Maini & Varsha Agrawal, "Electronic Devices and Circuits", 1st Edition, Wiley India, New Delhi, 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	outline the working principle and characteristics of differential amplifier	Understanding (K2)
CO2	demonstrate the configurations and biasing circuits of BJT	Applying (K3)
CO3	analyze various parameters of BJT amplifier circuits using small signal analysis	Analyzing (K4)
CO4	analyze the frequency response of amplifiers using hybrid -πmodel	Analyzing (K4)
CO5	apply design procedure to design power supply circuits	Applying (K3)
CO6	demonstrate the characteristics of electron devices	Applying (K3), Imitation (S1)
CO7	design, construct and test various biasing circuits for electronic systems	Evaluating (K5), Precision (S3)
CO8	design, analyze and test the performance of electronic devices using electronic systems design tools	Evaluating (K5), 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			3							2	2	1
CO2	3	2	1	1	2				2			2	3	1
CO3	3	3	2	2	1								3	2
CO4	3	3	2	2	1								3	2
CO5	3	2	1	1			3		2			2	3	1
CO6	3	2	1	1					3				3	1
CO7	3	3	3	3	3				3				3	3
CO8	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	10	30	20	40			100
CAT2	10	20	30	40			100
CAT3	10	40	50				100
ESE	10	25	40	25			100

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

18ECT32 - ELECTROMAGNETICS AND WAVEGUIDES

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Applied Physics	3	PC	3	0	0	3

Preamble	To employ the use of basic laws to show the behavior of electric and magnetic fields in static environment. It illustrates the field distribution in time varying environment and relates the field with propagation of waves along guided structures and in waveguides.	
Unit - I	**Electrostatics:**	**9**
Introduction to Coordinate system - Rectangular, cylindrical and spherical coordinate system - Coulomb's law - Electric field intensity of Point and line charge - Electric flux density - Gauss law - Applications of Gauss law for point and line charge - Electric potential of a point charge - Potential due to dipole - Boundary conditions for electric field.		
Unit - II	**Magnetostatics:**	**9**
Magnetic Field Intensity for finite and infinite line - Ampere's circuital law - Applications of Ampere's Circuital Law for line charge - Magnetic vector potential - Magnetic flux and Magnetic flux density - Nature of magnetic materials - Boundary conditions for Magnetic field.		
Unit - III	**Maxwell's Equation:**	**9**
Maxwell's equation in point form and integral form for steady and time varying fields - Wave Equation - Poynting theorem - Uniform Plane Waves – Reflection – Refraction – Polarization.		
Unit - IV	**Guided Waves:**	**9**
Waves between parallel planes of perfect conductors- Field Equations -TE waves -TM waves - Characteristics of TE and TM waves - Attenuation of TE and TM waves in parallel plane guides - TEM Waves.		
Unit - V	**Rectangular Waveguides and Resonators:**	**9**
Field equations - TM waves -TE waves - Characteristic of TE and TM Waves - Impossibility of TEM waves - Dominant mode - Characteristic impedance - Excitation of modes.Introduction to cavity resonator - Field Stregnth Equation of Rectangular cavity resonators and characteristics.		

Total:45

TEXT BOOK:

1. William H. Hayt, Jr & John A. Buck, "Engineering Electromagnetics", 7th Edition, McGraw Hill, New Delhi, 2011.

REFERENCES:

1. Matthew N.O. Sadiku & Kulkarani S.V., "Principles of Electromagnetics", 6th Edition, Oxford University Press, New Delhi, 2015.
2. Nannapaneni Narayana Rao, "Fundamentals of Electromagnetics for Engineering", 1st Edition, Pearson Education, New Delhi, 2009.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply the basic laws to determine electric field intensity and potential for point and line charge distributions	Applying (K3)
CO2	calculate the magnetic field intensity for current carrying conductor	Applying (K3)
CO3	make use of the basic laws to develop Maxwell's Equation and Wave Equation	Applying (K3)
CO4	compute the characteristics of uniform plane waves in conductor, lossless and lossy dielectric media and guided waves	Applying (K3)
CO5	determine the field equations, characteristics and performance parameters for rectangular waveguides and rectangular cavity resonators	Applying (K3)

Mapping of 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	20	40	40				100
CAT2	20	40	40				100
CAT3	15	35	50				100
ESE	20	30	50				100

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

18ECC32 - OBJECT ORIENTED CONCEPTS AND PROGRAMMING WITH C++

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	3	ES	3	0	2	4

Preamble	To impart the knowledge of Object Oriented Concepts and to develop the programs with C++.	
Unit - I	**Classes and Objects:**	**9**
Overview of Object Oriented programming- Classes and Objects-Arrays-Pointers-References.		
Unit - II	**Polymorphism:**	**9**
Function Overloading –Copy Constructors- Default Arguments- Operator Overloading		
Unit - III	**Inheritance and Virtual Functions:**	**9**
Inheritance and protected members, Inheriting Multiple Base Classes, Virtual Functions, Pure Virtual Functions.		
Unit - IV	**Templates and Exception Handling:**	**9**
Generic Functions, Applying Generic Functions, Generic Classes. Exception Handling Fundamentals, Handling Derived-Class Exceptions, Exception Handling Options. Applying Exception Handling.		
Unit - V	**File Handling:**	**9**
File Classes-Opening and closing a File, Reading and Writing Text Files, Unformatted and Binary I/O		

List of Exercises / Experiments :

1.	Develop C++ Functions with default arguments.
2.	Develop C++ Classes with constructors and destructor.
3.	Develop C++ program using function and operator overloading
4.	Develop C++ program using inheritance
5.	Develop C++ program using multiple inheritance and pointers
6.	Develop C++ program for file handling
7.	Developing an application using object oriented concepts

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Herbert Schildt, "The Complete Reference C++", 4th Edition, McGraw Hill, New Delhi, 2016.

REFERENCES:

1.	Robert Lafore, "Object-Oriented Programming in C++", 4th Edition, SAMS, United States, 2002.
2.	Venugopal K.R & Raj Buyya, "Mastering C++", 10th Edition, McGraw Hill, New Delhi, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	develop programs using classes and objects	Applying (K3)
CO2	develop C++ program using polymorphism and inheritance	Applying (K3)
CO3	develop generic functions and classes using templates	Applying (K3)
CO4	develop programs to manage run time errors using exception handling	Applying (K3)
CO5	develop simple application using files	Applying (K3)
CO6	synthesis simple C++ program with function and operator overloading	Evaluating (K5), Precision (S3)
CO7	synthesis class hierarchies with virtual functions and inheritance	Evaluating (K5), Precision (S3)
CO8	synthesis an application using file handling	Evaluating (K5), Precision (S3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	35	50				100
CAT2	15	30	55				100
CAT3	15	30	55				100
ESE	10	30	60				100

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

18ECT33 - SENSORS AND ITS APPLICATIONS

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

Preamble	To interpret the working principles and make use of sensors for robotics, automotive, biomedical and farming applications.	
Unit - I	**Introduction to Sensors and Interface:**	**6**
Requirements of Sensors - Introduction to analog and digital sensors- Block diagram of sensor interface - Differential operational amplifier interface – Voltage divider interface.		
Unit - II	**Bridge Measurements:**	**6**
Resistance Measurement:Wheatstone Bridge - Capacitance Measurement: Schering Bridge –Inductance Measurement: Hay Bridge - Maxwell Bridge		
Unit - III	**Sensors in Robotics:**	**6**
Object detection using IR sensor and Proximity sensor– Distance measurement using Ultrasonic sensor - RPM measurement using Position encoder – Location sensing using GPS.		
Unit - IV	**Sensors in Automotive:**	**6**
Potentiometer -Airbag automation with Piezoelectric sensors -Speed detection using Hall Effect sensor - Inertial Measurement using Accelerometer, Gyroscope and compass sensor - fingerprint sensor		
Unit - V	**Sensors in Biomedical and Farming:**	**6**
Measurement of Temperature – heart beat measurement - Load measurement using Strain gauge – Flex sensors - pH sensor - Level Sensor –Flow sensor –humidity measurement – gas sensor – case study on sensor integration in farming.		

Total:30

TEXT BOOK:

1. Murty D.V.S., "Transducers and Instrumentation", 2nd Edition, Prentice Hall of India, New Delhi, 2012.

REFERENCES:

1. Ezzat G. Bakhoum, "Micro and nano Scale Sensors and Transducers", 1st Edition, CRC Press Taylor and Francis, New Delhi, 2015.
2. Hristoforou E & Vlachos D. S., "Materials and Applications for Sensors and Transducers", 1st Edition, Trans Tech Publication, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	predict sensors for automotive, industry, biomedical and farming applications and their interface	Understanding (K2)
CO2	compute unknown electrical parameters through suitable bridge measurements	Applying (K3)
CO3	employ suitable sensors for different parameter measurements in automotive applications	Applying (K3)
CO4	use appropriate sensors required for industrial robot	Applying (K3)
CO5	carry out integration of sensors in biomedical and farming 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	2	1										2	3	
CO2	3	2	1	1								2	3	1
CO3	3	2	1	1		2	2					2	3	2
CO4	3	2	1	1		2	2					2	3	2
CO5	3	2	1	1		2	2					2	3	2

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

ASSESSMENT PATTERN - THEORY

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

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

18ECL31 - DIGITAL ELECTRONICS LABORATORY

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	3	PC	0	0	2	1
Preamble	To design combinational and sequential logic circuits.						

List of Exercises / Experiments:

1.	Verification of Boolean theorems using digital logic gates
2.	Design and implementation of combinational circuits using basic gates and universal gates
3.	Design and implementation of code converters
4.	Design and implementation of 4 bit binary adder/subtractor using MSI devices
5.	Design and implementation of magnitude comparator using basic gates and MSI devices
6.	Design and implementation of multiplexers and demultiplexers using basic gates and MSI devices.
7.	Design and implementation of decoders and encoders.
8.	Truth table verification of flip flops.
9.	Design and implementation of shift registers in SISO, SIPO, PISO, PIPO modes using suitable ICs.
10.	Design and implementation of synchronous counters and asynchronous counters.

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	design, construct and verify combinational circuits using logic gates	Evaluating (K5), Precision (S3)
CO2	design, construct and verify combinational circuits using MSI devices	Evaluating (K5), Precision (S3)
CO3	design, construct and test sequential circuits using flipflops	Evaluating (K5), Precision (S3)

Mapping of COs with POs and PSOs

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

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	3	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

18MAT41 - PROBABILITY THEORY AND RANDOM PROCESS

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

Preamble	To impart knowledge in random variables, probability distributions, correlation and regression, also develop skills to apply random process concepts in communication engineering.	
Unit - I	**Random Variables:**	**9+3**
Discrete and Continuous random variables – Probability Mass and Probability density functions – Mathematical expectation and Variance – Moments – Moment generating functions – Functions of a random variable		
Unit - II	**Standard Probability Distributions:**	**9+3**
Discrete Distributions: Binomial distribution – Poisson distribution – Geometric distribution – Continuous Distributions: Uniform distribution – Exponential distribution – Normal distribution.		
Unit - III	**Two Dimensional Random Variables:**	**9+3**
Joint probability distributions – Marginal and conditional distributions – Covariance – Correlation and regression – Transformation of random variables.		
Unit - IV	**Random processes:**	**9+3**
Classification – Stationary process – Markov chains – Transition probabilities – Limiting distributions – Poisson process.		
Unit - V	**Spectral Densities:**	**9+3**
Auto Correlation- Cross Correlation – Properties (Without Proof) – Power spectral density – Cross spectral density – Properties (Without Proof) – Wiener- Khintchine relation – Relationship between cross power spectrum and cross correlation function.		

Lecture: 45, Tutorial:15, Total:60

TEXT BOOK:

1. Veerarajan T., "Probability and Statistics, Random Processes and Queuing Theory ", 4th Edition, Tata McGraw Hill Education, New Delhi, 2018.

REFERENCES:

1. Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", 9th Edition, Cengage Learning, USA, 2016.
2. Roy D.Yates & David J.Goodman, "Probability and Stochastic Processes - A friendly Introduction for Electrical and Computer Engineers", 3rd Edition, John Wiley & Sons, New Jersey, 2005.

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 Engineering problems	Applying (K3)
CO2	analyze and interpret engineering problems by means of suitable probability distribution	Applying (K3)
CO3	apply effectively the concepts of two dimensional random variables	Applying (K3)
CO4	use random process to handle communication problems	Applying (K3)
CO5	apply the concept and properties of spectral density function and cross correlation function to solve complex engineering problems	Applying (K3)

Mapping of COs with POs and PSOs

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

18CST46 - DATA STRUCTURE WITH PYTHON

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Object Oriented Concept and Programming with C++	4	ES	2	0	0	2

Preamble	To introduce the concepts in python programming and problem solving with data structures and also to implement data structures like stack, queue, tree and graph.	
Unit - I	**Introduction to Python 3:**	**6**
Python Keywords, Data Types: Numbers and String – Containers: Lists- Tuple- Dictionaries- Nested containers – Element Accessing methods - Set – Type casting. Operators - Conditional and Looping – List comprehension- Functions – Recursion - Reading and writing files (.txt & .csv).		
Unit - II	**Modules and Classes::**	**6**
Modules and Packages - Data Modeling: Base Class definition - Attributes – Methods: Special methods, object specific methods– Inheritance - Exception Handling- Collections		
Unit - III	**Array, Linked Structure and Tree:**	**6**
Array: Array data structure- 2D Array. Linked Structure- Operation on Singly Linked Structure- Stack- Queue- Trees: Binary Tree Traversals		
Unit - IV	**Operations:**	**6**
Search Algorithm: min-max Sort Algorithm: Selection, Bubble and Insertion- Faster Sorting: Merge sort – Efficiency : Memory consumption- Time to execution - Complexity analysis		
Unit - V	**Graph Theory:**	**6**
Graphs: Terminology - Representation of Graphs: Adjacency matrix, Adjacency list-Graph Traversal: Breadth first, Depth first, Trees within Graphs: Spanning and minimum spanning tree- Topological Sort.		

Total:30

TEXT BOOK:

1. Kenneth A. Lambert, "Fundamentals of Python: Data Structure", 2nd Edition, Cengage Learning, 2019.

REFERENCES:

1. Mark Lutz, "Learning Python", 5th Edition, O'Reilly Publication, 2013.
2. https://www.tutorialspoint.com/python/python_data_structure.htm

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	relate the usage of different data types in python and Build user defined function, module & standard library	Understanding (K2)
CO2	construct user defined class data types and experiment in storing and accessing of data in the memory	Applying (K3)
CO3	organize the linked data structure in accessing data in the memory	Applying (K3)
CO4	apply appropriate searching algorithm with respect to given application	Applying (K3)
CO5	solve in finding shortest path of given network structure	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18ECT41 - SIGNALS AND SYSTEMS

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Mathematics III	4	PC	3	1	0	4

Preamble	To introduce different types of signals and to analyze signals in time and frequency domain and also to analyze system response using Fourier, Laplace and Z transform.	
Unit - I	**Signals (CT and DT):**	**9+3**
Standard CT and DT Signals – Classification of CTS and DTS –Mathematical operations on CTS and DTS. Systems: CT and DT systems- Classification of continuous time and discrete time systems		
Unit - II	**Time Domain Analysis of CT and DT:**	**9+3**
Sampling of continuous time signals- Convolution integral and convolution sum -properties of convolution- Impulse response of a system- step response of a system- Graphical procedure for convolution - Interconnection of systems.		
Unit - III	**Real Frequency Domain Analysis:**	**9+3**
Complex exponential Fourier series analysis – Gibbs phenomenon-Fourier Transform: CTFT- Properties - Response of LTI CT systems, DTFT – Properties - Response of LTI DT systems. Inverse Fourier Transform.		
Unit - IV	**Laplace Transform (LT):**	**9+3**
Relation between CTFT and LT- Region of Convergence- LT of CT signals- Properties - Response of LTI-CT systems- Impulse response- Step response- Inverse Laplace Transform		
Unit - V	**Z-transform (ZT):**	**9+3**
Relation between DTFT and ZT - Region of Convergence- ZT of DT signals- Properties - Response of LTI-DT systems- Impulse response- Step response- Inverse Laplace Transform using partial fraction and residual method- Realization of DT systems using direct form I and II		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. NagoorKani A, "Signals and Systems", 1st Edition, McGraw-Hill, New Delhi, 2018.

REFERENCES:

1. Roberts M.J., "Signals And Systems Analysis Using Transform Method and Matlab", 3rd Edition, Tata McGraw-Hill, New Delhi, 2018.
2. OppenheimAlanv, Willsky Alan S & Hamid Nawab S, "Signals & Systems", 2nd Edition, Pearson Education, New Delhi, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	classify various types of signals and systems based on their functional and graphical representation and apply the required signal operations functionally and graphically in order to transform the independent variable	Applying (K3)
CO2	determine system response for a given input via solving differential and difference equation of a system and using convolution operation	Applying (K3)
CO3	breakdown a signal into its harmonics using Fourier transform	Analyzing (K4)
CO4	analyze the continuous time signal in s-domain using Laplace transform	Analyzing (K4)
CO5	analyze the discrete time sequence using z- transform	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									3	1
CO2	3	2	2	1									3	1
CO3	3	2	2	1		2			2	2		2	3	1
CO4	3	2	2	1		2			2	2		2	3	1
CO5	3	2	2	1		2			2	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	20	50	10			100
CAT2	10	20	60	10			100
CAT3	10	10	60	20			100
ESE	20	20	40	20			100

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

18ECT42 - ELECTRONIC CIRCUITS

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Solid State Devices and Circuits	4	PC	3	1	0	4

Preamble	To understand and analyze feedback amplifiers, large signal amplifiers, FET amplifiers, oscillators and wave shaping circuits.	
Unit - I	**Feedback Amplifiers:**	**9+3**
Feedback amplifiers - Block diagram, Loop gain, Gain and Cut off frequencies with Feedback – Effect of negative feedback - Four types of feedback topologies - Input and output resistances with feedback - Method of identifying feedback topology-Analysis of feedback amplifiers.		
Unit - II	**FET Amplifiers:**	**9+3**
Biasing of FET: Fixed bias, source self bias-small signal low frequency analysis: CS and CD amplifiers –High frequency large signal amplifiers: CS and CD amplifiers		
Unit - III	**Oscillators:**	**9+3**
Condition for oscillation – RC Oscillators: RC phase shift and Wien Bridge Oscillators - LC oscillators: Hartley and Colpitts oscillator, Quartz crystal: Construction, Electrical equivalent circuit of crystal, Crystal oscillator circuit- Miller and Pierce oscillators.		
Unit - IV	**Large Signal Amplifiers:**	**9+3**
Classification of amplifiers (Class A, B, AB, and C and D)- Direct coupled and transformer coupled class A power amplifiers and its efficiency-Distortion in power amplifiers- Class B complementary symmetry push-pull power amplifiers - Calculation of power output, efficiency and power dissipation-Crossover distortion and its elimination methods.		
Unit - V	**Multivibrators and Time Base Generators:**	**9+3**
: RL and RC Integrator and Differentiator circuits - Multivibrators: Collector coupled Astable multivibrator- Collector coupled Monostable multivibrator- Bistable multivibrators- Schmit trigger-Introduction to Voltage time base generator-Errors of generation of sweep waveform- UJT relaxation oscillator		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Salivahanan S & Sureshkumar N , "Electronic Devices and Circuits ", 4th Edition, McGraw Hill, New Delhi, 2017.

REFERENCES:

1. Millman & Taub H, "Pulse Digital And Switching Waveform", 2nd Edition, McGraw-Hill, New Delhi, 2007.
2. Anil K. Maini & Varsha Agrawal, "Anil K. Maini and Varsha Agrawal", 1st Edition, Wiley India, New Delhi, 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	examine the performance metrics of amplifiers using feedback concepts	Analyzing (K4)
CO2	analyze the FET biasing circuits , low and high frequency FET amplifiers	Analyzing (K4)
CO3	design oscillators for various frequencies for practical applications	Applying (K3)
CO4	analyze the performance of large signal amplifiers	Analyzing (K4)
CO5	design of non sinusoidal oscillators	Applying (K3)

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

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

ASSESSMENT PATTERN - THEORY

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

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

18ECT43 - MICROPROCESSOR AND MICROCONTROLLER

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Digital Electronics	4	PC	3	0	0	3

Preamble	To understand the concept of 8085 and 8051 and to do programming with microprocessor and microcontrollers techniques used for real time applications.	
Unit - I	**8085 Microprocessor:**	**9**
8085 - Functional block diagram – Registers, ALU, Bus systems - Basic interfacing concepts -Memory and I/O interfacing - machine cycle - T-state -Timing diagrams for Opcode Fetch Cycle ,Memory Read, Memory Write, I/O Read, I/O Write -Memory control signals- Interrupts-Method of servicing - Interrupts.		
Unit - II	**8085 Microprocessor ALP Programming:**	**9**
Instruction set of 8085 - Instruction set classification -addressing modes- simple programs -Stack and Subroutines Concept - Time delay using single and double register and calculations.		
Unit - III	**89C51 Microcontroller:**	**9**
Introduction to RISC and CISC machines – 89c51 Microcontroller hardware block diagram - Data and program memory mapping - Register organization - I/O pins - Ports and circuits - Interfacing to external memory- Instruction sets - Addressing modes		
Unit - IV	**89C51 Programming:**	**9**
Assembly language programming -Timer and counter programming – Serial Data Communication using MAX232 converter – Interrupt programming.		
Unit - V	**89C51 Interfacing with Peripherals:**	**9**
LED - Seven segment display – Switch interfacing – LCD-ADC0809 with LM35 sensor - Stepper motor - Speed control of DC motor - Matrix keypad – Case study: Voice Operated Home Appliances for Physically challenged.		

Total:45

TEXT BOOK:

1. Ramesh Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085", 6th Edition, Penram International Publishing, Mumbai, 2013 for Units I,II.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi & RolinMcKinlay, "The 8051 Microcontroller and Embedded Systems using Assembly and C", 2nd Edition, Pearson Education Pvt. Ltd, New Delhi, 2007 for Units III,IV,V.

