KONGU ENGINEERING COLLEGE

(Autonomous Institution Affiliated to Anna University, Chennai)

PERUNDURAI ERODE – 638 060

TAMILNADU INDIA

Estd : 1984

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 ELECTRICAL AND ELECTRONICS ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

KONGU
Assuring the Best

INDEX

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 ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To be a centre of excellence for development and dissemination of knowledge in Electrical and Electronics Engineering to benefit the society in the National and global level.

MISSION

Department of Electrical and Electronics Engineering is committed to:

MS1: Develop innovative, competent, ethical and quality engineers to contribute for technical advancements to meet societal needs.

MS2: Provide state-of-the-art facilities for continual improvement in teaching-learning process and research activities.

MS3: Enrich the knowledge and skill of the students to cater to the industrial needs and motivate them to become entrepreneurs.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduate of Electrical and Electronics Engineering programme will:

PEO1: Succeed in professional career by utilizing fundamental knowledge of basic sciences and engineering.

PEO2: Design, simulate, analyze and develop Electrical and Electronics Engineering based products which are reliable, cost effective and safe.

PEO3: Demonstrate communication skills, team work, ethics, codes of professional practice as well as an aptitude for continuous learning.

MAPPING OF MISSION STATEMENTS (MS) WITH PEOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

PROGRAM OUTCOMES (POs)

Graduates of Electrical and Electronics 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 Electrical and Electronics Engineering will**:**	
PSO1	Comprehend, analyse and design products in core domains namely power, control and energy to meet the ever-changing demands of industry and society.
PSO2	Develop expertise to apply and control the conventional and non-conventional electrical systems for specific requirements.

MAPPING OF PEOs WITH POs AND PSOs

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

1 – Slight, 2 – Moderate, 3 – Substantial

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638060

(Autonomous)

REGULATIONS 2018
(Revision: 4)

CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION

BACHELOR OF ENGINEERING (BE) / BACHELOR OF TECHNOLOGY (BTech)

DEGREE PROGRAMMES

These regulations are applicable to all candidates admitted into BE/BTech Degree programmes from the academic year 2018 – 2019 onwards.

1. DEFINITIONS AND NOMENCLATURE

In these Regulations, unless otherwise specified:

i. "University" means ANNA UNIVERSITY, Chennai.

ii. "College" means KONGU ENGINEERING COLLEGE.

iii. "Programme" means Bachelor of Engineering (BE) / Bachelor of Technology (BTech) Degree programme

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

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

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

vii. "Grade" means the letter grade assigned to each course based on the marks range specified.

viii. "Grade point" means a numerical value (0 to 10) allocated based on the grade assigned to each course.

ix. "Principal" means Chairman, Academic Council of the College.

x. "Controller of Examinations" means authorized person who is responsible for all examination related activities of the College.

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

2. PROGRAMMES AND BRANCHES OF STUDY

The following programmes and branches of study approved by Anna University, Chennai and All India Council for Technical Education, New Delhi are offered by the College.

Programme	Branch
BE	Civil Engineering
	Mechanical Engineering
	Electronics and Communication Engineering
	Computer Science and Engineering
	Electrical and Electronics Engineering
	Electronics and Instrumentation Engineering
	Mechatronics Engineering
	Automobile Engineering
BTech	Chemical Engineering
	Information Technology
	Food Technology

3. ADMISSION REQUIREMENTS

3.1 First Semester Admission

The candidates seeking admission to the first semester of the eight semester BE / BTech Degree Programme:

Should have passed the Higher Secondary Examination (10 + 2) in the academic stream with Mathematics, Physics and Chemistry as three of the four subjects of study under Part-III subjects of the study conducted by the Government of Tamil Nadu or any examination of any other University or authority accepted by the Anna University, Chennai as equivalent thereto.

(OR)

Should have passed the Higher Secondary Examination of Vocational stream (Vocational groups in Engineering / Technology) as prescribed by the Government of Tamil Nadu.

They should also satisfy other eligibility conditions as prescribed by the Anna University, Chennai and Directorate of Technical Education, Chennai from time to time.

3.2 Lateral Entry Admission

The candidates who hold a Diploma in Engineering / Technology awarded by the State Board of Technical Education, Tamilnadu or its equivalent are eligible to apply for Lateral entry admission to the third semester of BE / BTech in relevant branches of study.