REFERENCES:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay & Lyla B. Das, "Microprocessors and Microcontrollers", 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 8085 microprocessor architecture	Understanding (K2)
CO2	use assembly language programming skill for simple addition/Subtraction/Multiplication/Division and sorting program using 8085 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										3	1	
CO2	3	2	1	1						2			3	2
CO3	2	1										3	1	
CO4	3	2	1	1	2					2		2	3	1
CO5	3	2	1	1	2	2				2		2	3	2

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

ASSESSMENT PATTERN - THEORY

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

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

18CSL44 - DATA STRUCTURE WITH PYTHON LABORATORY

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Object Oriented Concept and Programming with C++	4	ES	0	0	2	1
Preamble	To implement data structures like stack, queue, tree and graph using python programming						

List of Exercises / Experiments :

1.	Write a program to create variable of data type list & tuple do accessing of the data in it and save it as "ABC.txt" with encoded in UTF-8 format
2.	Write a program to create a user defined module for loading a file
3.	Write a program to create a class for Employee detail defining class member of collection and display of details.
4.	Write a program to find maximum element in an array created
5.	Write a program to implement singly linked list ADT with required operations
6.	Write a program to implement Stack and its operations
7.	Write a program to implement Binary Search Tree Traversals
8.	Write a program to implementation of sorting algorithms using insertion sort, bubble sort
9.	Write a program to implementation of sorting algorithms using quick sort and merge sort
10.	Write a program to implement Dijkstra's algorithm to find shortest path

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual
2.	Jupyter Notebook / Visual Studio / Spyder / PyCharm

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	experiment with user defined function, module of different data types in python	Applying (K3), Manipulation (S2)
CO2	experiment with different data structure in accessing data in the memory	Applying (K3), Manipulation (S2)
CO3	experiment sorting and searching algorithm with respect to given application	Applying (K3), Manipulation (S2)

Mapping of COs with POs and PSOs

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

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

18ECL41 - ELECTRONIC CIRCUITS LABORATORY

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Solid State Devices and Circuits	4	PC	0	0	2	1
Preamble	To design amplifiers, oscillators and multivibrators						

List of Exercises / Experiments :

1.	Frequency response of current series feedback amplifier
2.	Frequency response of voltage shunt feedback amplifier
3.	Frequency response of common source amplifier using self bias
4.	Class -B Complementary symmetry Power amplifier-with and without crossover distortion
5.	Design of audio frequency oscillator: RC Phase Shift Oscillator
6.	Design of radio frequency oscillator: Hartley oscillator
7.	Design of radio frequency oscillator: Colpitts oscillator
8.	Design of Bistable multivibrator using transistor
9.	UJT relaxation oscillator
10.	Simulation of the following experiments using PSPICE i) Frequency response of current series feedback amplifier ii) Frequency response of voltage shunt feedback amplifier
11.	Simulation of the following oscillators using PSPICE i) RC Phase Shift Oscillator ii) Wien Bridge Ocsillator
12.	Simulation of the following experiments using PSPICE i) Frequency Response of Darlington Pair ii) Hartley Oscillator

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual
2.	Orcad Cadence PSPICE Software 16.6

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	organize feedback and large signal amplifiers (BJT) and FET amplifier	Applying (K3), Precision (S3)
CO2	demonstrate RC and LC oscillators and multivibrator circuits	Applying (K3), Precision (S3)
CO3	design and test the performance of biasing circuits, amplifiers and oscillators using electronic systems design tools	Applying (K3), Precision (S3)

Mapping of COs with POs and PSOs

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

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

18ECL42 - MICROPROCESSOR AND MICROCONTROLLER LABORATORY

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	4	PC	0	0	2	1
Preamble	To do programming using 8085 and 89c51						

List of Exercises / Experiments :

1.	Addition / Subtraction operations using 8085.
2.	Multiplication using 8085 microprocessor
3.	Sorting and searching using 8085
4.	Hex./ASCII code conversion using 8085 microprocessor
5.	BCD code conversion using 8085 microprocessor
6.	Addition / Subtraction / Multiplication / Division using 89c51 microcontroller.
7.	Interfacing of switch and LED with 89c51 microcontroller.
8.	Interfacing of ADC with 89c51 microcontroller.
9.	Interfacing of DAC with 89c51 microcontroller.
10.	Stepper Motor interfacing with 89c51 microcontroller.
11.	UART /LCD interfacing with 89c51 microcontroller using Keil and Proteus
12.	DC Motor interfacing with 89c51 microcontroller

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual
2.	Keil and Proteus software

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 8085	Remembering (K1), Imitation (S1)
CO2	build LED and Switch Interface with 8051 Microcontroller	Applying (K3), Imitation (S1)
CO3	demonstrate speed control of DC Motors and Stepper Motor using 8051 Microcontroller	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	2	1							3		2		2	1
CO2	3	2	1	1	3				3		3	1	3	2
CO3	3	3	2	2	3				3		3	2	3	3

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

18ECT51 - ANALOG AND DIGITAL COMMUNICATION

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Signals and Systems, Electronic Circuits, Probability Theory and Random Process	5	PC	3	0	0	3

Preamble	To endow the fundamentals and analytical perspectives of communication systems.	
Unit - I	**Amplitude Modulation:**	**9**
DSB-FC AM and its spectrum, power distribution – Linear modulation schemes: DSBSC, SSBSC and VSB – Frequency translation – Frequency division multiplexing – Superheterodyne receivers – Noise in AM receivers: coherent detection, envelope detection.		
Unit - II	**Angle Modulation:**	**9**
Frequency modulation, Narrowband FM, Wideband FM – Generation of FM: indirect method – FM demodulation: frequency discriminator – Non-linear effects in FM systems – Noise in FM receivers – capture effect – pre-emphasis and de-emphasis in FM		
Unit - III	**Pulse Modulation and Baseband Pulse Transmission:**	**9**
Sampling process – PAM – Quantization process –PCM – TDM – Delta modulation, Line coding: unipolar NRZ, Polar NRZ, Unipolar RZ, Manchester – Matched Filter as optimum receiver – Intersymbol Interference – Eye patterns – Nyquist Criterion for distortion less baseband binary transmission – Pulse shaping with raised cosine filter – Duobinary signaling – Adaptive equalization : LMS algorithm		
Unit - IV	**Passband Digital Transmission and Spread Spectrum Communication:**	**9**
Introduction – Coherent Phase shift keying: BPSK, QPSK, OQPSK, π/4 shifted QPSK – QAM, PN sequence and its properties, Direct Sequence Spread Spectrum, Frequency Hopping Spread Spectrum		
Unit - V	**Information Theory and Coding:**	**9**
Entropy and its properties – Source coding theorem – Discrete Memory less Channel – mutual information and its properties – Channel coding theorem – information capacity theorem; Hamming codes – Cyclic codes – Convolutional codes – Viterbi algorithm – Trellis coded modulation :8 ary PSK		

Total:45

TEXT BOOK:

1. Simon Haykin, Michael Moher, "Introduction to Analog and Digital Communications", 2nd Edition, John Wiley & Sons, New Delhi, 2012.

REFERENCES:

1. Simon Haykin, "Digital Communication Systems", 2nd Edition, John Wiley, New Delhi, 2014.
2. GautamSahe, Taub & Schilling, "Principles of Communication Systems", 4th Edition, McGraw-Hill, New Delhi, 2007.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply the concept of amplitude modulation and infer the effect of noise in AM receivers	Applying (K3)
CO2	make use of the concept of narrowband and wide band FM and interpret the effect of noise in FM receivers	Applying (K3)
CO3	identify the notion of baseband pulse transmission, inter-symbol interference and its compensation methods	Applying (K3)
CO4	examine the scheme of passband digital transmission for band limited and wideband signals	Analyzing (K4)
CO5	inspect the characteristics of discrete memory less channel and provide the solution for lossless, error free communication	Analyzing (K4)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	65	25				100
CAT2	15	65	20				100
CAT3	10	50	30	10			100
ESE	10	55	25	10			100

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

18ECT52 - LINEAR INTEGRATED CIRCUITS

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Electronic Circuits	5	PC	3	0	0	3

Preamble	To explore the analog systems using active devices such as op-amp and IC555 and verifying their functionality.	
Unit - I	**Operational Amplifiers:**	**9**
Internal block diagram of OP-AMP- Circuits for improving CMRR: Constant current sources, Widlar and Wilson current sources, Current repeaters. DC Characteristics of OP-AMP: Input bias current-Input offset current-Input offset voltage -Thermal drift. AC characteristics of OP-AMP: Frequency response- Frequency compensation methods -slew rate.		
Unit - II	**Applications of Operational Amplifier:**	**9**
Ideal Inverting and Non inverting Amplifiers-Adder-Subtractor-Instrumentation amplifier–Differentiator –Integrator – Comparators-Applications of Comparator: Zero Crossing Detector-Window Detector-Schmitt trigger-Sinewave generators: RC phase shift oscillator and Wien bridge oscillator.		
Unit - III	**Rectifiers, Active Filters and Regulators:**	**9**
First and Second order low pass and high pass filters. Rectifiers- Half wave rectifier- Full wave rectifier. Regulators- Voltage regulator IC: Series op-amp regulator (78XX), General Purpose regulator (IC 723)- Switching regulator.		
Unit - IV	**A/D Converter and D/A Converter:**	**9**
Analog to digital Converter: Flash type, Integrating type and Successive Approximation type-Digital to Analog converter: Weighted resistor type, R-2R ladder type and Inverted R-2R ladder type.		
Unit - V	**Special ICs:**	**9**
Timer (IC 555)- Functional block diagram -Astable and Monostable operation –Applications-Phase Locked Loop : block diagram-Derivation of capture and lock range –Phase detector: Analog phase detector and Digital phase detector -Voltage controlled Oscillator-Applications.		

Total:45

TEXT BOOK:

1. Roy Choudhry D & Shail B. Jain, "Linear Integrated Circuits", 5th Edition, New Age International, New Delhi, 2018.

REFERENCES:

1. Gaykwad, Ramakant A, "OP-AMP and Linear IC", 4th Edition, PHI Learning, New Delhi, 2015.
2. Salivahanan S & Kanchanabhaaskaran V.S, "Linear Integrated Circuits", 3rd Edition, McGraw Hill Education, New Delhi, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	elaborate the need of various current sources circuits for improving CMRR and the dc and ac characteristics of operational amplifier.	Understanding (K2)
CO2	develop different applications of operational amplifiers for the given specification.	Applying (K3)
CO3	Construct I, II order low pass and high pass filters, rectifiers and regulators.	Applying (K3)
CO4	examine A/D and D/A converters.	Applying (K3)
CO5	demonstrate the construction and applications of PLL and special function ICs.	Applying (K3)

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	3	
CO2	3	2	1	1	2				2			2	2	
CO3	3	2	1	1								2	2	
CO4	3	2	1	1		2						2	3	3
CO5	3	2	1	1					2			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	10	60	30				100
CAT2	10	40	50				100
CAT3	10	40	50				100
ESE	10	50	40				100

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

18ECT53 - DIGITAL SIGNAL PROCESSING

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	**Signals and Systems**	**5**	**PC**	**3**	**0**	**0**	**3**

Preamble	This course aims to find the frequency components of a signal using Fast Fourier Transform and also to design the digital filter with specified parameters.	
Unit - I	**Sampling in Time & in Frequency:**	**9**
Discretize CT signal -Nyquist rate and Aliasing in DTFT- Discretize DTFT – Relation between DTFT and DFT – Properties of DFT.		
Unit - II	**Efficient Computation of DFT:**	**9**
Radix2-FFT (2-point, 4-point, 8-point) : Decimation in Time – Decimation in Frequency – IFFT – Comparison of DFT and Fast Fourier Transform.		
Unit - III	**FIR Filter Design:**	**9**
Response of FIR Filter – Group delay & phase delay- Non-Causal Filter design - Causal Filter Design using : Rectangular –Hamming – Hanning- Blackmann Window		
Unit - IV	**IIR Filter Design:**	**9**
Analog filter design: Butterworth filter - Digital Transformation : Impulse invariance technique – Bilinear transformation Applications: Filtering of Discrete sequence using circular convolution: Overlap add and Overlap Save		
Unit - V	**Finite Word Length Effect:**	**9**
Quantization noise – Derivation for quantization noise power –Truncation and rounding error – Input quantization error-Coefficient quantization error-Product quantization error – Limit cycle oscillations- Overflow error-Signal scaling.		

Total:45

TEXT BOOK:

1. NagoorKani, "Digital Signal Processing", 2nd Edition, McGraw-Hill, New Delhi, 2017.

REFERENCES:

1. Proakis John G & ManolakisDimtris G, "Digital Signal Processing: Principles, Algorithms and Applications", 4th Edition, PHI Learning, New Delhi, 2018.
2. Alan V. Oppenheim & Ronald W. Schafer, "Discrete Time Signal Processing", 2nd Edition, Pearson education, New Delhi, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply Sampling theorem to obtain DT signal and also to find frequency components using DFT	Applying (K3)
CO2	apply FFT to find frequency components in a signal.	Applying (K3)
CO3	build a Digital FIR filter using different windows for a given specification to filter selective frequency components in a signal.	Applying (K3)
CO4	design an Analog IIR filter for a given specification using Butterworth and convert it into digital IIR filter using impulse invariant and bilinear transformation.	Applying (K3)
CO5	apply the concepts of finite word length effects in DSP processor	Applying (K3)

Mapping of 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	2		2		2	2	2		3	1
CO4	3	2	1	1	2				2	2	2		3	1
CO5	3	2	1	1								2	3	1

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	40	30				100
CAT2	20	20	60				100
CAT3	10	40	50				100
ESE	15	35	50				100

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

18ECT54 - CONTROL ENGINEERING

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Circuit Analysis and Network Synthesis, Signals and Systems	5	PC	3	1	0	4

Preamble	This course provides the concepts of the mathematical modeling of various systems. It also examines the response, stability analysis of the developed models in both time and frequency domain.	
Unit - I	**System Representation:**	**9+3**
Basic elements in control systems – Open and closed loop systems – Modeling of Mechanical systems-Translational and Rotational Systems-Modeling of Electrical Networks- Electrical analogy of mechanical systems – Transfer function - DC Motors-Electromechanical system - Gear trains-Block Diagram Reduction-Signal Flow Graph.		
Unit - II	**Time Domain Analysis:**	**9+3**
Standard test signals- Time response of First and Second order system response- Time domain specifications – Error coefficients – Steady state error- Generalized error series –Introduction to P, PI, PID controllers - Effect of P, PI, PID controllers on time response.		
Unit - III	**Stability Analysis in time Domain:**	**9+3**
Characteristics Equation – Location of Roots in S plane for stability – Routh Hurwitz Criterion – Root Locus construction – Effect of poles and zeros on system stability.		
Unit - IV	**Frequency Response Analysis:**	**9+3**
Frequency response – Correlation between frequency domain and time domain specifications -Bode plot – Polar plot –Stability Analysis in Frequency Domain-Nyquist Stability Criteria-Introduction to Compensators.		
Unit - V	**State Space Representation:**	**9+3**
Introduction to state space analysis - Phase variable and canonical forms - State transition matrix - Solutions to state space equation - Controllability and Observability of systems-Kalman test for Controllability and Observability.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Nagrath I.J & Gopal M, "Control Systems Engineering", 5th Edition, New Age International , New Delhi, 2013.

REFERENCES:

1. Norman S Nise, "Control Systems Engineering", 5th Edition, Wiley-India Publishers, New Delhi, 2017.
2. Gopal M, "Control Systems; Principles and Design", 4th Edition, McGraw-Hill, New Delhi, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	develop Mathematical models for various types of control systems.	Applying (K3)
CO2	analyze the time response for different controllers with first and second order.	Analyzing (K4)
CO3	examine the stability of the systems in time domain.	Analyzing (K4)
CO4	make use of plots to interpret the stability of systems in frequency domain.	Analyzing (K4)
CO5	apply various tests to find the controllability and observability for various systems.	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1				3				2	3	
CO2	3	3	2	2	2			2					3	
CO3	3	3	2	2	2			2	2	2		2	3	
CO4	3	3	2	2	2			2	2	2		2	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	20	35	35	10			100
CAT2	10	30	40	20			100
CAT3	5	25	50	20			100
ESE	10	20	60	10			100

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

18ECL51 - ANALOG AND DIGITAL COMMUNICATION LABORATORY

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	PC	0	0	2	1
Preamble	This course contains the sufficient practical components to build a firm foundation of communication systems.						

List of Exercises / Experiments :

1.	Amplitude modulation and demodulation using discrete components / USRP and observation through spectrum and observation through spectrum analyzer
2.	Generation and detection of frequency modulation using discrete components /USRP and measurements through spectrum analyzer
3.	Estimation of SNR and Figure of Merit for DSB-SC AM and FM through simulation
4.	Verification of analog pulse modulations (PAM, PWM)
5.	Simulation and verification of PCM and Delta modulation
6.	Simulation of line coding and verification of eye pattern
7.	Simulation of binary pass band shift keying modulation and demodulation (BASK, BFSK, BPSK) with verification of constellation, eye pattern, spectrum and BER calculations
8.	Simulation of M-ary pass band shift keying modulation and demodulation (QPSK, QAM and MSK) with verification of constellation, spectrum and BER calculations
9.	Simulation of Minimum shift keying modulation and demodulation (MSK) with verification of spectrum and BER calculations
10.	Simulation of cyclic code and decoding
11.	Generate Turbo coding for a given binary sequence and perform decoding
12.	Perform the trellis modulation for a given binary sequence

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual
2.	MATLAB

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	construct the analog modulation schemes using discrete components and verify the types of modulation and spectrum using simulation.	Applying (K3), Manipulation (S2)
CO2	demonstrate the coding to simulate analog pulse modulation, digital pulse modulation and line coding techniques and analyze the effect of noise using eye pattern.	Applying (K3), Precision (S3)
CO3	generate the spectrum and analyze the constellation, BER vs SNR for digital passband transmission schemes, develop a MATLAB program for cyclic coding and decoding.	Applying (K3), Precision (S3)

Mapping of COs with POs and PSOs

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

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

18ECL52 - LINEAR INTEGRATED CIRCUITS LABORATORY

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	PC	0	0	2	1
Preamble	This course contains the sufficient practical components to build a firm foundations of linear opamp systems.						

List of Exercises / Experiments :

1.	Construction of Op-Amp circuits- Inverting and non-inverting amplifiers, Voltage Follower, Differentiator and Integrator
2.	Frequency response of 2nd order active low pass and high pass filters using Op-Amps
3.	Applications of comparator: Zero crossing detector and Window detector
4.	R-2R ladder type Digital to Analog Converter and Flash type Analog to Digital Converter
5.	Application of instrumentation amplifier using sensors. (Thermistor, LDR and Audio Signal)
6.	Pulse Position Modulation and Pulse Width Modulation using IC 555
7.	Voltage regulator using 78xx series
8.	Schmitt trigger using IC741
9.	Half-wave and Full wave rectifiers using Op-Amps
10.	RC phase shift oscillator and Wien bridge oscillator using Op-Amps

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual
2.	PSPICE

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	build amplifiers, filters and comparator circuits using operational Amplifiers.	Applying (K3), Precision (S3)
CO2	demonstrate the working of oscillator circuits, Analog to Digital Converter and Digital to Analog Converter using IC 741, Pulse Position Modulation and Pulse Width Modulation using IC 555.	Applying (K3), Precision (S3)
CO3	calibrate and test the application of instrumentation amplifier using sensors.	Applying (K3), Precision (S3)

Mapping of COs with POs and PSOs

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

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

18ECL53 - DIGITAL SIGNAL PROCESSING LABORATORY

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Signals and Systems	5	PC	0	0	2	1
Preamble	This course aims to simulate and analyze the digital systems.						

List of Exercises / Experiments :

1.	Generate various continuous and discrete time signals given its functional form and plot it. Simulate under sampling, Critical sampling and oversampling of a signal.
2.	Convert a signal from time to frequency domain using DFT and FFT plot the spectra and write the inference. Compare DFT and FFT in terms of computational requirement.
3.	Build a FIR filter using various windows and plot the frequency response of the filter. Filter a signal and observe the spectra of input signal before and after filtering operation.
4.	Build a digital IIR filter and plot the frequency response of the filter. Filter a signal and observe the spectra of input signal before and after filtering operation.
5.	Time Response of Systems and Stability Analysis, Stability Analysis in Frequency Domain.
6.	Generate various continuous and discrete time signals given its functional form and plot it. Simulate under sampling, Critical sampling and oversampling of a signal
7.	Convert a signal from time to frequency domain using DFT and FFT plot the spectra and write the inference.
8.	Build a FIR filter using various windows and plot the frequency response of the filter. Filter a signal and observe the spectra of input signal before and after filtering operation.
9.	Build a digital IIR filter and plot the frequency response of the filter. Filter a signal and observe the spectra of input signal before and after filtering operation.
10.	Effect of P,PI and PID Controllers and Lag and Lead compensator on time and frequency response

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual
2.	MATLAB

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	generate and plot various signals and transform independent variable of the generated signals.	Applying (K3), Precision (S3)
CO2	design a FIR digital filter using proper windows to remove range of frequency components in an input signal.	Applying (K3), Precision (S3)
CO3	design an IIR digital filter to remove range of frequency components in an input signal.	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		3		3		3	2
CO2	3	2	3	3	3	3	2		3		3		3	2
CO3	3	2	3	3	3	3	2		3		3		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. & Electronics and Communication 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. & Electronics and Communication 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)**

18ECT61 - VLSI DESIGN

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Digital Electronics	6	PC	3	0	0	3

Preamble	To impart global understanding of Verilog Hardware Description Language and MOS transistor characteristics, fabrication and testing of ICs.	
Unit - I	**Verilog HDL Gate Level modeling and Data flow modeling:**	**9**
Overview of Verilog HDL- Hierarchical Modeling Concepts-Basic Concepts- Modules and Ports- Gate level modeling- Dataflow modeling		
Unit - II	**Verilog HDL Behavioural modeling and Switch level modeling:**	**9**
Behavioral modeling – Structured Procedures- Blocking and non blocking statements- delay control- event control, conditional statement- multiway branching-loop- Switch level modeling - Tasks and Function- RTL Coding.		
Unit - III	**MOS Transistor:**	**9**
CMOS Logic- MOS Transistor Theory- Long Channel I-V characteristics- C-V characteristics- Nonideal I-V effects- DC characteristics--Power dissipation – Switching Characteristics.		
Unit - IV	**MOS Fabrication:**	**9**
An overview of silicon semiconductor technology - Basic CMOS technology: Nwell- P well, Twin tub and SOI Process- Latch up and prevention- Layout Design rules- Stick diagram- Layout diagram for basic logic gates- Introduction to Static CMOS- Pseudo nMOS logic -Dynamic CMOS-Cascade Voltage Switch Logic.		
Unit - V	**CMOS Testing:**	**9**
Need for testing- Manufacturing test principles- Design strategies for test- chip level test techniques-system level test techniques.		

Total:45

TEXT BOOK:

1. Neil Weste & David Harris , "CMOS VLSI Design-A circuits & System Perspective", 4th Edition, Pearson education, New Delhi, 2017 for Units III,IV,V.
2. Palnitkar Samir, "Verilog HDL: Guide to Digital Design and synthesis", 2nd Edition, Pearson Education, New Delhi, 2017 for Units I,II.

REFERENCES:

1. Pucknell, Douglas A & Eshragian K, "Basic VLSI Design", 3rd Edition, PHI Learning, New Delhi, 2012.
2. Rabaey J. M, Chandrakasan A & Nikolic B, "Digital integrated circuits: a design perspective", 2nd Edition, PHI Learning, New Delhi, 2003.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	develop digital logic circuits using Verilog Hardware Description Language Programming.	Applying (K3)
CO2	model VLSI systems using Verilog Hardware Description Language.	Applying (K3)
CO3	elaborate the characteristics of MOS transistor and techniques used for VLSI fabrication	Understanding (K2)
CO4	make use of layout design rules to draw layout of logic functions	Applying (K3)
CO5	outline the techniques for chip level and system level testing.	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	2	1		2				2	1	3
CO2	3	2	1	1	2	1		2				2	1	3
CO3	2	1										1		2
CO4	3	2	1	1								2	1	3
CO5	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	10	20	70				100
CAT2	10	60	30				100
CAT3	20	60	20				100
ESE	10	50	40				100

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

18ECT62 - DATA COMMUNICATION AND INTERNETWORKING

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Analog and Digital Communication	6	PC	3	0	0	3

Preamble	To provide a broad overview on various internetworking devices, various types of network technologies, algorithms, protocols and its applications.	
Unit - I	**Network Architecture:**	**9**
OSI model - TCP/IP model - Guided Media: Twisted pair, Coaxial and Fiber Optic cables Unguided Media: Radio waves , Micro Waves and Infrared - Circuit switching networks - Datagram Networks - Virtual circuit networks - Connecting devices : Hub, Bridge, Router, Gateway- Back Bone networks.		
Unit - II	**Link Layer (LL):**	**9**
Linear Block Codes - Cyclic Codes – Checksum - Stop and Wait - Go-Back-N - Selective Repeat – Point to Point Protocol – Random Access :CSMA/CD, CSMA/CA-IEEE 802.3 - Gigabit Ethernet - IEEE 802.11- WLAN.		
Unit - III	**Network Layer:**	**9**
IPV4 Addressing and Datagram format- IPV6 Addressing and Datagram format - Sub-netting - Address mapping: ARP and RARP – Internet Control Message Protocol - Routing Protocols: DVR , LSR, BGP, OSPF and RIP.		
Unit - IV	**Transport Layer:**	**9**
Process-To-Process Delivery – UDP - TCP - Packet format – Services - Error and flow control - Congestion Control in TCP – QoS Parameters- Techniques to improve QoS- Token Bucket and Leaky Bucket.		
Unit - V	**Application Layer:**	**9**
E-Mail: Architecture, User Agent, MTA:SMTP,MAA:POP and IMAP- File Transfer Protocol(FTP) – HTTP-Voice over IP(VoIP): SIP, H.323 and Domain Name System (DNS) : Name Space, Domain Name Space, Distribution of name space, DNS in the internet Cryptography: security attacks-plain text-chipper text, symmetric key ciphers : substitution, transposition ciphers.		

Total:45

TEXT BOOK:

1. Behrouz A. Forouzan, "Data communication and Networking", 5th Edition, Tata McGraw Hill, New Delhi, 2019.

REFERENCES:

1. James F. Kurose & Ross Keith W, "Computer Networking: A Top-Down Approach Featuring the Internet", 6th Edition, Pearson Education, New Delhi, 2012.
2. Tanenbaum, Andrew S & David Wetherall, "Computer Networks", 5th Edition, PHI Learning, New Delhi, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	comprehend different network models and architecture.	Understanding (K2)
CO2	Identify the different functionalities of link layer.	Applying (K3)
CO3	analyze the routing mechanisms and IP address management.	Analyzing (K4)
CO4	apply suitable protocols for connection oriented and connection less services in internet.	Applying (K3)
CO5	Interpret the functionalities of application protocols.	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										2	2	
CO2	3	2	1	1								2	3	
CO3	3	3	2	2	1			2	2	2		2	3	3
CO4	3	2	1	1				1	1	1		1	3	1
CO5	2	1							1	1		2	2	3

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

ASSESSMENT PATTERN - THEORY

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

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

18ECT63 - MICROWAVE AND OPTICAL COMMUNICATION

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Electromagnetics and Waveguides, Solid State Devices and Circuits	6	PC	3	0	0	3

Preamble	To understand the characteristics of passive microwave components, microwave semiconductor devices and the measurement of microwave signal parameters.To acquire the knowledge in optical fiber characteristics and the working of different optical sources and receivers for signal transmission.	
Unit - I	**Microwave Networks and Circuit Representation:**	**9**
Microwave frequency- S parameter representation of N ports – Properties – Advantages - S Matrix of a directional coupler- Waveguide tees – Isolator – Circulator – Slotted section – Waveguide corners- Bends- Twists-Matched loads.		
Unit - II	**Microwave Semiconductor Devices and Vacuum Tubes:**	**9**
Gunn diode-Gunn effect-RWH theory – Avalanche transit time devices - Read diode– TRAPATT diodes - Reflex klystron: Velocity modulation - Power output - Efficiency and electronic admittance-Magnetron: Cylindrical magnetron.		
Unit - III	**Microstriplines and Microwave Measurements:**	**9**
Microstrip lines – Losses in microstrip lines – Quality factor Q of microstrip lines. Measurements: Impedance – Frequency – Power – VSWR- Microstrip lines filters:LPF.		
Unit - IV	**Optical Fiber Structures and Digital Transmission Systems:**	**9**
Elements of an optical fiber transmission link- Total internal reflection, Acceptance angle, Numerical aperture – Optical fiber modes and configurations – Linearly polarized modes - Fiber fabrication.		
Unit - V	**Optic Sources and Optical Receivers:**	**9**
Direct and indirect band gap materials- LED structures: SLED,ELED – Concept of lasers diodes- Operation of PIN and APD diodes- Fundamental receiver operation – Error sources- Probability of error - Point to point link system considerations- Link power Budget and rise time budget.		

Total:45

TEXT BOOK:

1. Samuel Y. Liao, "Microwave Devices & Circuits", 3rd Edition, Pearson Education, New Delhi, 2015 for Units I,II,III.
2. Gerd Keiser, "Optical Fiber Communication", 5th Edition, McGraw Hill, New Delhi, 2020 for Units III,IV.

REFERENCES:

1. Annapurna Das & Sisir K. Das, "Microwave Engineering", 3rd Edition, McGraw Hill Inc, New Delhi, 2019.
2. John M. Senior, "Optical Fiber Communication", 3rd Edition, Pearson Education, New Delhi, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	comprehend the features and characteristics of microwave components.	Understanding (K2)
CO2	apply the principles for the measurement of microwave signal parameters.	Applying (K3)
CO3	Illustrate the principles involved in microstrip lines for communication.	Understanding (K2)
CO4	elaborate on the devices, signal propagation and losses in optical fiber cable.	Applying (K3)
CO5	elucidate the errors in optical receiver.	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											2	
CO2	3	2	1	1				1						1
CO3	2	1				3							1	
CO4	2	1					3					1	2	1
CO5	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	10	55	35				100
CAT2	15	55	30				100
CAT3	15	60	25				100
ESE	15	55	30				100

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

18ECL61 - VLSI DESIGN LABORATORY

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Digital Electronics	6	PC	0	0	2	1
Preamble	To impart the knowledge of design and implementation of digital circuits using Verilog Hardware Description Language						

List of Exercises / Experiments :

1.	Modeling of Combinational Digital Systems
2.	Modeling of Sequential Digital Systems
3.	Modeling of State Machine Design
4.	Modeling of Memory Design
5.	Design of FIFO and ALU
6.	Design of Booth multiplier
7.	Design and implementation of serial and parallel adders using FPGA
8.	Design and implementation of traffic light controller using FPGA
9.	Design and implementation of Real Time Clock using FPGA
10.	Design of Full adder using CMOS transistor

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual
2.	Modelsim, Xilinx, Microwind

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	design Digital systems using Verilog	Applying (K3), Precision (S3)
CO2	implement Digital systems in FPGA	Applying (K3), Precision (S3)
CO3	design digital Circuits at transistor level	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	2			2	1	2
CO2	3	2	1	1	3			2	2			2	1	2
CO3	3	2	1	1	3			2	2			2	1	2

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

18ECL62 - DATA COMMUNICATION AND INTERNETWORKING LABORATORY

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Analog and Digital Communication	6	PC	0	0	2	1
Preamble	To provide a hands-on experience in the field of computer networking such as creating different network topologies, network protocol implementation and analysing the performance using standard metrics						

List of Exercises / Experiments :

1.	Design and implement network topologies: Star, Bus, Mesh, Ring
2.	ARQ mechanism: Stop & Wait, GoBack N and Selective Repeat
3.	ARP realization and Subnetting using IPV4
4.	Distance vector routing & Link state routing
5.	Leaky bucket algorithm
6.	UDP: Server-Client Model
7.	TCP: ON-OFF
8.	TCP: Bulk Transfer Applications
9.	Creating Dumbbell and Parking lot topologies for TCP and UDP traffic
10.	Packet analysis using network protocol analyzer

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual
2.	Netsim,NS-3, Wireshark

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	identify and apply different network layer topologies.	Applying (K3), Manipulation (S2)
CO2	analyse L2, L3 and L4 protocols under different traffic conditions.	Analyzing (K4), Manipulation (S2)
CO3	analyse different data packets using packet capture tools.	Analyzing (K4), Manipulation (S2)

Mapping of COs with POs and PSOs

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

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

18ECL63 - MICROWAVE AND OPTICAL COMMUNICATION LABORATORY

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Solid State Devices and Circuits	6	PC	0	0	2	1
Preamble	To build a firm foundation for the measurement and analysis of microwave and optical communication.						

List of Exercises / Experiments :

1.	Reflex Klystron mode characteristics
2.	Radiation pattern of Horn antenna
3.	Impedance measurement using VSWR
4.	Characteristics and Power measurement of Gunn Diode oscillator
5.	Design and simulate the Magic Tee
6.	Design and simulate the microstrip LPF using transmission line step impedance method
7.	Measurement of the numerical aperture and data communication system using a fibre-optic system
8.	LED and laser diode characteristics
9.	Mode characteristics of an optical fibre using Laser diode
10.	Characteristics of APD/ PD.

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual
2.	HFSS, ADS

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	observe the characteristics of microwave oscillators and its signal parameters using a microwave set-up.	Understanding (K2), Manipulation (S2)
CO2	analyse the characteristics of Magic Tee and microstrip transmission lines.	Analyzing (K4), Precision (S3)
CO3	analyze the characteristics of optical source, fibre and detector.	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	1				2	1	1	3	1		1	1	
CO2	3	3	2	2	3	1		1	3	1	1	2	2	2
CO3	3	1	2	2	1	2	1	1	3	1		1	1	

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. & Electronics and Communication 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**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				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	40	40				100
CAT2		50	50				100
CAT3		50	50				100
ESE	NA						

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

18ECP61 - PROJECT WORK I PHASE I

Programme & Branch	B.E. & Electronics and Communication 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:	identify, analyze, interpret and formulate the real world problem and conceptualize the methodology of the project	Applying (K3)
CO2:	design the electronics based system using mathematical analysis	Applying (K3)
CO3:	develop the model using modern tools and demonstrate the working of the model	Analyzing (K4)
CO4:	articulate the project report and presentations	Evaluating (K5)
CO5:	plan and execute the project as a team	Evaluating (K5)

Mapping 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	2	2	2	3	3	3	2	3	3
CO2	3	3	3	3	3	2	2	2	3	3	3	2	3	3
CO3	3	3	3	3	3	2	2	2	3	3	3	2	3	3
CO4	3	3	3	3	3	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 BE/BTech Engineering And Technology Branches except Chemical Engineering)

Programme & Branch	B.E. & Electronics and Communication 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)**

18ECT71 - ANTENNAS AND WAVE PROPAGATION

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Electromagnetics and Waveguides	7	PC	3	0	2	4

Preamble	To analyze and design antenna based on the fundamental principles of antenna theory and to deal with the state of the art methods for measurements of antenna characteristics	
Unit - I	**Fundamentals of Antenna:**	**9**
Radiation from Hertzian- Power radiated and radiation resistance, half-wave dipole– Power radiated and radiation resistance — Definitions: Radiation intensity – Directive gain – Directivity – Power gain – Beam width – Bandwidth – Gain, Folded dipole – Baluns- Effective length and effective area – Relation between maximum aperture and gain, Transmission between two antennas		
Unit - II	**Antenna Arrays:**	**9**
Expression for electric field from two element arrays: Broadside and endfire array–Uniform linear array–Method of pattern multiplication –Binomial array- Yagi Uda antenna, Log periodic dipole array, Smart antennas		
Unit - III	**Special and Aperture Antennas:**	**9**
Helical antenna: Normal mode and axial mode of radiation, Horn antenna, Babinet's principle and complementary antennas, Slot antennas, Antenna with Parabolic reflectors, Microstrip patch antenna: Rectangular patch: transmission line model design procedure		
Unit - IV	**Propagation of Radio Waves:**	**9**
Ground wave propagation - Tropospheric wave propagation-line of sight distance- effective earth's radius, Filed strength of Tropospheric wave - Sky wave propagation – effective dielectric constant and conductivity of ionosphere-Virtual height- Critical frequency - Maximum usable frequency – Skip distance		
Unit - V	**Antenna Measurements:**	**9**
Antenna Measurement Ranges- Antenna impedance measurement– Radiation Pattern measurements–Measurement of Antenna gain – Measurement of Radiation resistance – Antenna efficiency – Polarization		

List of Exercises / Experiments :

1.	The radiation pattern measurement of dipole antenna
2.	The radiation pattern measurement of Yagi-uda antenna
3.	The radiation pattern measurement of Helical antenna
4.	Design, simulate and verify the radiation pattern of a rectangular microstrip patch antenna
5.	Design, simulate and verify the radiation pattern of a circular microstrip patch antenna
6.	Prove the reciprocity principle for antenna
7.	Study the characteristics of planar antenna using Vector Network analyzer

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Prasad K.D, "Antennas and Wave Propagation", 4th Edition, SatyaPrakashan Publications, New Delhi, 2019.

REFERENCES:

1.	Kraus John D& Marhefka Ronald J& Ahmad S. Khan, "Antennas and Wave Propagation", 5th Edition, McGraw Hill, New Delhi, 2018.
2.	Balanis Constantine A, "Antenna Theory", 4th Edition, John Wiley & Sons, New York, 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	exhibit the concepts of antenna parameters and its terminologies	Understanding (K2)
CO2	demonstrate the performance of antenna arrays and identify its radiation pattern	Applying (K3)
CO3	identify the parameters of the special antennas	Applying (K3)
CO4	illustrate the wave propagation effects	Understanding (K2)
CO5	comprehend the importance of measurement of antenna parameters	Understanding (K2)
CO6	verify the antenna parameters of dipole antenna, helical antenna and yagiuda antenna	Applying (K3), Precision (S3)
CO7	design and simulate the microstrip patch antenna	Applying (K3), Precision (S3)
CO8	analyze and prove the reciprocity principle for an antenna	Analyzing (K4), Manipulation (S2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1										2		1
CO2	3	2	1	1						2	1	2		2
CO3	3	2	1	1		2					1	1	2	2
CO4	3	1				2	3					1		
CO5	3	1				1	3	1				2	2	2
CO6	3	2	1	2	1				3	2		1	2	1
CO7	3	2	1	2	3				3	1	1	2	3	3
CO8	3	3	2	2	1	1	1	1	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	15	75	10				100
CAT2	15	65	20				100
CAT3	15	65	20				100
ESE	15	65	20				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

18ECP71 - PROJECT WORK I PHASE II

Programme & Branch	B.E. & Electronics and Communication 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:	identify, analyze, interpret and formulate the real world problem and conceptualize the methodology of the project	Applying (K3)
CO2:	design the electronics based system using mathematical analysis	Applying (K3)
CO3:	develop the model using modern tools and demonstrate the working of the model	Analyzing (K4)
CO4:	articulate the project report and presentations	Evaluating (K5)
CO5:	plan and execute the project as a team	Evaluating (K5)

Mapping 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	2	2	2	3	3	3	2	3	3
CO2	3	3	3	3	3	2	2	2	3	3	3	2	3	3
CO3	3	3	3	3	3	2	2	2	3	3	3	2	3	3
CO4	3	3	3	3	3	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

18ECP81 - PROJECT WORK II

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	---	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:	identify, analyze, interpret and formulate the real world problem and conceptualize the methodology of the project	Applying (K3)
CO2:	design the electronics based system using mathematical analysis	Applying (K3)
CO3:	develop the model using modern tools and demonstrate the working of the model	Analyzing (K4)
CO4:	articulate the project report and presentations	Evaluating (K5)
CO5:	plan and execute the project as a team	Evaluating (K5)

Mapping 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	2	2	2	3	3	3	2	3	3
CO2	3	3	3	3	3	2	2	2	3	3	3	2	3	3
CO3	3	3	3	3	3	2	2	2	3	3	3	2	3	3
CO4	3	3	3	3	3	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

18ITE01 - JAVA PROGRAMMING

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	4	PE	3	0	0	3

Preamble	To understand the fundamental concepts of Java programming	
Unit - I	**Introduction:**	**9**
Introduction: Java Features – Comparison of Java with C and C++ - Java and Internet–Java Environment–Java program structure–Java tokens – Implementing a Java program–Java virtual machine–Constants–variables–Data types–Scope of variables –Type casting – Operators and expressions – Decision making, Branching and Looping.		
Unit - II	**Classes, Objects and Methods:**	**9**
Classes, Objects and Methods: Defining a class–Constructors–Methods–Overloading–static members–Nesting of methods Overriding methods–Final classes–Abstract class–Visibility control–arrays–Creating an array–two dimensional arrays–Strings–String arrays–String methods–String buffer class–Vectors–Wrapper class		
Unit - III	**Inheritance, Interfaces and Packages:**	**9**
Inheritance, Interfaces and Packages: Defining a subclass–Subclass Constructor–Multi level inheritance–Hierarchical Inheritance–Defining interfaces–Extending interfaces–Implementing interfaces–Java API packages–Creating a package–Accessing and using a package–Adding a class to a package –hiding classes.		
Unit - IV	**Multithreading, Exception Handling and Files:**	**9**
Multithreading, Exception Handling and Files: Creating threads - Extending the tread class–Thread life cycle–Thread exception–Thread priority–Synchronization–Runnable interface–Exceptions–Throwing own exceptions–Concepts of streams–stream classes–Byte stream classes–character stream classes–Using streams–Using file class–Other stream classes.		
Unit - V	**Applet Programming and Graphics Programming:**	**9**
Applet Programming and Graphics Programming: Introduction -Applets Vs Applications -Writing Applets -Building Applet Code -Applet Life Cycle –Creating an Executable Applet –Designing a Web Page –Applet Tag - Running the Applet – Passing Parameters –Graphics Programming: The Graphics Class –Lines and Rectangles –Circles and Ellipses -Drawing Arcs –Drawing Polygons.		