(OR)

The candidates who hold a BSc degree (10+2+3 stream) with mathematics as one of the subjects at the BSc level from a recognised University are eligible to apply for Lateral entry admission to the third semester of BE / BTech. Such candidates shall undergo two additional Engineering course(s) in the third and fourth semesters as prescribed by the College.

They should satisfy other eligibility conditions prescribed by the Anna University, Chennai and Directorate of Technical Education, Chennai from time to time.

4. STRUCTURE OF PROGRAMMES

4.1 Categorisation of Courses

The BE / BTech programme shall have a curriculum with syllabi comprising of theory, theory cum practical, practical courses in each semester, professional skills training/industrial training, project work, internship, etc. that have been approved by the respective Board of Studies and Academic Council of the College. All the programmes have well defined Programme Outcomes (PO), Programme Specific Outcomes (PSO) and Programme Educational Objectives (PEOs) as per Outcome Based Education (OBE). The content of each course is designed based on the Course Outcomes (CO). The courses shall be categorized as follows:

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

ii. Basic Science (BS) Courses

iii. Engineering Science (ES) Courses

iv. Professional Core (PC) Courses

v. Professional Elective (PE) Courses

vi. Open Elective (OE) Courses

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

viii. Audit Courses (AC)

ix. Mandatory Courses (MC)

4.2 Credit Assignment

4.2.1. Credit Assignment

Each course is assigned certain number of credits as follows:

Contact period per week	Credits
1 Lecture / Tutorial Period	1
2 Practical Periods	1
2 Project Work Periods	1
40 Training / Internship Periods	1

The minimum number of credits to complete the programme shall vary from 168 to 173 as per the chosen programme of study.

4.3 Employability Enhancement Courses

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

4.3.1 Professional Skills Training/Industrial Training/ Entrepreneurships/Start Ups

A candidate may be offered with appropriate training courses imparting programming skills, communication skills, problem solving skills, aptitude skills etc. It is offered in two phases as phase I in fifth semester and phase II in sixth semester including vacation periods and each phase can carry two credits.

(OR)

A candidate may be allowed to go for training at research organizations or industries for a required number of hours in sixth semester vacation period. Such candidate can earn two credits for this training course in place of Professional Skills Training course II in sixth semester. He/She shall attend Professional Skills Training Phase I in fifth semester and can earn two credits.

(OR)

A candidate may be allowed to set up a start up and working part-time for the start ups by applying his/her innovations and can become a student entrepreneur during BE/BTech programme. Candidates can set up their start up from fifth semester onwards either inside or outside of the college. Such student entrepreneurs may earn a maximum of 2 credits per semester for two semesters each in place of either Professional Skills Training I or Professional Skills Training II. The area in which the candidate wants to initiate a start up may be interdisciplinary or multidisciplinary. The progress of the startup shall be evaluated by a panel of members constituted by the Principal through periodic reviews.

4.3.2 Comprehensive Test and Viva

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

4.3.3 Internships

The curriculum enables a candidate to go for full time projects through internship during a part of seventh semester and/or entire final semester and can earn credits vide clause 7.6 and clause 7.11.

A candidate is permitted to go for full time projects through internship in seventh semester with the following condition: The candidate shall complete a part of the seventh semester courses with a total credit of about 50% of the total credits of seventh semester including Project Work I Phase II in the first two months from the commencement of the seventh semester under fast track mode. The balance credits required to complete the seventh semester shall be earned by the candidate through either approved Value Added Courses /Online courses / Self Study Courses or Add/Drop courses as per clause 4.4 and clause 4.5 respectively.

A candidate is permitted to go for full time projects through internship during eighth semester. Such candidate shall earn the minimum number of credits required to complete eighth semester other than project through either approved Value Added Courses /Online courses / Self Study Courses or Add/Drop courses as per clause 4.4 and clause 4.5 respectively.

Assessment procedure is to be followed as specified in the guidelines approved by the Academic Council.

4.4 Value Added Courses / Online Courses / Self Study Courses

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

4.4.1 Value Added Courses: Value Added courses each with One / Two credits shall be offered by the college with the approval from respective Board of Studies. A candidate can earn a maximum of six credits through value added courses during the entire duration of the programme.

4.4.2 Online Courses: Candidates may be permitted to earn credits for online courses, offered by NPTEL / SWAYAM / a University / Other Agencies, approved by respective Board of Studies.

4.4.3 Self Study Courses: The Department may offer an elective course as a self study course. The syllabus of the course shall be approved by the respective Board of Studies. However, mode of assessment for a self study course will be the same as that used for other courses. The candidates shall study such courses on their own under the guidance of member of the faculty following due approval procedure. Self study course is limited to one per semester.