Total:45

TEXT BOOK:

1. Balagurusamy E, "Programming with Java A Primer", 5 Edition, McGraw-Hill Education, 2015.

REFERENCES:

1. Schildt Herbert, "Java: The Complete Reference", 9 Edition, McGraw-Hill Education, 2014.
2. Buyya Rajkumar, Thamarai Selvi S. and Xingchen Chu, "Oriented Programming with Java Essentials and Applications", 1 Edition, McGraw-Hill Education, 2009.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	use the basic syntax and semantics of the Java language with programming environment	Applying (K3)
CO2	apply the concepts of classes and objects to solve simple problems	Applying (K3)
CO3	develop applications using inheritance, packages and interfaces	Applying (K3)
CO4	build the concept of exception handling mechanisms, multithreaded model and I/O classes	Applying (K3)
CO5	develop interactive Java programs using Applet class	Applying (K3)

Mapping of 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	
CO4	3	2	1	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	30	30	40				100
CAT2	20	30	50				100
CAT3	20	35	45				100
ESE	20	30	50				100

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

18ECE01 - TRANSMISSION LINES AND NETWORKS

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Electromagnetics and Waveguides	4	PE	3	0	0	3

Preamble	To impart the concepts of different types of transmission lines and its parameters and to provide a complete understanding of stub matching and its design using smith chart. Also it provides a clear understanding of basics of networks and design of filters, attenuators and equalizers.	
Unit - I	**Transmission Line Parameters:**	**9**
A line of cascaded T sections - Transmission lines -General solution - Physical significance of the equations -the infinite line- Wavelength –Velocity – propagation - distortionless line The telephone cable - Reflection on a line not terminated in Zo - Reflection coefficient - Open and short circuited lines - Insertion loss.		
Unit - II	**The Line at Radio Frequency:**	**9**
Parameters of open wire line and Coaxial cable at RF-Line constants for zero dissipation -Voltages and currents on the dissipationless line -Standing waves -Nodes - Standing wave ratio - Input impedance of the dissipationless line -Input impedance of open and short circuited lines -Power and impedance measurement on lines -The eighth wave- The quarter wave line- Impedance matching- The Half wave line.		
Unit - III	**Stub Matching and Smith Chart:**	**9**
The circle diagram for the dissipationless line- The Smith circle diagram- Smith chart application: Plotting complex impedance- Admittance for given impedance- Input impedance of a TL terminated in a short or open -Input impedance of a TL at any distance from a load- Locating first maximum and minimum from any load- Matching a TL to a load with a parallel tuning stub- Derivations of single stub impedance matching on a line.		
Unit - IV	**Networks:**	**9**
Functional classification of networks- Electrical characteristics of symmetrical and asymmetrical network- Iterative impedances- Image transfer constant- iterative transfer constant-Characteristics of passive four terminal network- T-network-π network- Equivalence of T and π network L-section-Half section- Lattice network-Bridged T network-Twin T network-Matching networks		
Unit - V	**Filters:**	**9**
Characteristics-Types-Uses- Constant K filters-Phase shift and attenuation constant of Constant K filters-m-derived filters-Composite filters. Attenuators: Symmetrical Attenuators: T, π, Bridged T, Lattice- Asymmetrical attenuators: T,π,L. Equalizers: Classification of two terminal equalizer-Series and shunt equalizer(two terminal network only)		

Total:45

TEXT BOOK:

1. Umesh Sinha, "Transmission Lines and Networks", 1st Edition, SatyaPrakasan, New Delhi, 2020.

REFERENCES:

1. Ryder J.D, "Networks Lines and Fields", 2nd Edition, Pearson Education, New Delhi, 2015.
2. Raju G.S.N, "Electromagnetic Field Theory and Transmission Lines", 3rd Edition, Pearson Education, New Delhi, 2009.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	comprehend different types of transmission lines and its parameters	Understanding (K2)
CO2	determine the impedance value for different lengths of line	Applying (K3)
CO3	make use of Smith Chart for Stub Matching	Applying (K3)
CO4	compute the performance parameters for various networks	Applying (K3)
CO5	determine the characteristics of different types of filters	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18ECE02 - ELECTRONIC INSTRUMENTATION

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	4	PE	3	0	0	3

Preamble	To focus on different measurement concepts and usage of modern instrumentation tools.	
Unit - I	**Measurement Concepts and Measuring Instruments:**	**9**
Measurement systems- Static and dynamic characteristics – Units and standards of measurements – Error analysis – Moving coil – Torque equations - Moving iron instruments - DC ammeters - DC voltmeters - Multimeters - Wattmeters - Energy meters		
Unit - II	**CRO:**	**9**
Cathode ray oscilloscopes – block schematic – applications – special Oscilloscopes: – delayed time base oscilloscopes, analog and digital storage oscilloscope- sampling oscilloscope.		
Unit - III	**Transducers:**	**9**
Variable reluctance transducers – Linear variable differential transformer- Capacitive transducer – Vibration sensor –Optoelectronic transducers-Instrumentation amplifier using operational amplifier.		
Unit - IV	**Virtual Instrumentation and Software:**	**9**
Block diagram of a virtual instrument – Physical quantities and analog interfaces - Hardware and software – User interfaces – Advantages– Architecture of a virtual instrument and its relation to the operating system - LabVIEW – Graphical user interfaces - Controls and indicators.		
Unit - V	**VI Software Tools and Programming Techniques:**	**9**
Editing, debugging and running a virtual instrument – Graphical programming palettes and tools – Front panel objects – Function and libraries – VI and sub-VI Decision structures - Formula nodes – Sequence structures – Arrays and clusters –String and file I/O – High level and Low level file I/Os – Attribute nodes- Local and global variables.		

Total:45

TEXT BOOK:

1. Albert D. Helfrick & William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", 1st Edition, Pearson Education, New Delhi, 2015.

REFERENCES:

1. Jeffery Travis & Jim Kring, "LabVIEW for Everyone: Graphical programming made easy and Fun", 3rd Edition, Pearson Education, New Delhi, 2009.
2. Kalsi H. S, "Electronic Instrumentation", 1st Edition, McGraw Hill, New Delhi, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	describe various measurement errors and standards in measuring instruments	Understanding (K2)
CO2	describe the functionality of CRO and DC meters	Understanding (K2)
CO3	identify appropriate sensors and transducers for pressure, displacement and vibration	Understanding (K2)
CO4	build LabVIEW program for Simple Arithmetic operations	Applying (K3)
CO5	integrate LabVIEW for development of applications using sub VI	Applying (K3)

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	1										2	1	
CO3	2	1										3	1	
CO4	3	2	1	1	3							2	2	
CO5	3	2	1	1	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	80					100
CAT2	20	70	10				100
CAT3	20	40	40				100
ESE	20	50	30				100

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

18ECE03 - COMPUTER ARCHITECTURE AND INTERFACING

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Electromagnetics and Waveguides, Microprocessor and Microcontroller	4	PE	3	0	0	3

Preamble	To introduce the basic structure of computers, the operations that they perform at the machine-instruction level, input/output methods and the memory management system of the computer.	
Unit - I	**Structure of Computers and Machine Instructions:**	**9**
Functional units- Basic operational concepts - Bus structures - Software - Performance – Memory locations, Addresses and operations – Instruction and instruction sequencing – Addressing modes – Basic I/O operations – Stacks and queues.		
Unit - II	**Computer Arithmetic:**	**9**
Addition and subtraction of signed numbers – Design of fast adders – Multiplication of positive numbers- Signed-Operand multiplication and Fast multiplication – Integer division – Floating point numbers and operations: IEEE standard for floating point numbers.		
Unit - III	**Basic Processing and Memory Unit:**	**9**
Fundamental concepts – Execution of a complete instruction – Multiple bus organization – Hardwired Control - Semiconductor RAMs, ROMs – Speed, size and cost – Cache memories – Mapping functions- Virtual memory – Address translation.		
Unit - IV	**Input and Output:**	**9**
External Devices - I/O modules - Programmed I/O - Interrupt-Driven I/O - Direct Memory Access - I/O Channels and Processors.		
Unit - V	**Computer Peripherals and Multicomputers:**	**9**
Input Devices - Output Devices - Serial Communication Links: Asynchronous Transmission - Synchronous Transmission - Standard Communications - Multicomputers: Local Area Networks - Ethernet Bus - Token Ring -Network of Workstations.		

Total:45

TEXT BOOK:

1. Hamacher Carl, VranesicZvonko & ZakySafwat, "Computer Organization", 5th Edition, McGraw Hill, New Delhi, 2011.

REFERENCES:

1. Stallings William, "Computer Organization and Architecture: Designing for Performance", 11th Edition, Pearson Education, New Delhi, 2018.
2. Hayes John P, "Computer Architecture and Organization", 3rd Edition, McGraw-Hill, New Delhi, 2017.

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	Understanding (K2)
CO2	identify the operations of the arithmetic unit including the algorithms	Applying (K3)
CO3	illustrate the saliency of central processing unit and pipelining	Applying (K3)
CO4	analyze the memory sub-system of a typical computer	Analyzing (K4)
CO5	compare the different ways of communication with 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											2	
CO2	3	2											2	
CO3	3	2	2										2	
CO4	3	3										2	2	
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	10	60	30				100
CAT2	10	45	35	10			100
CAT3	15	50	35				100
ESE	10	45	35	10			100

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

18ECE04 - MEDICAL ELECTRONICS

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	4	PE	3	0	0	3

Preamble	To understand the working of the various physiological systems in the human body. It also helps the student to comprehend the basics of recording along with the measurement of the bio signals and gain knowledge on various diagnostic , therapeutic devices and techniques	
Unit - I	**Human Physiology:**	**9**
Physiological systems of the Body - Basic medical instrumentation system and its performance requirements - General constraints in design of medical instrumentation systems -Origin of bioelectric signals -Propagation of action potentials- Bioelectric potentials : ECG,EEG and EMG		
Unit - II	**Basic Medical Recording System:**	**9**
Electrodes for ECG - Electrodes for EEG - Electrodes for EMG Basic recording system -General consideration for electronic recorder amplifiers -Preamplifiers - Sources of noise in low level recording circuits -The main amplifier and driver stage		
Unit - III	**Recording and Monitoring Instruments:**	**9**
Basic electrocardiograph machine - ECG leads - Phonocardiograph -Electroencephalograph - Electromyograph - Common artefacts in ECG and EMG -Measurement of heart rate- direct method of Blood pressure measurement -Carbon di-oxide method of respiration rate measurement -Single channel telemetry systems - Temperature telemetry system -Multichannel wireless telemetry system		
Unit - IV	**Measurements and Analysis Techniques:**	**9**
Basic principles of external cardiac pacemaker and ventricular synchronous demand pacemaker - Basic principles of a defibrillator- Electric shock hazards -Leakage currents - Test instruments for checking safety parameters of biomedical equipment- ECG arrhythmia monitoring system		
Unit - V	**Medical Instrumentation:**	**9**
Haemodialysis machine -Radio isotopes in medical diagnosis- Positron Emission Tomography (PET) scanner -Surgical diathermy machine- Electrodes used with surgical diathermy -Safety aspects in electrosurgical units		

Total:45

TEXT BOOK:

1. 1. Khandpur R. S, "Handbook of biomedical instrumentation", 3rd Edition, McGraw Hill, New Delhi, 2014.

REFERENCES:

1. Cromwell Leslie, Weibell Fred J & Pfeiffer Erich A, "Biomedical Instrumentation and Measurements", 2nd Edition, Pearson Education, New Delhi, 2015.
2. Reddy D.C., "Biomedical Signal Processing – Principles and Techniques", 1st Edition, McGraw Hill, New Delhi, 2008.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	review the physiological systems of the human body	Understanding (K2)
CO2	develop a knowledge of basic recording system	Understanding (K2)
CO3	interpret the principles of recording and monitoring instruments	Applying (K3)
CO4	categorize the various measurement techniques and the need for electrical safety of biomedical devices	Applying (K3)
CO5	determine the working of few medical instruments	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				2			2	2			3	
CO2	3	2				2			2	2			3	
CO3	3	2	1			2			2	2			3	
CO4	3	2	1			2			2	2			3	
CO5	3	2				2			2	2			3	

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	75					100
CAT2	15	50	35				100
CAT3	20	60	20				100
ESE	20	60	20				100

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

18ECE05 - ELECTRICAL MACHINES

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	4	PE	3	0	0	3

Preamble	To understand the construction, operation and behavior of various electrical machines and also identify and classify the different types of starting and speed control techniques.	
Unit - I	**DC Generator:**	**9**
Construction - Principle and Theory of Operation - EMF Equation- Types of Excitation – Characteristics		
Unit - II	**DC Motor:**	**9**
Principle and Operation – Back E.M.F - Torque Equation - Types and their Characteristics – Starters - Speed Control - Applications.		
Unit - III	**Transformer:**	**9**
Principle - Construction Details of Shell and Core Type Transformers - EMF Equation - Regulation and Efficiency of a Transformer - OC and SC Test of Transformers –Load Test - Equivalent Circuit – All day Efficiency - Auto Transformer - Introduction to Three Phase Transformer.		
Unit - IV	**Alternator and Synchronous Motor:**	**9**
Alternator- Construction and Principle of Operation as Alternator - EMF Equation - Voltage Regulation by EMF Method. Synchronous Motor- Principle of Operation - Starting Methods - V and Inverted V Curves - Synchronous Condenser - Applications		
Unit - V	**Special Machines:**	**9**
Construction, Principle of Operation and Applications of Stepper Motor – Universal Motor - Servo Motor - Brushless DC Motor.		

Total:45

TEXT BOOK:

1. Theraja B. L, "A Textbook of Electrical Technology in SI Units", S.Chand Publishing, New Delhi, 2012. Volume II

REFERENCES:

1. Metha V. K, RohitMetha, "Principles of Electrical Machine", 1st Edition, S.Chand Publishing, New Delhi, 2018.
2. Charles Kingsley Jr, Fitzgerald A.E & Stephen D.Umans, "Electric Machinery", 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain the construction, working and compute the characteristics of DC Generators	Applying (K3)
CO2	paraphrase the construction and working of DC Motors and compute its characteristics	Applying (K3)
CO3	comprehend the working of transformers and its testing	Applying (K3)
CO4	discuss the construction, operation of alternators and synchronous machines	Understanding (K2)
CO5	explain the construction, operation and applications of special electrical machines	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	3	2	1	1									3	
CO3	3	2	1	1		2						2	3	
CO4	3	1										2	2	
CO5	3	1							2	2		2	2	

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

ASSESSMENT PATTERN - THEORY

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

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

18ECE07 - AUTOMOTIVE ELECTRONIC SYSTEMS

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Solid State Devices and Circuits	6	PE	3	0	0	3

Preamble	To learn the concepts of automotive systems and apply the various novel methods to develop electronic based automobile devices for all vehicle conditions	
Unit - I	**Introduction:**	**9**
Evolution of electronics in automobiles – Introduction to Euro Emission standards(I to VI) – Equivalent Bharat Standards – Emission testing – Exhaust gas measurement – Exhaust Analyzer. Working principle and characteristics of sensors: Airflow rate, Engine crankshaft angular position, Hall effect, Throttle angle, temperature, Knock Sensor – Manifold Pressure Sensors – EGR sensor. Working principle and characteristics of Actuators: Solenoid Actuators –EGR actuators, stepper motor actuator and vacuum operated actuator.		
Unit - II	**Charging and Starting systems:**	**9**
Working of charging system – Circuit diagram – Rectification methods – Types of Alternators – Smart Charging. Requirements of starting system – Circuits – DC Characteristics – Types of Starter motors		
Unit - III	**Ignition and Injection Systems:**	**9**
Ignition systems: Ignition fundamentals – Electronic ignition systems – Electronic Spark Ignition – Distribution less Ignition – Spark Plugs. Electronic fuel Control – Basics of combustion – Engine fuelling and exhaust emissions – Electronic control of carburetion – Fuel Injection – Petrol fuel injection – Diesel fuel injection.		
Unit - IV	**Engine and Emission Control Systems:**	**9**
Engine and Emission Control Systems: Control modes for Ignition and fuel control – Engine management system. Catalytic converter – EGR – SCR – DeNox Trap. Diagnostics systems in modern automobiles. In vehicle networks: CAN, LIN, FLEXRAY, MOST, KWP2000		
Unit - V	**Chassis, Comfort and Safety Systems:**	**9**
Antilock braking system - Traction and Stability Control – Active Suspension – Electronic control of automatic transmission – Cruise control – Adaptive cruise control – Airbag and Seat belt tensioners. Centralized door locking system – Climate control of cars – Obstacle avoidance Radar – Automatic Parking System. Electric vehicles – Vehicle Layout – Charging system.		

Total:45

TEXT BOOK:

1. Tom Denton, "Automobile Electrical and Electronics Systems", 5th Edition, Edward Arnold Publishers, London, 2017.

REFERENCES:

1. Hollembeak & Barry, "Automotive Electricity, Electronics & Computer Controls", Delmar Publishers, New York, 2002.
2. Tim & Gilles, "Automotive Engines: Diagnosis, Repair, Rebuilding", 8th Edition, Delmar Publishers, New York, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	interpret to the continuous changes in emission norms of India and uses of electronic devices in automobile applications.	Understanding (K2)
CO2	describe the operations of charging and starting techniques involved in Vehicles.	Understanding (K2)
CO3	utilize the principles of electronic ignition and fuel injection system used in automobile	Applying (K3)
CO4	apply the engine and fuel control system for ECU used in engine management system	Applying (K3)
CO5	employ the essential comfort and safety systems for automobile.	Applying (K3)

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

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

ASSESSMENT PATTERN - THEORY

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

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

18ECE08 - DIGITAL IMAGE PROCESSING

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Digital Signal Processing	6	PE	3	0	0	3

Preamble	This course enables the students to learn and apply the various Digital Image Processing techniques on real time images	
Unit - I	**Digital Image Fundamentals:**	**9**
Elements of digital image processing systems, Elements of visual perception– Brightness– Contrast– Hue– Saturation– Mach band effect, Image sampling– Quantization, Basic relationship between pixels, Color image fundamentals – RGB– HSI models		
Unit - II	**Image Transforms:**	**9**
Need for transforms, DFT and its Properties: Separable – Spatial shift – Periodicity –Scaling – Orthogonality – Rotation, DCT, KLT, SVD, Haar		
Unit - III	**Image Enhancement and Restoration:**	**9**
Image Enhancement: Basic intensity transformations – Piecewise linear transformation functions, Histogram equalization, Spatial filtering : Smoothing and sharpening Filters, Frequency domain filtering : Smoothing and sharpening filters – Homomorphic filters. Image Restoration: Degradation model – Noise distributions– Median – Geometric mean – Harmonic mean – Contra harmonic mean filters – Order Statistics filters – Inverse and wiener filtering – Constrained least square filtering.		
Unit - IV	**Image Segmentation, Representation and Description:**	**9**
Point, line and edge detection – Basics of intensity thresholding – Region based segmentation : Region growing – Region splitting and merging, Image representation : Chain codes, – Boundary descriptors – Regional descriptors		
Unit - V	**Image Compression:**	**9**
Fundamentals: Fidelity Criteria – Image Compression Model – Types of redundancy – Huffmann – Run length coding – Arithmetic coding – Bit–plane coding – Block Transform coding – Lossless and Lossy Predictive coding – JPEG standard		

Total:45

TEXT BOOK:

1. Rafael C Gonzalez & Richard E Woods, "Digital Image Processing", 4th Edition, Pearson Education, New Delhi, 2016.

REFERENCES:

1. Jayaraman S, Esakkirajan S & Veerakumar T, "Digital Image Processing", 1st Edition, Tata McGraw Hill, New Delhi, 2016.
2. Anil K Jain, "Fundamentals of Digital Image Processing", 4th Edition, PHI Learning, New Delhi, 1995.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	utilize the fundamental concepts of digital image processing and 2D sampling for real time applications	Applying (K3)
CO2	apply DFT, DCT, KLT, SVD and Haar transformations on an image	Applying (K3)
CO3	apply Image enhancement and restoration techniques in both spatial and frequency domain to improve the quality of images	Applying (K3)
CO4	identify the features and region of interest of an image using segmentation, representation and description techniques for image classification	Applying (K3)
CO5	employ image compression algorithms on digital images	Applying (K3)

Mapping of 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	2							1	3	1
CO3	3	2	1	1	3	2	2	1	3	1		2	3	3
CO4	3	2	1	1	3	2	2	1	3	1		2	3	3
CO5	3	2	1	1	1			1	3	1		1	3	1

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

ASSESSMENT PATTERN - THEORY

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

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

18ECE09 - MICROCONTROLLER BASED AUTOMATION

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Digital Electronics	6	PE	3	0	0	3

Preamble	Interpret the concepts of microcontroller, display devices and sensors to make an automated embedded product	
Unit - I	**Introduction to 8 bit Microcontroller:**	**9**
Architecture of PIC 16F877A- Register file structure -CPU Register- Status Register- Instruction sets- Addressing modes -Simple programs using ALP- Oscillator and reset circuits.		
Unit - II	**Memory Organization:**	**9**
Program memory- Data memory- On-chip Peripherals: Timers-Compare-Capture and PWM Modules- Interrupts-Watchdog timer		
Unit - III	**PIC Programming in C:**	**9**
Simple I/O port programming-LED-7 segment-switch-Timer programming-ADC-USART.		
Unit - IV	**Case Studies:**	**9**
Automation in boilers - Temperature, Pressure, Water level-display in LCD-Automation in conveyor belt based LPG cylinder filling - cylinder count - weight - sealing-display in 7 segment		
Unit - V	**Case Studies:**	**9**
Digital Alarm clock using real time clock interfacing through I2C protocol-time, date, day, alarm time-display in LCD-DC motor based speed control for electric vehicles- speed and direction control		

Total:45

TEXT BOOK:

1. Peatman & John B, "Design with PIC Microcontrollers", 1st Edition, Pearson Education, New Delhi, 2009.

REFERENCES:

1. Myke Predko, "Programming and customizing the PIC Microcontroller", 3rd Edition, Tata Mcgraw Hill, Delhi, 2008.
2. http://ww1.microchip.com/downloads/en/DeviceDoc/39582C.pdf

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	comprehend the architecture and concepts of PIC microcontroller	Understanding (K2)
CO2	Illustrate the working principle of internal peripherals in PIC microcontroller and its applications	Understanding (K2)
CO3	apply embedded C programming skills for on-chip peripherals in real applications using PIC microcontroller	Applying (K3)
CO4	develop embedded C program for automation process in boilers and conveyor belt based LPG cylinder filling	Applying (K3)
CO5	build embedded C program for digital Alarm clock through I2C protocol and Speed Control using DC motor for electric vehicles.	Applying (K3)

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

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

ASSESSMENT PATTERN - THEORY

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

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

18ECE10 - SOFT COMPUTATIONAL TECHNIQUES

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	6	PE	3	0	0	3

Preamble	To gain knowledge on application development using Neural network and Fuzzy Logic Systems	
Unit - I	**Introduction To Neural Networks:**	**9**
Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, characteristics of ANN, Types of Neuron Activation Function, Terminologies of ANN - Learning Strategy (Supervised, Unsupervised, Reinforcement) - McCulloch-Pitts Model – Hebb Rule		
Unit - II	**Learning Networks:**	**9**
Adaptive linear neuron - Radial Basis Function Network (RBFN) - Associative memory networks: Discrete hop field network - Kohonen self organising feature maps. Supervised Learning Networks: Perceptron Network : Theory – Architecture- Learning Rule, Back Propagation Network : Theory – Architecture- Training and Testing Algorithm		
Unit - III	**Advanced Neural Network:**	**9**
Support Vector Machine Classifier – Random Forest Classifier – Extreme Learning Machine (Training and testing algorithms only)		
Unit - IV	**Basic Concepts of Fuzzy Logic:**	**9**
Introduction to fuzzy logic - Classical sets and fuzzy sets - Fuzzy relations - Membership function: Features of membership function – Fuzzification - Methods of membership value assignments - Fuzzy rules and reasoning: Fuzzy If-Then Rules		
Unit - V	**Fuzzy Inference Systems (FIS):**	**9**
Introduction – Methods of FIS: Mamdani - Sugeno and Tsukamoto. Defuzzification: Lambda-Cuts for Fuzzy sets and Fuzzy Relations, Defuzzification Methods Applications of Neural networks and Fuzzy logic: In image processing- forecasting –communication-business		

Total:45

TEXT BOOK:

1. S.Rajasekharan & G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Systems and Evolutionary algorithms: synthesis and applications", 2nd Edition, Prentice Hall of India, New Delhi, 2018.

REFERENCES:

1. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", 3rd Edition, John Wiley, New Delhi, 2010.
2. Sivanandam S.N, Sumathi S & Deepa S.N, "Introduction to Neural Networks using MATLAB 6.0", 1st Edition, Tata McGraw-Hill, New Delhi, 2006.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	interpret the concepts of neural network	Understanding (K2)
CO2	develop Neural Network Architecture using Perceptron, BPN and RBFN learning	Applying (K3)
CO3	construct Neural Network Architecture using SVM, ELM and random forest classifier	Understanding (K2)
CO4	infer the concepts of fuzzy logic	Applying (K3)
CO5	develop FIS model and apply Neural network and Fuzzy logic for image processing 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	2	1											3	1
CO2	3	2	1	1	3			1	2			1	3	1
CO3	2	1			3			1	2			1	3	1
CO4	3	2	1	1									3	1
CO5	3	2	1	1	3	2		2	2	2		1	3	1

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	40	50				100
CAT2	25	45	30				100
CAT3	10	30	60				100
ESE	20	30	50				100

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

18ECE11 - SATELLITE COMMUNICATION

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Analog and Digital Communication	6	PE	3	0	0	3

Preamble	This course enables the students to understand the basic terminologies related to satellites, various sub systems and applications of a satellite. It also enables the student to understand the basics of uplink / downlink procedure and the various multiple access techniques used for communication with satellites	
Unit - I	**Overview of Satellite Systems:**	**9**
Introduction – Frequency allocations for satellite services – Kepler's law – Definitions of terms for earth orbiting satellites –Orbital elements – Apogee and Perigee heights – Orbital perturbations – Effects of a non spherical earth – Atmospheric drag – Inclined orbits – Calendars – The Orbital plane – The Geocentric equatorial coordinate system – Earth station referred to the IJK frame – The topocentric horizon coordinate system - The sub satellite point.		
Unit - II	**Geostationary Orbit and Space Segment:**	**9**
Antenna look angles – Limits of visibility - Earth eclipse of satellite – Sun transit outage – Launching orbits – Attitude control – Station keeping - telemetry, tracking and command sub system - Transponders – Wide band amplifier – Input demultiplexer –Power amplifier.		
Unit - III	**Earth Segment :**	**9**
Introduction – Receive only home TV systems – Outdoor unit -Indoor unit for analog (FM) TV – Master antenna TV system – Community antenna TV system – Transmit receive earth stations		
Unit - IV	**Space Link:**	**9**
Equivalent isotropic radiated power – Transmission losses – Free space transmission – Feeder losses – Antenna misalignment losses – Fixed atmospheric and ionospheric losses Link power budget equation – Carrier to noise ratio – Uplink –Saturation flux density – Input back off – The earth station HPA – Downlink – Output back off –Satellite TWTA output. **Applications :** Radarsat- GPS system		
Unit - V	**Satellite Access:**	**9**
Single access – Preassigned FDMA- Demand assigned FDMA- SPADE system TDMA: Reference burst - Preamble and Postamble- Carrier recovery- Network synchronization-Unique word detection- Traffic data- Frame efficiency and channel capacity- preassigned TDMA- Demand assigned TDMA - Code division multiple access – Space division multiple access. **Applications :** IMMARSAT,VSATs		

Total:45

TEXT BOOK:

1. Roddy Dennis, "Satellite Communications", 4th Edition, Mc-Graw Hill, New York, 2017.

REFERENCES:

1. VarshaAgrawal and AnilK.Maini, "Satellite Communications", 1st Edition, Wiley India Pvt. Ltd., New Delhi, 2010.
2. Pratt Timothy, Bostian Charles and Allnutt Jeremy, "Satellite Communications", 2nd Edition, Wiley India Private Limited, New Delhi, 2006.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	recite the various terminologies in satellite communication problems	Understanding (K2)
CO2	apply the working principle of various sub systems for satellite design	Applying (K3)
CO3	build the earth segment of satellite communication using terminal stations	Applying (K3)
CO4	understand the effect of losses and noise in link design	Understanding (K2)
CO5	review the different access methodologies for satellite communication	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	2	1			1				3	2	2	1
CO2	3	2	2	2		3		3			3	2	3	2
CO3	3	3	3	3			2	1	1	1	3	2	3	3
CO4	3	3	2	3			3				2	2	3	1
CO5	3	1	2	1		1		3	2	1	2	2	3	3

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	20	55	25				100
CAT3	30	70					100
ESE	20	55	25				100

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

18ECE12 - ELECTRONICS CIRCUIT BOARD DESIGN

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Digital Electronics	6	PE	2	0	2	3

Preamble	This course enables the student to carry out the different types of Printed Circuit Boards, design concepts, steps to fabricate PCB, different tools for PCB design and component tracing in assembled PCBs	
Unit - I	**Introduction to PCB designing concepts:**	**6**
Types of Components used in PCB, Terminologies in PCB Designing, Types of PCBs: Single Sided (Single Layer), Double Layer and Multi-Layer PCB, Flexible PCB, Materials for PCB manufacturing		
Unit - II	**PCB Design Considerations:**	**6**
PCB Design flow, General, Mechanical and Electrical considerations, Design rules for Analog, Digital and High frequency circuits. Electromagnetic interference/ Compatibility (EMI/ EMC).		
Unit - III	**Design and Simulation of PCB:**	**6**
Electronic Design Automation (EDA) Tools – Single layer PCB, Two layer PCB. Circuit Design and simulation, creating footprint, placement and routing, Generating Gerber file for single layer PCB.		
Unit - IV	**PCB Fabrication Techniques:**	**6**
Image transfer techniques. Plating techniques: Immersion, Electro less, Electroplating, Solder Mask, Etching techniques, Mechanical operations		
Unit - V	**Circuit Tracing and Testing & Case studies:**	**6**
Soldering techniques, Testing PCB, Environmental concern. Case studies - Power supply, Token Counter, Wien-bridge Oscillator.		

List of Exercises / Experiments :

1.	Study of CAD for PCB Design (Eagle CAD or Equivalent Open Source Tool)
2.	Soldering and de-soldering the components on the PCB
3.	Design and Simulation of 230V AC to 5V/9V/12V DC Power Supply in CAD Tool
4.	Placement , soldering and testing of component
5.	Design and Simulation of a IR Sensor Module
6.	Assembling and soldering of IR sensor module
7.	Preparation of layout from the circuit design
8.	Trouble shooting of single layer and multi layer PCB
9.	Soldering of SMD components

Lecture:30, Practical:30, Total:60

TEXT BOOK:

1. Khandpur R S, "Printed Circuit Board: Design ,Fabrication, Assembly and Testing", 1st Edition, McGraw Hill Education Pvt.Ltd., New Delhi, 2005.

REFERENCES:

1. Mehta S D, "Electronic Product Design", 1st Edition, S Chand Publications, New Delhi, 2011.
2. Clyde Coombs, "Printed Circuits Handbook", 6th Edition, McGraw Hill Professional, New Delhi, 2007.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	summarize different types of PCBs	Understanding (K2)
CO2	describe the PCB design rules and considerations	Understanding (K2)
CO3	apply the PCB Design rules to design and simulate single layer PCB	Applying (K3)
CO4	demonstrate single layer PCB for a given circuit	Applying (K3)
CO5	examine and trace the assembled electronic components on PCB	Analyzing (K4)
CO6	verify the PCB design using a simulation software	Evaluating (K5), Precision (S3)
CO7	carry out steps to fabricate single layer PCB	Applying (K3), Precision (S3)
CO8	assess the fault in a PCB and suggest solutions to rectify the fault	Evaluating (K5), Precision (S3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	70	10				100
CAT2	10	50	40				100
CAT3	5	40	40	15			100
ESE	10	40	40	10			100

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

18ECE13 - NATURAL LANGUAGE PROCESSING

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Data Structure with Python	6	PE	3	0	0	3

Preamble	To model the computer to perform useful tasks involving human language, task like conversational agent, dialogue system, machine translation, question and answering	
Unit - I	**Computer Language Processing and Regular Expressions:**	**9**
Knowledge in Speech and Language Processing, Ambiguity, Models and Algorithms, Turing Test, Basic Regular Expression Patterns, Disjunction, Grouping, and Precedence, Example: Simple and Complex, Advanced Operators		
Unit - II	**Text Tokenization and Normalization:**	**9**
Words, Corpora, Word tokenization and normalization, Word segmentation, Sentence segmentation, Minimum edit distance algorithm		
Unit - III	**Language Modelling:**	**9**
N-Grams, Evaluating Language Modelling, Smoothing algorithm		
Unit - IV	**Logistic Regression as Language Model:**	**9**
Training the Naïve Bayes, Optimizing for sentimental analysis, Naïve Bayes as language modelling, Evaluation of model.		
Unit - V	**Neural Language Models:**	**9**
Words and Vectors, Cosine Similarity, TF-IDF weighting terms in vector, Application of the TF-IDF vector model		

Total:45

TEXT BOOK:

1. Jurafsky, Daniel Martin & James H, "Speech and Language Processing - An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", 3rd Edition, Pearson Education India, New Delhi, 2019.

REFERENCES:

1. Eisenstein & Jacob, "Natural Language Processing", 1st Edition, MIT Press, USA, 2019.
2. PalashGoyal, Sumit Pandey & Karan Jain, "Deep Learning for Natural Language Processing: Creating Neural Networks with python", 1st Edition, Apress Media, New York, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand the concern of speech and language processing research for intelligent agent	Understanding (K2)
CO2	understand the pattern of regular expressions to search in texts	Understanding (K2)
CO3	understand and apply the text pre-processing technique using NLTK library	Applying (K3)
CO4	apply the way to assign probability to predict word from preceding words using sklearn library	Applying (K3)
CO5	apply on text categorization task of sentimental analysis using generative classifierusing sklearnlibrary	Applying (K3)

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

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

ASSESSMENT PATTERN - THEORY

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

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

18ECE14 - PRINCIPLES OF MACHINE LEARNING

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Mathematics I	7	PE	3	0	0	3

Preamble	This course enables the students to understand the principles of machine learning and its applications to classification and prediction problems.	
Unit - I	**Random Process:**	**9**
Random variables - Multivariate random variables – Transformation of Random variable -Parameters - Gaussian Distribution - Joint Distributions –Conditional Distributions - Bayesian rule		
Unit - II	**Parametric Modeling:**	**9**
Parameter estimation – regression – classification – bias-variance dilemma –Regularization-Maximum likelihood – Bayesian Inference-Curse of dimensionality – Validation		
Unit - III	**Classification:**	**9**
Bayesian Classification – Naïve Bayes - Decision Surfaces – Logistic regression – Scatter Matrices – Fisher discriminant: Two class,Multiclass – Ada-Boost – Log-Loss function		
Unit - IV	**Convex functions:**	**9**
Convex sets and functions – Properties of Projections – Application to classification and regression – Online learning cases		
Unit - V	**Sparsity-Aware Learning :**	**9**
Norms – LASSO - Sparset solutions-Compressed sensing – Dimensionality reduction – Application to image Denoising.		

Total:45

TEXT BOOK:

1. Sergious Theodoridis, ”Machine Learning : A Bayesian and optimization perspective”,2nd Edition, Academic Press, USA, 2020.

REFERENCES:

1. Trevor Hastie, "The Elements of Statistical Learning: Data Mining, Inference and Prediction", 12th Edition, Springer, New York, 2017.
2. MehryarMohri, "Foundations of Machine Learning", 2nd Edition, MIT Press, USA, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply concepts from multivariate random process	Applying (K3)
CO2	design regression model and measure its performance	Applying (K3)
CO3	design various classification models and measure its performance	Applying (K3)
CO4	summarize convex functions and its properties	Understanding (K2)
CO5	compare various methods that exploits sparsity in the data.	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											3	1
CO2	3	2	1	1	3	2	1	1	2	2		1	2	1
CO3	3	2	1	1	3	2	1	1	2	2		1	3	1
CO4	3	2	1	1	3								2	1
CO5	3	2	1	1	3	1			1	1		1	2	1

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

ASSESSMENT PATTERN - THEORY

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

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

18ECE15 - MOBILE COMMUNICATION

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Analog and Digital Communication	7	PE	3	0	0	3

Preamble	To acquire the fundamental concepts in cellular communication technology and articulate the study of 4th generation and 5th generation mobile technologies.	
Unit - I	**Cellular Concept and Propagation Model:**	**9**
Frequency reuse–Channel assignment strategies, Handoff strategies, Interference and system capacity, Co-channel interference and system capacity- Free space propagation model- Terrestrial propagation: Reflection- Two ray ground model- Scattering model- Indoor propagation model – Outdoor propagation model – Durkin		
Unit - II	**Channel Model, Equalizers and Diversity Techniques:**	**9**
Small-scale multipath propagation and measurements - Mobile multipath channel parameters - Types of small scale fading- Rayleigh and Rician channel model- Equalizers: Linear and nonlinear equalizers- Equalizer algorithms – Zero forcing- Least mean square- Selection diversity model - RAKE receiver		
Unit - III	**Multiple Access Techniques for Wireless Communications:**	**9**
FDMA-TDMA- Spread spectrum multiple access-Capacity of cellular CDMA – SDMA- WCDMA- Packet radio protocols- Capture effect in packet radio		
Unit - IV	**4G Wireless Networks:**	**9**
System Architecture Evolution – Architecture of LTE : High Level Architecture, User Equipment, Evolved UMTS Terrestrial Radio Access Network, Evolved Packet Core, Roaming Architecture–OFDMA in a Mobile Cellular Network : Multiple Access, Fractional Frequency Re-Use, Channel Estimation– SCFDMA		
Unit - V	**5G Wireless Networks:**	**9**
Evolution of LTE Technology to beyond 4G –– 5G objectives and usage scenarios, 10 Pillars of 5G – 5G Architecture – 5G Internet - channel access method/air interface - Cognitive Radio Technology in 5G Wireless Communication - Spectrum Optimization Literature in 5G- Key Requirements and Challenges for 5G Cognitive Terminals		

Total:45

TEXT BOOK:

1.	Rappaport S. Theodore, "Wireless Communications", 2nd Edition, Pearson Education, New Delhi, 2010.

REFERENCES:

1.	Christopher Cox, "An Introduction to LTE: LTE, LTE Advanced, SAE, VoLTE and 4G Mobile Communications", 2nd Edition, Wiley Publications, New Delhi, 2014.
2.	Saad Z. Asif, "5G Mobile Communications Concepts and Technologies", 1st Edition, CRC Press Taylor & Francis Group, USA, 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	characterize the propagation model of cellular systems and gain an understanding of the cellular concept	Applying (K3)
CO2	analyze the performance of diversity techniques and equalizers for compensating the effects of multipath propagation	Applying (K3)
CO3	apply the fundamentals of multiple access techniques in wireless systems	Applying (K3)
CO4	comprehend the characteristics of 4G wireless networks	Understanding (K2)
CO5	perceive the architecture of 5G and Cognitive Radio terminologies related to 5G	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	1	2	2	1				1		
CO2	3	2	1	1	2	2	2	1	2	2	2		3	
CO3	3	2	1	1	2		1	2	1	1	2		3	
CO4	2	1	2	2	2	1	1	2	2	2	2	3	3	2
CO5	2	1	3	2	2	1	1	2	2	2	2	3	3	2

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	30	50				100
CAT2	20	40	40				100
CAT3	45	55					100
ESE	10	50	40				100

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

18ECE16 - NANO SCIENCE AND NANO TECHNOLOGY

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Solid State Physics	7	PE	3	0	0	3

Preamble	To impart the knowledge on the nanoscience and technology and also describes the different types of nanostructure and its synthesis. It also describes the semiconductor nanoparticles and understands the applications of aforementioned material for transistors, energy conversion and energy storage.	
Unit - I	**Nanoscience and Technology:**	**9**
Scientific revolutions, Emerging trends in nanoscience and technology, Challenges in nanoscience and technology, Atomic structure, Molecules and phases, Energy, Molecular and atomic size, Surfaces and dimensions.		
Unit - II	**Nanomaterials:**	**9**
Prospects at the nano scale, Bulk to nanotransition, size dependent properties, Optical, electrical,mechanical, magnetic properties, surface area, Quantum confinement, 0D, 1D, 2D, 3D nanostructures, quantum dot, quantum wire, quantum well bulk materials, length and time scale in nanostructures		
Unit - III	**Synthesis of Nanomaterials:**	**9**
Top-Down and Bottom-up approach, Chemical precipitation, Sol-gel synthesis, Self-assembly, Microwave synthesis, Electrochemical synthesis, Ball Milling, Molecular beam epitaxy, Chemical vapour deposition and Electro deposition, Types of Nanocomposite, Core-Shell structured nanocomposites.		
Unit - IV	**Semiconductor Nanoparticles:**	**9**
Excitons, band-gap variations, quantum confinement, metal-semiconductor and metal-insulator, Semiconductor junctions, field-effect transistors, MOSFETs, CMOS: heterostructures, HEMTs, Quantum Hall effect, SETs, quantum dots, Coulomb blockade.		
Unit - V	**Applications of Nanomaterials in Energy Conversion and Storage:**	**9**
Solar cells and Batteries, Fuel Cells, Polymer membranes for fuel cells, Acid/ alkaline fuel cells, Hydrogen Storage in CNT, Nanoscale catalysts to save energy and increase the productivity in industry, Rechargeable batteries, Nanocomposites for electrodes and electrolyte applications.		

Total:45

TEXT BOOK:

1. Charles P. Poole JR. & Franks. J. Qwens, "Introduction to Nanotechnology", 1st Edition, Wiley India Edition , New Delhi, 2012.

REFERENCES:

1. Pradeep .T, "Nano the Essential Nanoscience and Nanotechnology", 1st Edition, McGraw hill, New Delhi, 2012.
2. Linden, "Hand book of Batteries and fuel cells", 4th Edition, McGraw Hill, New Delhi, 2011.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand the fundamental principles of nanoscience and technology	Understanding (K2)
CO2	infer the optical, electrical, mechanical and magnetic properties of nanomaterials	Understanding (K2)
CO3	apply engineering and physics concepts for the preparation of nanomaterials	Applying (K3)
CO4	analyze the properties of semiconducting nanoparticles for the development of transistors	Analyzing (K4)
CO5	apply the concepts of nanostructured materials for energy storage	Applying (K3)

Mapping of COs with POs and PSOs														
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3					2						1	
CO2	3	3	3	3									3	
CO3	3	3	3	3		2	3		2	1		2	3	
CO4	3	3	3	3	1	2	2					3	3	2
CO5	3	3	3	3	3	3	3		2	1		3	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	40	60					100
CAT2	20	40	40				100
CAT3	20	20	40	20			100
ESE	20	30	35	15			100

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

18ECE17 - DISPLAY DEVICES

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Solid State Devices and Circuits	7	PE	3	0	0	3

Preamble	To deal with the recent and advanced display devices and their applications in two and three dimensional display systems.	
Unit - I	**Characteristics of display systems:**	**9**
Human visual characteristics related to display systems-Brightness and contrast - Visual acuity, information content and resolution-Field of view and angle of viewing- Perception of colour- Colour gamut - Perception of motion, refresh rate and Critical Fusion Frequency. Non-Human visual characteristics related to display systems-Size, Aspect ratio, Electromagnetic emission, Degradation and screen burn , power consumption.		
Unit - II	**Liquid crystal displays, Light-emitting Diode Display:**	**9**
LCD -construction-principle–technology for display, Construction and principle in LED. OLED:Definition, basic device structure,basic light emission mechanism, lifetime and image burning, comparison between OLED and LCD modules, basic passive and active matrix OLED display,		
Unit - III	**TFT and Plasma Display:**	**9**
TFT –structure ,process, MOSFET basics , LTPS-TFT –driven OLED display design, TFT technologies for OLED displays- new OLED applications-TFT Active matrix LCD, Construction and principle in PDP.		
Unit - IV	**Advanced Display Devices:**	**9**
Construction and principle in Quantum dot display (QLED) display, Electroluminescent (ELD) ,Surface-conduction electron-emitter displays(SEDs) ,Field emission displays(FEDs) ,Nano-emissive display(NEDs),Liquid crystal on Silicon, Laser video display, Interferometric modulator display, Digital light processing(DLP),e-paper.		
Unit - V	**2 and 3-dimensional Displays:**	**9**
2-dimensional displays: Basic principle of operation and applications of Television set-Computer monitors- Head mounted display-Broadcast reference monitor-Medical monitors. 3-dimensional displays:Basic principle of operation and applications of Volumetric display-Laser display-Holographic display-Light field displays.		

Total:45

TEXT BOOK:

1. Takatoshi Tsujimura, "OLED Display Fundamentals and Applications", 2nd Edition, John Wiley and Sons , New Delhi, 2017.