4.4.4 The elective courses in the final year may be exempted if a candidate earns the required credits vide clause 4.4.1, 4.4.2 and 4.4.3 by registering the required number of courses in advance.

4.4.5 A candidate can earn a maximum of 30 credits through all value added courses, online courses and self study courses.

4.5 Flexibility to Add or Drop Courses

4.5.1 A candidate has to earn the total number of credits specified in the curriculum of the respective programme of study in order to be eligible to obtain the degree. However, if the candidate wishes, then the candidate is permitted to earn more than the total number of credits prescribed in the curriculum of the candidate's programme.

4.5.2 From the first to eighth semesters the candidates have the option of registering for additional elective courses or dropping of already registered additional elective courses within two weeks from the start of the semester. Add / Drop is only an option given to the candidates. Total number of credits of such courses during the entire programme of study cannot exceed eight.

4.6 Maximum number of credits the candidate can enroll in a particular semester cannot exceed 30 credits.

4.7 The blend of different courses shall be so designed that the candidate at the end of the programme would have been trained not only in his / her relevant professional field but also would have developed to become a socially conscious human being.

4.8 The medium of instruction, examinations and project report shall be English.

5. DURATION OF THE PROGRAMME

5.1 A candidate is normally expected to complete the BE / BTech Degree programme in 8 consecutive semesters/4 Years (6 semesters/3 Years for lateral entry candidate), but in any case not more than 14 semesters/7 Years (12 semesters/6 Years for lateral entry candidate).

5.2 Each semester shall consist of a minimum of 90 working days including continuous assessment test period. The Head of the Department shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus for the course being taught.

5.3 The total duration for completion of the programme reckoned from the commencement of the first semester to which the candidate was admitted shall not exceed the maximum duration specified in clause 5.1 irrespective of the period of break of study (vide clause 11) or prevention (vide clause 9) in order that the candidate may be eligible for the award of the degree (vide clause 16). Extension beyond the prescribed period shall not be permitted.

6. COURSE REGISTRATION FOR THE EXAMINATION

6.1 Registration for the end semester examination is mandatory for courses in the current semester as well as for the arrear courses failing which the candidate will not be permitted to move on to the higher semester. This will not be applicable for the courses which do not have an end semester examination.

6.2 The candidates who need to reappear for the courses which have only continuous assessment shall enroll for the same in the subsequent semester, when offered next, and repeat the course. In this case, the candidate shall attend the classes, satisfy the attendance requirements (vide clause 8) and earn continuous assessment marks. This will be considered as an attempt for the purpose of classification.

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

7. ASSESSMENT AND EXAMINATION PROCEDURE FOR AWARDING MARKS

7.1 The BE/BTech programmes consist of Theory Courses, Theory cum Practical courses, Practical courses, Comprehensive Test and Viva, Project Work, Professional Skills Training, Internship and Entrepreneurships/ Start ups. Performance in each course of study shall be evaluated based on (i) Continuous Assessments (CA) throughout the semester and (ii) End Semester Examination (ESE) at the end of the semester except for the courses which are evaluated based on continuous assessment only. Each course shall be evaluated for a maximum of 100 marks as shown below:

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

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

7.3 Theory Courses

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

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

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

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

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

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

7.4 Theory Cum Practical Courses

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

7.5 Practical Courses

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

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

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

7.6 Project Work II / Project Work I Phase II

7.6.1 Project work shall be assigned to a single candidate or to a group of candidates not exceeding 4 candidates in a group. The project work is mandatory for all the candidates.

7.6.2 The Head of the Department shall constitute review committee for project work. There shall be two assessments by the review committee during the semester. The candidate shall make presentation on the progress made by him/her before the committee.

7.6.3 The continuous assessment and end semester examination marks for Project Work II/ Project Work I Phase II and the Viva-Voce Examination shall be distributed as below:

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

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

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

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

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

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

7.7 Project Work I Phase I/Industrial Training

The evaluation method shall be same as that of the Project Work II as per clause 7.6 excluding 7.6.3, 7.6.5, 7.6.6 and 7.6.7. The marks distribution is given below:

Continuous Assessment (Max. 100 Marks)								
Zeroth Review		Review I (Max.. 20 Marks)		Review II (Max.. 30 Marks)		Review III (Max. 50 Marks)		
						Report Evaluation (Max. 20 Marks)	Viva - Voce (Max. 30 Marks)	
Review Committee	Supervisor	Review Committee (excluding supervisor)	Supervisor	Review Committee (excluding supervisor)	Supervisor	Review Committee	Supervisor	Review Committee
0	0	10	10	15	15	20	10	20

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

7.8 Professional Skills Training

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

7.9 Comprehensive Test and Viva

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

7.10 Entrepreneurships/ Start ups

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

A review committee shall be formed by the Principal for reviewing the progress of the Start ups / Business models, innovativeness, etc. The review committee can recommend the appropriate grades for academic performance for the candidate(s) involved in the start ups. This course shall carry a maximum of two credits in fifth semester and two credits in sixth semester respectively and shall be evaluated through continuous assessments for a maximum of 100 marks vide clause 7.1. A report about the start ups is to be submitted to the review committee for evaluation for each start up and the marks will be given to Controller of Examinations after getting approval from Principal.

7.11 Projects through Internships

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

7.12 Value Added Course

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

7.13 Online Course

The Board of Studies will provide methodology for the evaluation of the online courses. The Board can decide whether to evaluate the online courses through continuous assessment and end semester examination or through end semester examination only. In case of credits earned through online mode from NPTEL / SWAYAM / a University / Other Agencies approved by Chairman, Academic Council, the credits may be transferred and grades shall be assigned accordingly.

7.14 Self Study Course

The member of faculty approved by the Head of the Department shall be responsible for periodic monitoring and evaluation of the course. The course shall be evaluated through continuous assessment and end semester examination. The evaluation methodology shall be the same as that of a theory course.

7.15 Audit Course

A candidate may be permitted to register for specific course not listed in his/her programme curriculum and without undergoing the rigors of getting a 'good' grade, as an Audit course, subject to the following conditions.

The candidate can register only one Audit course in a semester starting from second semester subject to a maximum of two courses during the entire programme of study. Such courses shall be indicated as 'Audit' during the time of registration itself. Only courses currently offered for credit to the candidates of other branches can be audited.

A course appearing in the curriculum of a candidate cannot be considered as an audit course. However, if a candidate has already met the Professional Elective and Open Elective credit requirements as stipulated in the curriculum, then, a Professional Elective or an Open Elective course listed in the curriculum and not taken by the candidate for credit can be considered as an audit course.

Candidates registering for an audit course shall meet all the assessment and examination requirements applicable for a credit candidate of that course. Only if the candidate obtains a performance grade, the course will be listed in the semester Grade Sheet and in the Consolidated Grade Sheet along with the grade SF (Satisfactory). Performance grade will not be shown for the audit course.

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

7.16 Universal Human Values

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

8. REQUIREMENTS FOR COMPLETION OF A SEMESTER

8.1 A candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester and permitted to appear for the examinations of that semester.

8.1.1 Ideally, every candidate is expected to attend all classes and secure 100 % attendance. However, a candidate shall secure not less than 80 % (after rounding off to the nearest integer) of the overall attendance taking into account the total number of working days in a semester.

8.1.2 A candidate who could not satisfy the attendance requirements as per clause 8.1.1 due to medical reasons (hospitalization / accident / specific illness) but has secured not less than 70 % in the current semester may be permitted to appear for the current semester examinations with the approval of the Principal on payment of a condonation fee as may be fixed by the authorities from time to time. The medical certificate needs to be submitted along with the leave application. A candidate can avail this provision only twice during the entire duration of the degree programme.

A candidate who could not satisfy the attendance requirements as per clause 8.1.1 due to his/her entrepreneurships/ start ups activities, but has secured not less than 60 % in the current semester can be permitted to appear for the current semester examinations with the recommendation of review committee and approval from the Principal.

8.1.3 In addition to clause 8.1.1 or 8.1.2, a candidate shall secure not less than 60 % attendance in each course.

8.1.4 A candidate shall be deemed to have completed the requirements of study of any semester only if he/she has satisfied the attendance requirements (vide clause 8.1.1 to 8.1.3) and has registered for examination by paying the prescribed fee.

8.1.5 Candidate's progress is satisfactory.

8.1.6 Candidate's conduct is satisfactory and he/she was not involved in any indisciplined activities in the current semester.

8.2. The candidates who do not complete the semester as per clauses from 8.1.1 to 8.1.6 except 8.1.3 shall not be permitted to appear for the examinations at the end of the semester and not be permitted to go to the next semester. They have to repeat the incomplete semester in next academic year.