REFERENCES:

1. https://www.elprocus.com/tft-oeld-advancement-display-technology/
2. https://www.coursera.org/learn/displays

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	identify the characteristics related to display systems.	Understanding (K2)
CO2	differentiate the working principles of LED, LCD and their types for display systems.	Understanding (K2)
CO3	understand the technologies involved in modern display devices.	Understanding (K2)
CO4	apply the concepts for the two and three dimensional display systems.	Applying (K3)
CO5	examine the applications in the real world of professional optics.	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	2	1				3		1		1				
CO2	2	1			2							2	3	
CO3	2	1			3		2				1	1		
CO4	3	2	1	1	3					2		2	2	
CO5	3	3	2	2		3			2		2		2	2

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

ASSESSMENT PATTERN - THEORY

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

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

18ECE18 - EMBEDDED IOT

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Microprocessor and Microcontroller	7	PE	3	0	0	3

Preamble	To understand and apply the basic concept of IoT Systems for real time applications.	
Unit - I	**Introduction to M2M and IoT:**	**9**
Introduction–M2M communication–IoT(Internet of Things)–Implications for IoT–IoT value chains– Real-World Design Constraints–An emerging industrial structure for IoT–M2M and IoT analytics: Introduction–Analytics architecture.		
Unit - II	**IoT Architecture and Use Case:**	**9**
IoT Reference Model: IoT domain model– Information model–Functional model–communication model–Safety, Privacy, Trust, Security model Implementation Examples: The Smart Grid–Industrial Automation.		
Unit - III	**Introduction to Raspberry pi and Python Programming:**	**9**
Raspberry Pi: History of the Raspberry Pi -- Installing the Raspbian OS and Overview of OS -- Python Programming: Python tools for Raspberry Pi -- Using the Python command line -- Writing a simple Python program -- Creating the class -- Creating the object -- Using the object inspector -- Testing your class -- Making the code flexible -- Reading the state of a button		
Unit - IV	**Web Services and Raspberry Pi as Web Server:**	**9**
Subscribing to Web Services: Amazon Web Services IoT -- IBM Watson platform -- Google Cloud platform -- Microsoft Azure -- Weather Underground -- A basic Python program to pull data from the cloud. Raspberry Pi as Web Server: Introducing CherryPy – a minimalist Python web framework -- Creating a simple web page using CherryPy		
Unit - V	**Preparing IoT Projects:**	**9**
Python libraries for the Raspberry Pi -- Accessing Raspberry Pi's GPIO -- Setting up the circuit -- Hello LED -- Reading the state of a button -- Reading the state from an infrared motion sensor -- Modifying Hello LED using infrared sensor. IoT Projects Prepration: Using the DHT11 to find temperature and humidity-- Using the Pi camera to take a photo -- Creating and Displaying data on dashboard using CherryPy		

Total:45

TEXT BOOK:

1. Jan Holler, "From Machine-to-Machine to the Internet of Things Introduction to a New Age of Intelligence", 1st Edition, Academic Press - Elsevier, Waltham, USA, 2014 for Units I,II.
2. Colin Dow, "Internet of things Programming Projects", 1st Edition, PACKT publishing, Birmingham, UK, 2018 for Units III, IV, V.

REFERENCES:

1. https://www.raspberrypi.org/documentation/
2. https://docs.python.org/3/

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	describe the basic concepts of M2M and IoT	Understanding (K2)
CO2	distinguish different IoT Architectures and apply IoT for automation	Applying (K3)
CO3	apply python programming knowledge for IoT application developments	Applying (K3)
CO4	manipulate software and hardware of single board computer for web interface	Applying (K3)
CO5	develop IoT based projects for real time applications using single board computer	Applying (K3)

Mapping of 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	1	1	1	1
CO2	3	2	1	1	1	1		1	1	2	1	2	2	1
CO3	3	2	1	1	3	1		1	2	2	1	1	2	1
CO4	3	2	1	1	3	1		1	1	2	2	2	3	2
CO5	3	2	3	1	3	1		1	3	2	3	3	3	3

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	60	30				100
CAT2	5	25	70				100
CAT3		30	70				100
ESE	10	30	60				100

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

18ECE19 - WIRELESS NETWORKS

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Data Communication and Internetworking	7	PE	3	0	0	3

Preamble	To provide a broad overview on wireless personal area, local area and wide area networks and its functionalities	
Unit - I	**Radio Propagation and Propagation Path-Loss Models:**	**9**
Overview of Wireless Systems-Radio Propagation and Propagation Path-Loss Models-Free-Space Attenuation-Attenuation over Reflecting Surface-Effect of Earth's Curvature-Radio Wave Propagation-Characteristics of Wireless Channel-Signal Fading Statistics		
Unit - II	**Wireless Local Area Network (WLAN):**	**9**
IEEE 802.11architecture- Physical layer: OFDM, DSSS and FHSS- Data link layer: Frame Format, CSMA/CA, DCF and EDCA - MAC sub layer- Power management-802.11. Case Studies: IEEE 802.11n and IEEE 802.11 ac		
Unit - III	**Wireless Personal Area Network (WPAN):**	**9**
IEEE 802.15.1(Bluetooth): Protocol stack- Bluetooth network connection establishment, Bluetooth low energy. IEEE 802.15.4 (WPAN-LR): 802.15.4-protocol stack- super frame structure, Frame formats CSMA/CA, routing protocol: AODV		
Unit - IV	**Cellular Networks:**	**9**
GSM: Architecture, GSM Channels, GPRS: Architecture (core networks and radio sub system), GPRS Channels Mobility Management, Session Management and Packet Transfer Procedures. UMTS: Architecture (R4 core networks), UMTS channel types		
Unit - V	**Mobile Network and Transport Layer:**	**9**
Wireless TCP/IP - Network layer in internet- TCP enhancements for wireless networks - Wireless TCP implementation-Mobile IP – SIP - WAP – Model and architecture		

Total:45

TEXT BOOK:

1. Vijay K. Garg, "Wireless Communications and Networking", 1st Edition, Morgan Kaufmann Publishers, USA, 2010.

REFERENCES:

1. Jeffrey G. Andrews, Arunabha Ghosh & RiasMuhamed, "Fundamentals of WiMAX: understanding broadband wireless networking", 1st Edition, Prentice Hall, New Delhi, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	interpret various propagation and path loss model	Understanding (K2)
CO2	perceive various WLAN standards and technologies	Understanding (K2)
CO3	comprehend the functionalities of personal area wireless systems	Understanding (K2)
CO4	interpret the functionalities of GSM, GPRS and UMTS networks	Applying (K3)
CO5	investigate distinct protocols implemented for wireless environment	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	2	1						1		1		3		
CO2	2	1										1	2	
CO3	2	1										2	2	
CO4	3	2	1	1				1	2	1		2	3	2
CO5	3	3	2	2	1				1			1	3	1

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	75					100
CAT2	20	60	20				100
CAT3	10	45	25	20			100
ESE	10	50	25	15			100

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

18ECE20 - COMPUTER VISION

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

Preamble	This course deals with intelligent algorithms which can perform/mimic the task of human visual perception – wide range of object recognition, object detection, and scene categorization	
Unit - I	**Image Formation and Transformations:**	**9**
Image Formation – Sampling and Representation - Types of Images: Binary, Gray and Colour - Neighbourhood Processing – Transformations: Shifting, Rotations and Scaling – Image filtering in time-domain.		
Unit - II	**Feature Detection:**	**9**
Properties: Scale and Rotation Invariance – Affine Invariance – DoG Descriptors – Feature Descriptors: Haris Corner - ANMS – SIFT, Feature Matching Strategy and error rates.		
Unit - III	**Segmentation:**	**9**
Active Contours: Snakes – Dynamic Snakes – Level Sets, Area: Watershed – Graph Cuts- K-means Clustering.		
Unit - IV	**Object Classification:**	**9**
Linear classification – Curse of Dimensionality - Support vector machine – Loss functions – Optimization – Non-linearly separable cases – Regularization		
Unit - V	**Face Recognition:**	**9**
Eigen faces – Artificial Neural Networks – Activation functions – Back Propagation – Convolutional Neural Networks – Architectures		

Total:45

TEXT BOOK:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", 2nd Edition, Springer, NewYork, 2010.

REFERENCES:

1. M Mohri, A Rostamizadeh & A Talwalkar, "Foundations of Machine Learning", 2nd Edition, MIT Press, USA, 2018.
2. Stanford Lecture Notes at https://cs231n.github.io/convolutional-networks/

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	describe formation of image and apply the various spatial transformations on the image	Applying (K3)
CO2	compare various feature detector and matching techniques	Applying (K3)
CO3	make use of various established segmentation algorithms for a specific task	Applying (K3)
CO4	apply linear classification algorithms for image classification and recognition	Applying (K3)
CO5	study artificial neural networks and deep convolutional neural networks for face recognition	Applying (K3)

Mapping of 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	3	2
CO2	3	2	1	1	2							1	3	2
CO3	3	2	1	1	2	1	1	1	1	1		2	3	2
CO4	3	2	1	1	1	2	1	2	2	2	2	2	3	2
CO5	3	2	1	1	2	2	1	2	3	2	2	2	3	2

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	6	60	34				100
CAT2	6	60	34				100
CAT3	14	70	16				100
ESE	10	60	30				100

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

18ECE21 - OPTIMIZATION TECHNIQUES

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Mathematics I	7	PE	2	0	2	3

Preamble	To acquaint and familiarize with different types of optimization techniques, solving optimization problems, implementing computational techniques, abstracting mathematical results and proofs etc	
Unit - I	**Introduction:**	**6**
Features of Evolutionary Computation -Advantages of Evolutionary Computation - Applications of Evolutionary Computation		
Unit - II	**Genetic Algorithms:**	**6**
Introduction - Biological Background - Conventional Optimization and Search Techniques .- Advantages and Limitations of Genetic Algorithm-Terminologies and Operators of GA		
Unit - III	**Advanced GA:**	**6**
Advanced Operators and Techniques in Genetic Algorithm-Classification of Genetic Algorithm-Application of GA in Machine learning, Image Processing		
Unit - IV	**Particle Swarm Optimization:**	**6**
PSO Algorithm - Accelerated PSO – Implementation - Convergence Analysis - Binary PSO – Applications.		
Unit - V	**Ant Colony Optimization and Cuckoo Search:**	**6**
ACO algorithm – Characteristics- -Convergence analysis - Implementation –Applications. Cuckoo Search : Cuckoo Life Style -– flowchart –Algorithm		

List of Exercises / Experiments :

1.	Analyzing a problem and finding its parameters for optimization
2.	Solving a cost function using GA tool.
3.	Solving and analyzing a cost function using MATLAB code
4.	Optimization of a cost function using PSO algorithm for an application
5.	Optimization of a cost function using ACO algorithm for an application
6.	Optimization of a cost function using Cuckoo search algorithm for an application

Lecture:30, Practical:30, Total:60

TEXT BOOK:

1.	Sivanandam S.N &Deepa S.N, "Introduction to Genetic Algorithms", 1st Edition, Springer, NewYork, 2008.

REFERENCES:

1.	OmidBozorg & Haddad , "Advanced Optimization by Nature-Inspired Algorithms", Springer, Singapore, 2018.
2.	SrikantaPatnaik, Xin-She Yang & Kazumi Nakamatsu, "Nature-Inspired Computing and Optimization Theory and Applications", Springer, Switzerland, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	infer the concepts of Evolutionary Computation	Understanding (K2)
CO2	solve an optimization problem with GA	Applying (K3)
CO3	apply the advanced GA operators for Machine learning, Image Processing	Applying (K3)
CO4	apply the concepts of PSO in optimization problems	Applying (K3)
CO5	apply the concepts of ACO and cuckoo search in engineering applications	Applying (K3)
CO6	solving the cost function using GA	Analyzing (K4) Precision (S3)
CO7	solving the cost function using PSO and ACO	Analyzing (K4) Precision (S3)
CO8	experiment the concepts of cuckoo search using software tools	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	2	1											2	
CO2	3	2	1	1									2	
CO3	3	2	1	1									2	
CO4	3	2	1	1									2	
CO5	2	1											2	
CO6	3	3	2	2	3	2			2	1			3	
CO7	3	3	2	2	3	2			2	1			3	
CO8	3	3	2	2	3	2			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	40	40	20				100
CAT2	30	30	40				100
CAT3	30	30	40				100
ESE	30	30	40				100

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

18ECE22 - COGNITIVE RADIO NETWORKS

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Analog and Digital Communication	7	PE	3	0	0	3

Preamble	To know the fundamental concepts of cognitive radio network, spectrum management and MAC protocols.	
Unit - I	**Introduction to Cognitive Radio Networking:**	**9**
Evolution of Cognitive Radio Networking, Key applications, architecture of cognitive radio networking: centralized cognitive radio networks		
Unit - II	**Spectrum Sensing and Sharing:**	**9**
Primary signal detection, unlicensed spectrum sharing, licensed spectrum sharing, secondary spectrum access (SSA), real time SSA, Multiband spectrum sensing-Serial SST, Parallel SST		
Unit - III	**Cooperative Spectrum Acquisition:**	**9**
Basics of Cooperative Spectrum Sensing - Hard Combining, Soft Combining, Hybrid Combining, Acquisition Techniques, Cooperative Transmission Techniques, Selective Cooperative Spectrum Sensing Strategies-Dual Threshold Selective CSS Strategy, Maximum Cooperative Spectrum Sensing Strategy		
Unit - IV	**Spectrum Handoff:**	**9**
Spectrum Mobility, Spectrum Handoff Strategies,Design Requirements for Spectrum Mobility Management, Performance Metrics, Mathematical Models for Spectrum Handoff - Performance of Spectrum Handoff Strategies, Time Relationship Model of Spectrum Handoff		
Unit - V	**MAC Protocols in Cognitive Radio Networks:**	**9**
Functionality of MAC Protocol in Spectrum Access, Interframe Spacing and MAC Challenges in the Absence of Common Control Channel for CSMA/CA, Mobility Management		

Total:45

TEXT BOOK:

1. Mohamed Ibnkahla, "Cooperative CognitiveRadio Networks-The complete spectrum cycle", 1st Edition, CRC Press, USA, 2015.

REFERENCES:

1. Alexander M.Wyglinski, MazierNekovee&Y.ThomasHou, "Cognitive Radio Communication Networks: Principles and Practice", 1st Edition, Academic Press, Elsevier, USA, 2010.
2. Ahmed Khattab, Dmitri,&MagdyBayoumi, "Cognitive Radio Networks-from Theory to Practice", 1st Edition, Springer, New York, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand the architecture and evolution of cognitive radio networks	Understanding (K2)
CO2	apply the fundamentals of communication systems to study the spectrum management in cognitive radio networks	Applying (K3)
CO3	characterize the cooperative spectrum management in receivers of cognitive radio networks	Understanding (K2)
CO4	comprehend the characteristics and features of handoff in cognitive radio networks	Understanding (K2)
CO5	interpret the media access protocols used in cognitive radio 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	3	1												
CO2	3	2	1	1	2				1	1		1		
CO3	2	1			2			2				1	3	
CO4	2	1						2				3	2	
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	25	60	15				100
CAT2	15	60	25				100
CAT3	20	80					100
ESE	15	65	20				100

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

18ECE23 - REAL TIME OPERATING SYSTEM

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Microprocessor and Microcontroller	7	PE	3	0	0	3

Preamble	To understand the concepts of real time operating systems for embedded applications development	
Unit - I	**Real Time Operating Systems:**	**9**
Basic definitions – Foreground/Background systems – Shared resources – Multitasking – Tasks – Priority inversion problem – Context switches – Kernels – Scheduling approaches – FIFO – Non-preemptive and preemptive kernels – Round-Robin scheduling – Rate monotonic scheduling – Mutual exclusion – Deadlock – Synchronization – Event flags – Interrupts – Clock ticks – Advantages and disadvantages of real time kernels.		
Unit - II	**Task Management:**	**9**
Tasks –Task states – TCB – Task scheduling – Locking and unlocking the schedulers – Idle task – Statistics task - Creating tasks – Task stacks – Stack checking – Deleting – Changing a task's priority – Suspending task – Resuming task – Task query.		
Unit - III	**Time Management and Event Control Blocks:**	**9**
Delaying a task – Resuming a delayed task – System time. Event Control Blocks: Placing a task in the ECB wait List – Removing a task from an ECB wait list – Finding the highest priority task – List of free ECBs – Initialize – Task ready, wait and time out of an event		
Unit - IV	**Inter-task Communication Management:**	**9**
Semaphore Management: Creating – Deleting – Waiting – Signaling - Non-Blocking and Query, Message Mailbox Management: Creating – Deleting – Waiting - Sending and getting a message - Query and using a mailbox as a binary semaphore, Message Queue Management: Creating – Deleting – Waiting - Sending (FIFO and LIFO) and getting a message – Flushing – Query - Using a queue when reading analog inputs and using a queue as a counting semaphore		
Unit - V	**Memory Management:**	**9**
Memory control blocks - Creating partition - Obtaining a memory block - Returning a memory block – Query - Memory partition and waiting for memory blocks from a partition. Case study: Design of Embedded Systems using µC/OS-II: Automatic Chocolate Vending Machine and Digital Camera		

Total:45

TEXT BOOK:

1. Jean J. Labrosse, "MicroC/OS – II The Real Time Kernel", 2nd Edition, CMP Books, UK, 2015.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	comprehend the fundamental concepts and scheduling algorithms for real time applications	Understanding (K2)
CO2	recognize the characteristics of task management with an example	Understanding (K2)
CO3	express the working of time and event management of tasks.	Understanding (K2)
CO4	employ the principles of Inter-task communication services in operating systems	Applying (K3)
CO5	design real time embedded systems using the concepts of RTOS	Applying (K3)

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

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

ASSESSMENT PATTERN - THEORY

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

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

18ECE24 - ASIC DESIGN

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	VLSI Design	7	PE	3	0	0	3

Preamble	To learn different programmable ASICs, logic cells, I/O cells and interconnects and to learn how synthesis and physical design flow is carried out in an ASIC design	
Unit - I	**Introduction to ASICs, CMOS Logic, ASIC Library Design:**	**9**
Types of ASICs - Design flow – CMOS transistors- Transistor as resistors - Transistor parasitic capacitance – Logical effort-Antifuse - Static RAM - EPROM and EEPROM technology		
Unit - II	**Programmable ASICs and I/O Cells:**	**9**
Actel ACT - Xilinx LCA - DC & AC inputs and outputs – Clock & power inputs		
Unit - III	**Programmable Interconnects and Logic Synthesis:**	**9**
Actel ACT – Xilinx LCA - Verilog logic synthesis – Delays- Blocking and Non blocking assignment, Combinational logic, multiplexers, Case statement, decoders, arithmetic and Sequential logic		
Unit - IV	**Partitioning, Floorplanning and Placement:**	**9**
Physical design flow -System partitioning - FPGA partitioning - -KL algorithm –Floorplanning –Types –Placement – Constructive and iterative placement algorithms		
Unit - V	**Routing:**	**9**
Global routing - Detailed routing –Area routing-Maze Algorithm-Channel routing- Left Edge Algorithm-Special routing		

Total:45

TEXT BOOK:

1. Smith M.J.S, "Application Specific Integrated Circuits", 12th Edition, Pearson Education Pvt. Ltd, New Delhi, 2013.

REFERENCES:

1. Wayne Wolf, "FPGA-Based System Design", 1st Edition, PHI, New Delhi, 2009.
2. Erik larson, "Introduction to Advanced System-on-Chip Test Design and Optimization", 1st Edition, Springer, USA, 2005.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	demonstrate the different types of ASICs design	Understanding (K2)
CO2	realize the digital logic functions using programmable ASIC and I/O cells	Applying(K3)
CO3	infer the different programmable interconnects and synthesis	Understanding (K2)
CO4	apply algorithms for partitioning, floor planning and placement	Applying (K3)
CO5	perform routing design in an ASIC	Applying (K3)

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	1			3	1
CO2	3	2	3	2	2	1	2	1	2	2		2	2	1
CO3	2	1	2	1	3	1	1	1	2	2	1	2	3	2
CO4	3	2	3	2	3	2	2	2	3	3	2	3	2	2
CO5	3	2	3	2	3	2	2	2	3	3	2	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	30	50	20				100
CAT2	20	50	30				100
CAT3	10	50	40				100
ESE	10	50	40				100

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

18ECE25 - NETWORK INFORMATION SECURITY

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Data Communication and Internetworking	7	PE	3	0	0	3

Preamble	To provide a broad overview on cryptographic algorithms, secure key management and distribution mechanism implemented in data communication networks	
Unit - I	**Network security:**	**9**
Computer security concepts, the OSI security architecture, Security attacks, services and Mechanisms -Network security model, Divisibility and the division algorithm, Euclidean Algorithm, Modular arithmetic, Groups, rings, and fields, finite fields of the form GF(p), Polynomial arithmetic		
Unit - II	**Number theory and Classical Encryption techniques:**	**9**
Prime numbers, Fermat‘s and Euler‘s theorems - Testing for primality -The Chinese remainder theorem- Discrete logarithms. Classical Encryption techniques: Symmetric cipher model, substitution techniques, transposition techniques, Stream and block cipher techniques		
Unit - III	**Symmetric Key Cryptography and Public key cryptography:**	**9**
Data Encryption Standard-Block cipher principles-block cipher modes of operation, Advanced Encryption Standard (AES). Public key cryptography: Principles of public key cryptosystems-The RSA algorithm- Security of RSA		
Unit - IV	**Key management and distributions and User Authentication:**	**9**
Symmetric key Distribution using symmetric encryption, Symmetric key Distribution using asymmetric encryption, Distribution of public keys, X.509. User Authentication: Remote user authentication principles, Remote user authentication using symmetric encryption, Kerberos, Remote user authentication using asymmetric encryption.		
Unit - V	**IP Security:**	**9**
Overview of IPSec - IP security policy, encapsulating security payload, combining security association, Internet key exchange, Cryptography suites		

Total:45

TEXT BOOK:

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

REFERENCES:

1. Behrouz A. Ferouzan & DebdeepMukhopadhyay, "Cryptography and Network Security", 2nd Edition, Tata McGraw-Hill, New Delhi, 2010.
2. Charles P Fleeger, "Security in Computing", 5th Edition, Prentice Hall, New Delhi, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand OSI security architecture and mathematics of cryptography	Understanding (K2)
CO2	understand number theory and classical encryption techniques	Understanding (K2)
CO3	apply knowledge in symmetric and public key cryptography	Applying (K3)
CO4	infer different key management and authentication mechanism	Understanding (K2)
CO5	analyse attacks in IP networks	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	1			2	2							2	1
CO2	2	2		1	1				1			1	3	1
CO3	3	2	1	2	1		2		1			2	3	2
CO4	2	1							2	1		1	3	2
CO5	3	3	2	2	1	1	2	2	2	1	2	1	3	2

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	10	40	50				100
CAT3	10	30	40	20			100
ESE	10	40	30	20			100

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

18ECE26 - REMOTE SENSING

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

Preamble	To understand the fundamentals of remote sensing and focusing on remotely sensed data for geospatial applications	
Unit - I	**Concepts and Foundations of Remote Sensing:**	**9**
Introduction, Energy Sources and Radiation Principles, Energy Interactions in the Atmosphere, Physical basis of Signatures of Earth features, Characteristics of Remote Sensing Systems, Global Navigation Satellite Systems (GNSS), An overview of Data Recaption and Data products, Geographic Information Systems (GIS).		
Unit - II	**Earth Observation Systems (EOS) and Platforms:**	**9**
Introduction, Classification of EOS, 1) Infrared-Visible optical sensors (IVOS): Photographic cameras, Television Cameras, Opto-mechanical Scanners, Push-broom Cameras, Multispectral and Hyperspectral imagers. 2) Microwave EOS: Passive microwave sensors, Active microwave sensors, Synthetic Aperture Radars, Ground Penetrating Radars. 3) Principles of Satellite Motion: Types of orbits, Orbit perturbations, Space craft Elements and GNSS		
Unit - III	**Data Reception and Processing:**	**9**
Introduction, Data formats, Data acquisition and onboard data handling, Data reception system, Data pre-processing – Radiometric and Geometric rectifications, Referencing Scheme, Data products generation, Data products Output media, Data Analysis and Quality Assessment, Special processing, digital and visual interpretation.		
Unit - IV	**Applications of EOS in Earth resources management:**	**9**
Agriculture and Soils, Forestry, Geology, Land Cover – Land use Mapping, Water resources, Snow and Glaciers, Urban studies, Coastal zone management and marine fisheries, Desertification, Archaeology		
Unit - V	**EOS image classification and Spatial Data Modelling and management:**	**9**
Introduction, Supervised and unsupervised classification concepts and methods, Change detection applications, Geographic information systems – Spatial data types, Data preparation and management, GIS working environment, Spatial data infrastructure.		