8.3 The candidates who satisfy the clause 8.1.1 or 8.1.2 but do not complete the course as per clause 8.1.3 shall not be permitted to appear for the end semester examination of that course alone. They have to repeat the incomplete course in the subsequent semester and satisfy the attendance requirements.

9. REQUIREMENTS FOR APPEARING FOR END SEMESTER EXAMINATION

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

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

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

10. PROVISION FOR WITHDRAWAL FROM EXAMINATIONS

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

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

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

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

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

11. PROVISION FOR BREAK OF STUDY

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

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

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

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

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

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

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

12. PASSING REQUIREMENTS

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

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

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

13. REVALUATION OF ANSWER SCRIPTS

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

14. SUPPLEMENTARY EXAMINATION

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

15. AWARD OF LETTER GRADES

Range of % of Total Marks	Letter Grade	Grade Point
91 to 100	O (Outstanding)	10
81 to 90	A+ (Excellent)	9
71 to 80	A (Very Good)	8
61 to 70	B+ (Good)	7
50 to 60	B (Average)	6
Less than 50	RA (Reappear)	0
Satisfactory	SF	0
Withdrawal	W	-
Absent	AB	-
Shortage of Attendance in a course	SA	-

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

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

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

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

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

The GPA and CGPA indicate the academic performance of a candidate at the end of a semester

and at the end of successive semesters respectively.

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

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

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

16. ELIGIBILITY FOR THE AWARD OF DEGREE

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

i. Successfully completed all the courses under the different categories, as specified in the regulations.
ii. Successfully gained the required number of total credits as specified in the curriculum corresponding to the candidate's programme within the stipulated time (vide clause 5).
iii. Successfully passed any additional courses prescribed by the respective Board of Studies whenever readmitted under regulations other than R-2018 (vide clause 11.3)
iv. No disciplinary action pending against him / her.

17. CLASSIFICATION OF THE DEGREE AWARDED

17.1 First Class with Distinction:

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

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

(OR)

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

- Should have passed the examination in all the courses of all the eight semesters (six semesters for lateral entry candidates) in the First Appearance within eight consecutive semesters (six consecutive semesters for lateral entry candidates) excluding the authorized break of study (vide clause 11) after the commencement of his / her study.

- Submission of equivalent course list approved by the respective Board of studies.

- Withdrawal from examination (vide clause 10) shall not be considered as an appearance.

- Should have secured a CGPA of not less than 9.00

17.2 First Class:

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

- Should have passed the examination in all the courses of all eight semesters (six semesters for lateral entry candidates) within ten consecutive semesters (eight consecutive semesters for lateral entry candidates) excluding authorized break of study (vide clause 11) after the commencement of his / her study.

- Withdrawal from the examination (vide clause 10) shall not be considered as an appearance.

17.3 Second Class:

All other candidates (not covered in clauses 17.1 and 17.2) who qualify for the award of the degree (vide clause 16) shall be declared to have passed the examination in Second Class.

17.4 A candidate who is absent for end semester examination in a course / project work after having registered for the same shall be considered to have appeared for that examination for the purpose of classification.

18. MALPRACTICES IN TESTS AND EXAMINATIONS

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

19. AMENDMENTS

Notwithstanding anything contained in this manual, the Kongu Engineering College through the Academic council of the Kongu Engineering College, reserves the right to modify/amend without notice, the Regulations, Curricula, Syllabi, Scheme of Examinations, procedures, requirements, and rules pertaining to its BE / BTech programme.

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

******

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**	**7.60**
BS	**11**	**11**	**4**	**4**					**30**	**17.54**
ES	**6**	**4**	**3**	**4**					**17**	**9.94**
PC		**3**	**14**	**13**	**18**	**16**			**64**	**37.43**
PE				**3**			**9**	**3**	**15**	**8.77**
OE					**4**	**4**	**3**	**3**	**14**	**8.19**
EC					**2**	**4**	**6**	**6**	**18**	**10.53**
Semesterwise Total	**21**	**21**	**22**	**24**	**26**	**24**	**21**	**12**	**171**	**100.00**

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

CATEGORISATION OF COURSES							
HUMANITIES AND SOCIAL SCIENCE INCLUDING MANAGEMENT (HS)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	18EGT11	English for Communication I	3	0	0	3	I
2.	18EGT21	English for Communication II	3	0	0	3	II
3.	18VEC11	Value Education	2	0	1	1	II
4.	18EGL31	English for workplace communication	0	0	2	1	IV
5.	18MBT71	Engineering Economics and Management	3	0	0	3	VII
6.	18GET51	Universal Human Values	2	0	0	2	V
Total Credits to be earned						**13**	