Total:45

TEXT BOOK:

1. George Joseph & C. Jeganathan, "Fundamentals of Remote Sensing", 3rd Edition, Universities Press (india) Pvt. Ltd, Hyderabad, 2018.

REFERENCES:

1. Thomas M.Lillesand, Ralph W.Kiefer, "Remote Sensing And Image Interpretation", 7th Edition, John Wiley, New Delhi, 2015.
2. Campbell, J.B & Randolph H. Wayne, "Introduction to Remote sensing", 5th Edition, Guilford Press, USA, 2011.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand the foundations of remote sensing	Understanding (K2)
CO2	explain the different types of remote sensing systems and their characteristics in terms of resolutions	Understanding (K2)
CO3	identify the various sensing and imaging techniques	Applying (K3)
CO4	perform the appropriate satellite image analysis for specific Applications	Applying (K3)
CO5	classify the types of Radar Sensing System for real time applications	Applying (K3)

Mapping of COs with POs and PSOs														
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1												
CO2	2	1												
CO3	3	2	1	1	2	1			1	1	2	1	2	
CO4	3	2	1	1	2	1	1		2	1	1	2	3	
CO5	3	2	1	1	2	3	2	3	2	1	2	2	2	
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

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

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

18ECE27 - SOFTWARE QUALITY ASSURANCE AND TESTING

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

Preamble	The aim and objective of this course is to make the students understand the concepts and apply the skills needed for software quality assurance and testing. Also to ensure 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 –Need for 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 Reviews / Inspections – Some psychological aspects of reviews.		
Unit - II	**Software Measurement and Metrics:**	**9**
Product quality –Models for software product Quality –Process Quality. Measurement and Metrics: Introduction –Measurement during software life cycle context –Defect metrics –Metrics for software maintenance –Classification of software metrics –Requirements related metrics –Measurements and process improvement –Measurement principles		
Unit - III	**Basics of Testing:**	**9**
Introduction- Definition- Need for Testing- 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 -The Seven Step Software Testing Process - Organizing for testing-Workbench-Procedure, Developing the test plan-Workbench-Procedure, Verification testing-Workbench-Procedure -Validation testing-Workbench-Procedure		
Unit - V	**Software Testing process:**	**9**
Analyzing and reporting test results-Workbench-Procedure, Testing software system security-Testing client/server systems-Testing web-based systems - Using Agile Methods to Improve Software Testing.		

Total:45

TEXT BOOK:

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

REFERENCES:

1. Mordechai Ben-Menachem & Garry S. Marliss, "Software Quality", 2nd Edition, Vikas PublishingHouse Pvt. Ltd, New Delhi, 2014.
2. Limaye M.G, "Software Testing -Principles, Techniques and Tools", 1st Edition, Tata McGraw-Hill, New Delhi, 2009.
3. RajaniRenu & Oak Pradeep, "Software Testing Effective Methods: Tools and Techniques", 2nd Edition, Tata McGraw-Hill, New Delhi, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	identify the components of software quality assurance systems	Understanding (K2)
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	2	1											1	
CO2	3	2	1	1	2								2	1
CO3	3	2	1	1	2				2				2	1
CO4	3	2	1	1		1	1				2		2	1
CO5	3	2	1	1		1	2		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	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)**

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)**

18ECE28 - COMPUTER DESIGN AUTOMATION FOR VLSI CIRCUITS

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	VLSI Design	8	PE	3	0	0	3

Preamble	To provide an overview of the VLSI physical design and understand CAD algorithms used in VLSI physical design automation field	
Unit - I	**Design Methodologies:**	**9**
Introduction to VLSI Design methodologies, Review of VLSI Design automation tools, Algorithmic Graph Theory and Computational Complexity, Tractable and Intractable problems, general purpose methods for combinatorial optimization problems		
Unit - II	**Partitioning and Placement:**	**9**
Placement, Circuit representation, Placement algorithms, Partitioning, Partitioning algorithms, Placement and Partitioning based on Genetic Algorithm		
Unit - III	**Floorplanning and Compaction:**	**9**
Floorplanning concepts, shape functions and floor plan sizing, Floorplanning based on Simulated Annealing.Compaction, Layout Compaction, Design rules, Problem formulation, Algorithms for constraint graph Compaction.		
Unit - IV	**Routing:**	**9**
Types of local routing problems, Area routing, channel routing, Introduction to global routing, Steiner tree Construction, Algorithms for global routing		
Unit - V	**Logic Simulation:**	**9**
Simulation, Gate-level modeling and simulation, Switch-level modeling and simulation. Introduction to Combinational Logic Synthesis, Binary Decision Diagrams, ROBDD, ROBDD principles, implementation, construction and manipulation		

Total:45

TEXT BOOK:

1. Gerez, S.H, "Algorithms for VLSI Design Automation", Reprint, John Wiley & Sons, NewYork, Reprint 2014.

REFERENCES:

1. Sherwani N.A, "Algorithms for VLSI Physical Design Automation", 3rd Edition, Kluwar Academic Publishers, USA, 2002.
2. Sarafzadeh & C.K. Wong, "An Introduction to VLSI Physical Design", McGraw-Hill, New Delhi, Reprint 2007.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	utilize the concepts and properties associated with graph theory	Applying (K3)
CO2	infer the concepts of partitioning and placement in VLSI physical design process	Understanding (K2)
CO3	demonstrate the concepts of floorplanning, compaction and routing in VLSI phyiscal design	Understanding (K2)
CO4	apply the concepts of design optimization algorithms and their applications to VLSI physical design automation	Applying (K3)
CO5	utilize the concepts of simulation in VLSI design automation	Applying (K3)

Mapping of 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	3	2									2	2	
CO3	3	3	2									2	2	
CO4	3	3	3	2	2				2	2		2	3	
CO5	3	3	2									2	2	

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

ASSESSMENT PATTERN - THEORY

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

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

18ECE29 - RF COMMUNICATIONS

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Analog and Digital Communication	8	PE	3	0	0	3

Preamble	To study the RF System design at the implementation level and to understand the design of Low Noise Amplifiers, Phase Locked Loop and Oscillators	
Unit - I	**Transceiver Specifications And Architectures:**	**9**
Transceiver architectures: Receiver: Homodyne – Heterodyne - Image reject - Low IF architectures – Transmitter: Direct up conversion - Two step up conversion		
Unit - II	**Bandwidth Estimation& Linearization Techniques:**	**9**
Open Circuit Time Constants- Short Circuit Time Constants – Rise Time, Delay & Bandwidth –Linearization Techniques – Feedback Technique – Envelope Elimination and Restoration		
Unit - III	**LNA Design:**	**9**
MOSFET two port noise parameters - LNA topologies - Power constrained noise optimization - Low Noise Amplifiers – Single ended and differential LNAs – Terminated with resistors and source degeneration LNAs		
Unit - IV	**PLL and Frequency Synthesizers:**	**9**
PLL: Linearised Model – Noise properties - Phase detectors – Loop filters and charge pumps – Sequential Phase Detectors - Frequency synthesizers - Integer-N frequency synthesizers		
Unit - V	**Mixers and Oscillators:**	**9**
Mixer: Characteristics – Non-linear based mixers: Multiplier based mixers - Single balanced and active double balanced mixers – Subsampling mixers - Oscillators: Colpitts oscillators		

Total:45

TEXT BOOK:

1. Thomas H. Lee, "Design of CMOS RF Integrated Circuits", 2nd Edition, Cambridge University Press, UK, 2004.

REFERENCES:

1. Razavi B, "RF Microelectronics", 2nd Edition, Pearson Education, New Delhi, 2011.
2. Jan Crols & MichielSteyaert, "CMOS Wireless Transceiver Design", 1st Edition, Kluwer Academic Publications, UK, 2003.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	characterize and understand the RF system architecture for various applications	Understanding (K2)
CO2	analyze the performance of RF power amplifiers and bandwidth constraints	Analyzing (K4)
CO3	comprehend the fundamentals of Low Noise Amplifier design	Understanding (K2)
CO4	evaluate the characteristics of Phase Locked Loop and Frequency synthesizers	Analyzing (K4)
CO5	analyze the various configurations of Mixers and Oscillators	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	1				1		1	1	1		1		
CO2	3	3	2	2	1				1		1	1	2	1
CO3	3	1							1		1	1	2	1
CO4	3	3	2	2	1				1	1		1	2	1
CO5	3	3	2	2	1				1		1	1	2	1

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	45	35				100
CAT2	10	25	45	20			100
CAT3	10	20	45	25			100
ESE	10	30	40	20			100

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

18ECE30 - RADAR ENGINEERING

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Electromagnetics and Waveguides	8	PE	3	0	0	3

Preamble	To gain knowledge in the different types of radar systems used for air-traffic control at airports and others that are used for long range surveillance and early-warning systems under different environments	
Unit - I	**Radar and Radar Equation:**	**9**
Introduction- Basic Radar –The simple form of the Radar Equation- Radar Block Diagram-Applications of Radar – Detection of Signals in Noise- Receiver Noise and the Signal-to-Noise Ratio-Probability Density Functions- Probabilities of Detection and False Alarm- Integration of Radar Pulses- Radar Cross Section of Targets, transmitter power, PPF		
Unit - II	**MTI and Pulse Doppler Radar:**	**9**
Introduction to Doppler and MTI Radar- Moving Target Detector – Limitations to MTI Performance – Pulse Doppler Radar		
Unit - III	**Tracking Radar:**	**9**
Tracking with Radar –Monopulse Tracking –Conical Scan and Sequential Lobing – Limitations to Tracking Accuracy – Low-Angle Tracking – Tracking in Range –Comparison of Trackers		
Unit - IV	**Detection of Signals in Noise:**	**9**
Detection Criteria – Detectors –-Automatic Detector – Integrators – Constant-False-Alarm Rate Receivers – The Radar operator – Signal Management		
Unit - V	**Phased Array and Navigational Aids:**	**9**
Phased Arrays – Basic concepts, feeds, phase shifters, frequency scan arrays, multiple beams, applications, advantages and limitations. Navigational Aids: VOR, ILS and LORAN		

Total:45

TEXT BOOK:

1.	Skolnik M.I, "Introduction to Radar Systems", 44th Reprint, McGraw Hill, New Delhi, 2018.

REFERENCES:

1.	Raju G.S.N, "Radar Engineering and Fundamentals and Navigational Aids", I.K. International, New Delhi, 2010.
2.	GottapuSasiBhushana Rao, "Microwave and Radar Engineering", 1st Edition, Pearson Education, Chennai, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	outline the principles of radar	Understanding (K2)
CO2	illustrate the working of pulse doppler radar and MTI radar	Applying (K3)
CO3	compare the various types of tracking radar	Understanding (K2)
CO4	infer methods of detecting signals in noise	Understanding (K2)
CO5	relate the principles of radar in phased array and navigational aids	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				1				1	1	1
CO2	3	1										1		
CO3	3	1												
CO4	3	1										1		
CO5	3	1				2	1	1			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	15	65	20				100
CAT2	15	70	15				100
CAT3	15	85					100
ESE	10	70	15				100

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

18ECE31 - RISC ARCHITECTURE

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Microprocessor and Microcontroller	8	PE	3	0	0	3

Preamble	To provide an overview and fundamentals of embedded systems for real time applications which includes interfacing, programming and debugging using ARM Cortex Microprocessors	
Unit - I	**ARM Cortex M Processors:**	**9**
Overview of Cortex M Processors- Advantages- Evolution- Architecture - Programmer's Model- Application Program Status Register- System Control Block- Resets- Instruction Set.		
Unit - II	**CMSIS Standard and Cortex M Programming:**	**9**
Software Development Flow- Software Flow- Inputs, outputs, and peripherals accesses- Microcontroller interfaces- Introduction to Cortex Microcontroller Software Interface standard (CMSIS)- Organization and Standardization of CMSIS Core- CMSIS Core Structure- Usage and benefits-Versions of CMSIS.		
Unit - III	**Memory System and Interrupts:**	**9**
Memory System Features Overview- Memory Maps- Memory Endianness- Memory Access Attributes- Default Memory Access Permissions- Bit-Band Operations- Unaligned Transfers- Exclusive Accesses. Exception Types- Interrupt Management- Priorities- Exception sequence- NVIC and SCB registers for exception control- Interrupt Masking.		
Unit - IV	**Floating Point:**	**9**
Single precision- half precision and double precision floating point numbers- Floating Point Unit- Overview and Registers- Lazy Stacking, DSP Applications using FPU		
Unit - V	**Embedded OS and Keil MDK:**	**9**
Getting Started with uVision- Project Options- Using IDE and debugger- Optimization Options- Keil RTX Real Time Kernel- CMSIS - OS examples on semaphores- Mutual Exclusion- Message Queue- Mail Queue- Timer and Signal Event Communication- OS aware debugging		

Total:45

TEXT BOOK:

1. Joseph Yiu, "The Definitive Guide to ARM_ Cortex_-M3 and Cortex-M4 Processors", 3rd Edition, Newnes, USA, 2014.

REFERENCES:

1. Trevor Martin, "The Designer’s Guide to the Cortex-M Processor Family- A tutorial Approach", 1st Edition, Newnes, USA, 2013.
2. Trevor Martin, "The Insider's Guide to the STM32 ARM Based Microcontroller", 1st Edition, Hitex(UK) Ltd, UK, 2008.
3. http://infocenter.arm.com/help/topic/com.arm.doc.ddi0439b/DDI0439B_cortex_m4_r0p0_trm.pdf

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	summarize the features and architecture of ARM Cortex M processor	Understanding (K2)
CO2	explain the role of CMSIS core in ARM Cortex programming	Understanding (K2)
CO3	differentiate between the different memory system configurations and interrupt schemes	Understanding (K2)
CO4	develop application programs using floating point operations in ARM Cortex	Applying (K3)
CO5	build OS based applications on ARM Cortex M using Keil MDK.	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2									2	2	
CO2	2	1	2		2							2	2	1
CO3	3	1	2									2	2	1
CO4	3	2	3	2	3	2			3	2	3	3	3	2
CO5	3	2	3	2	3	2			3	2	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	80					100
CAT2	20	70	10				100
CAT3	10	40	50				100
ESE	15	50	35				100

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

18ECE32 - OPTO ELECTRONICS

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Solid State Physics	8	PE	3	0	0	3

Preamble	To learn different types of display devices, detection mechanism and optoelectronic integrated circuits with applications	
Unit - I	**Elements of Light, Solid State Physics:**	**9**
Wave nature of light- Polarization interference- Diffraction- Light Source- Review of quantum mechanical concept- Review of solid state physics- Review of semiconductor physics and semiconductor junction device		
Unit - II	**Display Devices and Lasers:**	**9**
Photo luminescence- Cathode luminescence- Electro luminescence- Injection luminescence- LEDS plasma display- Liquid crystal displays- Numeric displays laser emission- Absorption- Radiation- Population inversion optical feedback- Threshold condition-Line shape function-Pumping - Laser modes- Classes of lasers- Mode locking- Q switching- Laser applications-Measurements of distance – Holography -Laser induced nuclear fusion		
Unit - III	**Optical Detectors:**	**9**
Photo detector- Thermal detector- Photo devices- Photo emissive devices-Photomultiplier- Noise in Photomultiplier-Photon counting technique- Image intensifier - Photo conductive detectors- Noise in photoconductive detectors - Junction detectors- Detector array - Detector performance		
Unit - IV	**Optoelectronic Modulator:**	**9**
Introduction- Analog and digital modulation Franz-Keldysh and Stark effect modulators: Quantum well - Electro absorption modulators- Electro optic modulators- Magneto optic devices- Acousto optic devices- Optical switching and logic devices.		
Unit - V	**Integrated Circuits:**	**9**
Introduction to optoelectronic ICs- Hybrid and monolithic integration- Application of optoelectronic integrated circuits- Integrated transmitters and receivers- Guided wave devices		

Total:45

TEXT BOOK:

1. Wilson J & Hawkes J, "Opto-electronics: An Introduction", 3rd Edition, PHI Learning , New Delhi, 2007.

REFERENCES:

1. Pallab Bhattacharya, "Semiconductor Opto-electronic Devices", 2nd Edition, PHI Learning, New Delhi, 2006.
2. Emmanuel Rosencher and Berge Vinter, "Optoelectronics", 1st Edition, Cambridge University Press, New York, 2002.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	interpret the state-of-art optoelectronic technology	Understanding (K2)
CO2	apply quantum mechanics and its role in the design and operation of optoelectronic devices	Applying (K3)
CO3	perceive semiconductor material properties and semiconductor optoelectronic device physics	Understanding (K2)
CO4	analyse laser theory and rate equations with optical ,Magnetic and Switching applications	Applying (K3)
CO5	apply the concepts and design optoelectronics modulators.	Applying (K3)

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	2				2		2	2	
CO2	3	2	1	1	2								3	1
CO3	2	1					2						3	1
CO4	3	2	1	1				2				2	3	1
CO5	3	2	1	1	2				2	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	45	35				100
CAT2	10	35	55				100
CAT3	10	35	55				100
ESE	10	40	50				100

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

18ECE33 - DSP PROCESSOR AND ITS APPLICATIONS

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Digital Signal Processing	8	PE	3	0	0	3

Preamble	To design the parameters of filters and implement it in real time DSP hardware	
Unit - I	**Introduction to Real-Time Digital Signal Processing:**	**9**
Basic Elements of Real-Time DSP Systems- Analog Interface- DSP Hardware-DSP system Design- Introduction to DSP Development Tools- Experiments and Program Examples		
Unit - II	**Introduction to TMS320C54x Digital Signal Processor:**	**9**
Introduction-Architecture of TMS320C54X – Peripherals-Addressing modes – Pipeline and Parallelism - Instruction Set		
Unit - III	**TMS320C54x Programming:**	**9**
TMS320C55x Assembly Language Programming - C Language Programming for TMS320C55x - Mixed C-and-Assembly Language Programming - Experiments and Program Examples		
Unit - IV	**Design and Implementation of Filters:**	**9**
Overview of FIR and IIR filters - Design of Filters Using MATLAB and FDATool - Implementation Considerations - Experiments and Program Examples.		
Unit - V	**Digital Signal Generators:**	**9**
Sine wave Generators- Noise Generators - Practical Applications - Experiments and Program Examples **Application:** DTMF Detection Using C5510 DSK - Acoustic Echo Canceller		

Total:45

TEXT BOOK:

1.	Sen.M.Kuo, Bob.H.Lee and Wenshun Tian, "Real-Time Digital Signal Processing: Implementations and Applications", 2nd edition, John Wiley & Sons Ltd, 2006

REFERENCES:

1.	Texas Instrumentation, "User guides: Analog Devices", Motorola Inc, Arizona, 2003
2.	Venkataramani, B. and Bhaskar, M., "Digital Signal Processors: Architecture, Programming and Applications", 2nd edition, McGraw Hill, New Delhi, 2011

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	infer the basic concepts of real time DSP processor	Understanding (K2)
CO2	summarize the architectural concepts of c54x processor	Understanding (K2)
CO3	apply programming concepts to develop simple and real time applications using c54x processor	Applying (K3)
CO4	apply programming concepts to develop FIR and IIR filter design.	Applying (K3)
CO5	generate real time signals using c54x processor	Applying (K3)

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							2	
CO2	2	1				1							3	1
CO3	3	2	1	1		3	1	2	3	3	2	1	3	1
CO4	3	2	1	1		2	1		2	2	1	1	3	1
CO5	3	2	1	1		2	1		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	70					100
CAT2	30	40	30				100
CAT3	20	40	40				100
ESE	25	50	25				100

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

18ECE34 - BLOCKCHAIN TECHNOLOGIES

Programme & Branch	B.E. & Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	8	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:**	**9**
Decentralization using blockchain – Methods – Routes - Blockchain and full ecosystem decentralization -Smart contract - Decentralized applications - Platforms for decentralization. Cryptography and Technical Foundations – Introduction - Cryptography - Confidentiality - Integrity – Authentication - Cryptographic primitives - Asymmetric cryptography - Public and private keys – RSA - Discrete logarithm problem - Hash functions - Elliptic Curve Digital signature algorithm		
Unit - III	**Bitcoin:**	**9**
Bitcoin – Transactions – Blockchain - Bitcoin payments - Alternative Coins : Theoretical foundations - Bitcoin limitations – Namecoin - Litecoin – Primecoin – Zcash - Smart Contracts		
Unit - IV	**Ethereum 101:**	**9**
Introduction – Ethereum blockchain - Elements of the Ethereum blockchain - Precompiled contracts – Accounts – Block – 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", 1st Edition, Packt Publishing, Mumbai, 2017.

REFERENCES:

1. Brenn Hill, Samanyu Chopra & Paul Valencourt, "Blockchain Quick Reference: A guide to exploring decentralized blockchain application development", 1st Edition, Packt publishing, Mumbai, 2018.
2. Andreas Antonopoulos, "Mastering Bitcoin: Programming the open blockchain", 2nd Edition, O'Reilly Media, USA, 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			1								2	
CO2	2	1			2							2	2	
CO3	2	1			3								2	
CO4	3	2	1	1	2			1	1	1	1		3	1
CO5	3	2	1	1	2			1	1	1	1		3	1

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

ASSESSMENT PATTERN - THEORY

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

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

18ECO01 - PCB DESIGN AND FABRICATION

(Offered by Department of Electronics and Communication Engineering)

Programme& Branch	All BE/BTech Branches except Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	OE	3	0	2	4

Preamble	This course enables the student to carry out the different types of Printed Circuit Boards, design concepts, steps to fabricate PCB, different tools for PCB design and component tracing in assembled PCBs	
Unit - I	**Introduction to PCB Designing Concepts:**	**9**
Types of Components used in PCB, Terminologies in PCB Designing, Types of PCBs: Single Sided (Single Layer), Double Layer and Multi-Layer PCB, Flexible PCB, Materials for PCB manufacturing		
Unit - II	**PCB Design Considerations:**	**9**
PCB Design flow, General, Mechanical and Electrical considerations, Design rules for Analog, Digital and High frequency circuits. Electromagnetic interference/ Compatibility (EMI/ EMC).		
Unit - III	**Design and Simulation of PCB:**	**9**
Electronic Design Automation (EDA) Tools – Single layer PCB, Two layer PCB. Circuit Design and simulation, creating footprint, placement and routing, Generating Gerber file for single layer PCB.		
Unit - IV	**PCB Fabrication Techniques:**	**9**
Image transfer techniques. Plating techniques: Immersion, Electro less, Electroplating, Solder Mask, Etching techniques, Mechanical operations		
Unit - V	**Circuit Tracing and Testing:**	**9**
Soldering techniques, Testing PCB, Environmental concern. Case Studies: Power supply, Token Counter, Wien-bridge Oscillator.		

List of Exercises / Experiments :

1.	Study of CAD for PCB Design (Eagle CAD or Equivalent Open Source Tool)
2.	Soldering and de-soldering the components on the PCB
3.	Design and Simulation of 230V AC to 5V/9V/12V DC Power Supply in CAD Tool
4.	Placement , soldering and testing of component
5.	Design and Simulation of a IR Sensor Module
6.	Assembling and soldering of IR sensor module
7.	Preparation of layout from the circuit design
8.	Trouble shooting of single layer and multi layer PCB
9.	Soldering of SMD components

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Khandpur R.S., "Printed Circuit Board: Design, Fabrication, Assembly and Testing", 1st Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 2005.

REFERENCES:

1.	Mehta S.D, "Electronic Product Design", 1st Edition, S Chand Publications, New Delhi, 2011.
2.	Clyde Coombs, "Printed Circuits Handbook", 6th Edition, McGraw Hill Professional, New Delhi, 2007.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	identify different types of PCBs	Remembering (K1)
CO2	describe the PCB design rules and considerations	Understanding (K2)
CO3	apply the PCB Design rules to design and simulate single layer PCB	Applying (K3)
CO4	demonstrate single layer PCB for a given circuit	Applying (K3)
CO5	examine and trace the assembled electronic components on PCB	Analyzing (K4)
CO6	verify the PCB design using a simulation software	Evaluating (K5), Precision (S3)
CO7	carry out steps to fabricate single layer PCB	Applying (K3), Precision (S3)
CO8	assess the fault in a PCB and suggest solutions to rectify the fault	Evaluating (K5), Precision (S3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	50					100
CAT2	20	45	35				100
CAT3	10	35	40	15			100
ESE	25	40	25	10			100

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

18ECO02 - NEURAL NETWORKS AND FUZZY LOGIC FOR ENGINEERING APPLICATIONS

(Offered by Department of Electronics and Communication Engineering)

Programme& Branch	All BE/BTech Branches except Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	OE	3	0	2	4

Preamble	To gain knowledge on application development using Neural network and Fuzzy Logic Systems.	
Unit - I	**Introduction To Neural Networks:**	**9**
Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, characteristics of ANN, Types of Neuron Activation Function, Terminologies of ANN - Learning Strategy (Supervised, Unsupervised, Reinforcement) - McCulloch-Pitts Model – Hebb Rule.		
Unit - II	**Supervised Learning Networks:**	**9**
Perceptron Network : Theory – Architecture- Learning Rule, Back Propagation Network : Theory – Architecture- Training and Testing Algorithm.		
Unit - III	**Advanced Neural Network:**	**9**
Support Vector Machine Classifier – Random Forest Classifier – Extreme Learning Machine (Training and testing algorithms only).		
Unit - IV	**Fuzzy Logic Systems:**	**9**
Introduction to fuzzy logic - Classical sets and fuzzy sets - Fuzzy relations - Membership function – Fuzzification - Defuzzification.		
Unit - V	**Fuzzy Inference System:**	**9**
Fuzzy rules and reasoning: Fuzzy If-Then Rules. Fuzzy Inference Systems (FIS)-Mamdani model-Sugeno model - Tsukamoto model.		

List of Exercises / Experiments :

1.	Implement logic function using a single linear perceptron network
2.	Build a Multilayer perceptron and observe the effect on the output by changing number of hidden layers and neurons in each layer
3.	Extract GLCM Features for an application
4.	Extract Gabor Features for an application
5.	Implement a Back Propagation Algorithm for classification and plot the error surface for pattern classification
6.	Implement a Support vector machine Algorithm for classification and plot the error surface for pattern classification
7.	Implement a two input two rule Mamdani FIS for an application
8.	Implement a Sugeno FIS model for an application
9.	Implement a Fuzzy logic system for any one application

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Rajasekharan S. &Vijayalakshmipai G.A., "Neural Networks, Fuzzy Logic, Genetic Algorithms: Synthesis and Applications", 1st Edition, PHI Publication, New Delhi, 2012.

REFERENCES:

1.	Timothy J. Ross, "Fuzzy Logic with Engineering Applications", 3rd Edition, Willey, New Delhi, 2010.
2.	Sivanandam S.N., Sumathi S. &Deepa N., "Introduction to Neural Networks using MATLAB 6.0", 7th Edition, McGraw Hill, New Delhi, 2008.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand the concepts of neural network	Understanding (K2)
CO2	develop Neural Network Architecture using Perceptron and BPN learning	Applying (K3)
CO3	develop Neural Network Architecture using SVM, ELM and random forest classifier	Applying (K3)
CO4	understand the concepts of fuzzy logic	Understanding (K2)
CO5	apply Neural network and Fuzzy logic for simple applications	Applying (K3)
CO6	derive features for pattern classification	Applying (K3), Manipulation (S2)
CO7	build fuzzy logic control application	Applying (K3), Precision (S3)
CO8	develop neural network architecture for pattern classification and recognition	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										1	3	1
CO2	3	2	1	1	2							2	3	1
CO3	3	2	1	1	3				3	1		2	3	1
CO4	2	1	1	1									3	1
CO5	3	2	1	1	3	2		1	3	1		2	3	1
CO6	3	2	1	1	3				2	2			3	1
CO7	3	2	1	1	3	2		1	2	2		2	3	1
CO8	3	2	1	1	3	3	1	1	2	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	30	30	40				100
CAT2	20	60	20				100
CAT3	20	40	40				100
ESE	20	40	40				100

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

18ECO03 - PRINCIPLES OF QUANTUM COMPUTING

(Offered by Department of Electronics and Communication Engineering)

Programme& Branch	All BE/BTech Branches except Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Applied Physics, Mathematics I	6	OE	3	0	2	4

Preamble	To provide a broad overview of the main ideas of the field of quantum computation and to describe the fundamental elements and different quantum algorithms. Also it describes general design principles and criteria for good physical implementations of quantum computers.	
Unit - I	**Introduction and overview:**	**9**
Global perspectives - Quantum bits - Quantum computation - Quantum algorithms - Experimental quantum information processing - Quantum information.		
Unit - II	**Introduction to quantum mechanics and Introduction to computer science:**	**9**
Introduction to quantum mechanics: Linear algebra - The postulates of quantum mechanics -Application: superdense coding - The density operator Introduction to computer science: Models for computation - The analysis of computational problems - Perspectives on computer science.		
Unit - III	**Quantum circuits:**	**9**
Quantum algorithms - Single qubit operations - Controlled operations – Measurement - Universal quantum gates - Quantum circuit model of computation - Simulation of quantum systems.		
Unit - IV	**The quantum Fourier transform and its applications:**	**9**
The quantum Fourier transform - Phase estimation – Order finding and factoring - General applications of the quantum Fourier transform - The quantum search algorithm.		
Unit - V	**Quantum computers (physical realization):**	**9**
Guiding principles - Conditions for quantum computation - Harmonic oscillator quantum computer - Optical photon quantum computer - Optical cavity quantum electrodynamics - Ion traps - Nuclear magnetic resonance.		

List of Exercises / Experiments :

1.	Simulation of single qubit gates
2.	Deign and simulation of multi qubit gates
3.	Simulation of Quantum dice
4.	Simulation of Measurement Error Mitigation
5.	Building of Quantum Random No. Generation
6.	Implementation of BB84 algorithm
7.	Decomposition of arbitrary unitary to universal quantum gates
8.	Implementation of Shor's Algorithms
9.	Implementation of Grover's Algorithm

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Nielsen M.A & Chuang I.L, "Quantum Computation and Quantum Information", 10th Edition, Cambridge University Press, UK, 2010.

REFERENCES:

1.	Phillip Kaye, Raymond Laflamme& Michele Mosca, "An Introduction to Quantum Computing", 1st Edition, Oxford University Press, New Delhi, 2007.
2.	Eleanor Rieffel& Wolfgang Polak, "Quantum Computing: A Gentle Introduction", 1st Edition, MIT Press, USA, 2014.
3.	Scott Aaronson, "Quantum Computing Since Democritus", 1st Edition, Cambridge University Press, UK, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	perceive the definition of qubit, quantum logic gates, quantum circuits and quantum algorithms.	Understanding (K2)
CO2	describe the quantum mechanics using linear algebra.	Applying (K3)
CO3	familiar with qubits and basic quantum gates.	Understanding (K2)
CO4	realize the quantum parallelism by using simplest quantum algorithms.	Applying (K3)
CO5	classify the schemes for implementation of quantum computers.	Understanding (K2)
CO6	develop quantum logic gate circuits.	Applying (K3), Precision (S3)
CO7	develop quantum algorithm.	Analyzing (K4), Manipulation (S2)
CO8	program quantum algorithm on major toolkits.	Applying (K3), Precision (S3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	60	10				100
CAT2	15	60	25				100
CAT3	15	55	30				100
ESE	15	60	25				100

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

18ECO04 - ELECTRONIC HARDWARE AND TROUBLESHOOTING

(Offered by Department of Electronics and Communication Engineering)

Programme& Branch	All BE/BTech Branches except Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	7	OE	2	0	2	3

Preamble	To carryout troubleshooting of consumer electronic equipments and to use the testing equipments for analysis, testing and troubleshooting purpose	
Unit - I	**Introduction to Troubleshooting and Failure Analysis and Prevention in Electronic Circuits:**	**6**
Troubleshooting Basics - Common Troubleshooting Techniques -Gaining Circuit Familiarity -Getting Prepared for Troubleshooting. Failure Analysis and Prevention in Electronic Circuits: Failure Symptoms -Failure -Causes Failure Types - Some Useful Terms in Failure.		
Unit - II	**Device Troubleshooting and Troubleshooting Industrial Controls:**	**6**
Device Troubleshooting: Tools for Servicing- Test and Measuring Instruments- Safety Issues – Test and Tagging of Portable Electrical Equipment. Troubleshooting Industrial Controls: Fundamentals-Types of controllers-Repair and Testing procedures-Preventive Maintenance.		
Unit - III	**Troubleshooting Residential ,Wireless Communication Systems:**	**6**
Lighting and Control system Repair-TV distribution system Repair- Fiber optic Communication Repair-Case study: Color CRT TV monitor troubleshooting		
Unit - IV	**Troubleshooting Digital Circuits:**	**6**
Moving from Analog to Digital -Moving into the Digital Circuits - Typical Faults in Digital Systems-Digital Circuit Trouble shooters-Digital Integrated Circuits -Programmable Logic Device (PLD) and Memory Definitions.		
Unit - V	**PCB Testing and Soldering Techniques and Maintenance and Safety Aspects:**	**6**
Soldering--Printed Circuit Board -Troubleshooting of Surface Mounted PCBs -Testing and Troubleshooting with ATE. Maintenance and Safety Aspects: Types of Maintenance, Advantages of Preventive Maintenance -Importance of Sound Maintenance Management -Maintenance Policy -Safety Aspects.		

List of Exercises / Experiments :

1.	Dismantling and Assembling of electronic hardware.
2.	Study of testing equipment
3.	Troubleshooting of digital circuits
4.	Troubleshooting of speakers and amplifiers
5.	Troubleshooting of home appliances – Radio / TV
6.	Troubleshooting of home appliances – Microwave Oven / Induction Stove
7.	Troubleshooting of wireless communication system – PCB of Mobile phone/Modem

Lecture:30, Practical:30, Total:60

TEXT BOOK:

1.	Daniel R. Tomal& Aram S. Agajanian, "Electronic Troubleshooting", 4th Edition, McGraw-Hill Education, New Delhi, 2014.

REFERENCES:

1.	Khandpur .R.S, "Troubleshooting Electronic Equipment: Includes Repair And Maintenance", 2nd Edition, McGraw-Hill Education (India) Private Limited, New Delhi, 2011.
2.	ShashiBhushan Sinha, "Handbook of Repair and Maintenance Of Domestic Electronics Appliances handbook", 1st Edition, BPB Publications, , 2017.
3.	Michael Jaygeier, "How to Dagnose and Fix Everything Electronic", 2nd Edition, McGraw-Hill Education Private Limited, New Delhi, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain troubleshooting principles for testing and point out the failures of electronic equipment.	Understanding (K2)
CO2	interpret the use of testing tools and instruments for troubleshooting electronic hardware.	Understanding (K2)
CO3	predict the electrical fault in home appliances.	Understanding (K2)
CO4	apply troubleshooting principles for testing of digital circuits.	Applying (K3)
CO5	employ PCB Testing, soldering techniques and summarize maintenance, safety aspects .	Applying (K3)
CO6	identify the active and passive components and apply trouble shooting procedures for digital circuits and amplifiers.	Applying (K3), Precision (S3)
CO7	determine the faults and trouble shoot home appliances using multimeter.	Applying (K3), Precision (S3)
CO8	design a PCB based circuit with Troubleshooting.	Applying (K3), Precision (S3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18ECO05 - PRINCIPLES OF COMMUNICATION TECHNIQUES

(Offered by Department of Electronics and Communication Engineering)

Programme& Branch	All BE/BTech Branches except Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Mathematics I	7	OE	3	0	0	3

Preamble	To provide the overview of the basic concepts in wired and wireless communication	
Unit - I	**Overview of Communication Systems:**	**9**
Historical evolution of communication – Elements of a communication system – Definition of modulation and demodulation - Need for modulation – Baseband and passband signals - Linear modulation strategies – Amplitude modulation – Envelope detection – Virtues, Limitations and modifications of amplitude modulation		
Unit - II	**Analog Modulation:**	**9**
Angle modulation: Definitions, Properties – Direct and Indirect methods of generating Frequency Modulated (FM) waves –Demodulation of FM signals – Comparison of amplitude, frequency and angle modulation schemes.		
Unit - III	**Pulse Modulation:**	**9**
Sampling process – Aliasing phenomenon –Types ofpulse modulation techniques – Pulse amplitude modulation – Pulse position modulation – Quantization process – Pulse code modulation – Advantages of digital pulse modulation techniques.		
Unit - IV	**Pass band digital transmission and Multiple Access Techniques:**	**9**
Introduction – Coherent Phase shift keying: BPSK, QPSK,QAM – FDMA-TDMA- Spread spectrummultiple access- SDMA- WCDMA		
Unit - V	**Wired and Wireless communication standards and technologies:**	**9**
1G, 2G, 3G, 4G andbeyond – Conventional telephony – Mobile phone - Bluetooth – WiFi – WiMAX- VoLTE- In-vehicle communication Protocols – Sensors and its mechanism for communication in automobile sectors		

Total:45

TEXT BOOK:

1. Simon Haykin& Michael Moher, "Introduction to Analog and Digital Communications", 2nd Edition, John Wiley & Sons, Inc, New Delhi, 2012.

REFERENCES:

1. Christopher Cox, "An Introduction to LTE: LTE, LTE Advanced, SAE, VoLTE and 4G Mobile Communications", 2nd Edition, Wiley Publications, New Delhi, 2014.
2. Taub Schilling &GautamSahe, "Principles of Communication Systems", 4th Edition, McGraw-Hill, New Delhi, 2007.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	outline the evolution of communication and the concept of modulation	Understanding (K2)
CO2	illustrate the concepts of angle modulation, frequency modulation and demodulation	Applying (K3)
CO3	determine the process of sampling & quantization and types of pulse modulation	Applying (K3)
CO4	examine the scheme of passband digital transmission and Multiple Access Techniques in wireless communication	Applying (K3)
CO5	comprehend the Wired and Wireless communication standards and technologies	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		2	2	2	1	1		2	2	1
CO3	3	2	1	1		1						2		
CO4	3	3	2	2	1	2	2	2	2	2	2	2	2	2
CO5	3	2	1	1	2	2	2	2	3	2	2	2	3	2

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	50	10				100
CAT2	30	50	20				100
CAT3	10	60	30				100
ESE	30	45	25				100

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

18ECO06 - BIOINSPIRED COMPUTING TECHNOLOGIES

(Offered by Department of Electronics and Communication Engineering)

Programme& Branch	All BE/BTech Branches except Electronics and Communication Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	8	OE	2	0	2	3

Preamble	To acquaint and familiarize with different types of optimization techniques, solving optimization problems, implementing computational techniques, abstracting mathematical results and proofs etc.	
Unit - I	**Introduction:**	**6**
Features of Evolutionary Computation -Advantages of Evolutionary Computation - Applications of Evolutionary Computation.		
Unit - II	**Genetic Algorithms:**	**6**
Introduction - Biological Background - Conventional Optimization and Search Techniques .- Advantages and Limitations of Genetic Algorithm-Terminologies and Operators of GA.		
Unit - III	**Operators and Applications:**	**6**
Advanced Operators and Techniques in Genetic Algorithm-Classification of Genetic Algorithm-Application of GA in Machine learning, Image Processing		
Unit - IV	**PSO Algorithm:**	**6**
PSO Algorithm - Accelerated PSO – Implementation - Convergence Analysis - Binary PSO – Applications. Ant Colony Optimization – Characteristics- Algorithm –Applications.		
Unit - V	**Cuckoo Search:**	**6**
Cuckoo Life Style -– flowchart –Algorithm , Bat Algorithms - Echolocation of Bats - Flowchart- algorithm, Bee-Inspired Algorithms – flowchart – algorithm- Teacher-Learner Based Optimization algorithm-Jaya Algorithm.		

List of Exercises / Experiments :

1.	Solving a cost function using GA tool
2.	Optimization of a cost function using PSO algorithm for an application
3.	Optimization of a cost function using ACO algorithm for an application
4.	Optimization of a cost function using Cuckoo search algorithm for an application
5.	Optimization of a cost function using Bat algorithm for an application
6.	Optimization of a cost function using TLBO /Jaya algorithm for an application

Lecture:30, Practical:30, Total:60

TEXT BOOK:

1.	Sivanandam S. N &Deepa S.N, "Introduction to Genetic Algorithms", 1st Edition, Springer, USA, 2008.

REFERENCES:

1.	OmidBozorg, Haddad , "Advanced Optimization by Nature-Inspired Algorithms", Springer, Volume 720, Singapore, 2018.
2.	SrikantaPatnaik, Xin-She Yang & Kazumi Nakamatsu, "Nature-Inspired Computing and Optimization Theory and Applications", Springer, Volume 10,USA, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	infer the concepts of Evolutionary Computation	Understanding (K2)
CO2	solve an optimization problem with GA	Applying (K3)
CO3	apply the advanced GA operators for Machine learning, Image Processing	Applying (K3)
CO4	apply the concepts of PSO and ACO in optimization problems	Applying (K3)
CO5	infer the concepts and Domain of application of Advanced Search algorithms	Understanding (K2)
CO6	experiment the concepts of PSO and ACO using software tools	Applying (K3), Precision (S3)
CO7	experiment the concepts of cuckoo search and bat algorithm using software tools	Applying (K3), Precision (S3)
CO8	experiment the concepts of TLBO and Jaya algorithm using software tools	Applying (K3), Precision (S3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	40	20				100
CAT2	30	30	40				100
CAT3	30	30	40				100
ESE	40	40	20				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	3	0	0	3

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):**	**9**
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):**	**9**
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):**	**9**
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) :**	**9**
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):**	**9**
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:45

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	3	0	0	3

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:**	**9**
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:**	**9**
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:**	**9**
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:**	**9**
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:**	**9**
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:45

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)**

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.						