BASIC SCIENCE (BS)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	18MAC11	Mathematics I	3	1*	2*	4	I
2.	18PHC11	Applied Physics	3	0	2*	3.5	I
3.	18CYC11	Applied Chemistry	3	0	2*	3.5	I
4.	18MAC21	Mathematics II	3	1*	2*	4	II
5.	18PHC25	Materials Science and Opto Electronic Devices	3	0	2*	3.5	II
6.	18CYC25	Environmental Science and Organic Electronic Materials	3	0	2*	3.5	II
7.	18MAC31	Mathematics III	3	1*	2*	4	III
8.	18MAC41	Statistics and Numerical Methods	3	1*	2*	4	IV
Total Credits to be earned						**30**	

ENGINEERING SCIENCE (ES)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	18GET11	Introduction to Engineering	3	0	0	3	I
2.	18CSC11	Problem Solving and Programming	2	0	2	3	I
3.	18MEC11	Engineering Drawing	2	0	2	3	II
4.	18MEL11	Engineering Practices Laboratory	0	0	2	1	II
5.	18EET33	Electrical Measurements	3	0	0	3	III
6.	18CST44	Object Oriented Programming using C++	3	0	0	3	IV
7.	18CSL43	Object Oriented Programming using C++ Laboratory	0	0	2	1	IV
Total Credits to be earned						**17**	

PROFESSIONAL CORE (PC)								
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**	**Domain/ Stream**
1.	18EET21	Principles of Electrical and Electronics Engineering	3	0	0	3	II	BG
2.	18EET31	Electrical Machines I	3	1	0	4	III	PEEM
3.	18EET32	Analog Electronics	3	0	0	3	III	ECE
4.	18EET34	Circuits and Networks	3	1	0	4	III	EPSE
5.	18EEL31	Electrical Machines I Laboratory	0	0	2	1	III	PEEM
6.	18EEL32	Analog Electronics Laboratory	0	0	2	1	III	ECE

7.	18EEL33	Circuits and Networks Laboratory	0	0	2	1	III	EPSE
8.	18EET41	Electrical Machines II	3	1	0	4	IV	PEEM
9.	18EET42	Electromagnetic Theory	3	1	0	4	IV	ECE
10.	18EET43	Digital Logic Circuits	3	0	0	3	IV	ECE
11.	18EEL41	Electrical Machines II Laboratory	0	0	2	1	IV	PEEM
12.	18EEL42	Digital Circuit Design Laboratory	0	0	2	1	IV	ECE
13.	18EET51	Control Systems	3	1	0	4	V	ECE
14.	18EET52	Power Electronics	3	1	0	4	V	PEEM
15.	18EET53	Microprocessors and Microcontrollers Interfacing	3	0	0	3	V	SAE
16.	18EET54	Generation, Transmission and Distribution	3	1	0	4	V	EPSE
17.	18EEL51	Control and Instrumentation Laboratory	0	0	2	1	V	ECE
18.	18EEL52	Power Electronics Laboratory	0	0	2	1	V	PEEM
19.	18EEL53	Microcontroller and Interfacing Laboratory	0	0	2	1	V	SAE
20.	18EET61	Signals and Systems	3	0	0	3	VI	ECE
21.	18EET62	Power System Analysis	3	1	0	4	VI	EPSE
22.	18EET63	Electrical Drives and Control	3	0	0	3	VI	PEEM
23.	18EET64	Power System Protection and SwitchGear	3	0	0	3	VI	EPSE
24.	18EEL61	Signals and Systems Laboratory	0	0	2	1	VI	ECE
25.	18EEL62	Power Systems Laboratory	0	0	2	1	VI	EPSE
26.	18EEL63	Electrical Drives Laboratory	0	0	2	1	VI	PEEM
Total Credits to be earned						**64**		

PROFESSIONAL ELECTVE COURSES (PE)								
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**	**Domain/ Stream**
		Elective 1						
1.	18EEE01	Electronic Circuit Analysis	3	0	0	3	IV	ECE
2.	18EEE02	Fundamentals of Solar cell	3	0	0	3	IV	EPSE
3.	18EEE03	Electronic Measurements and Instrumentation	3	0	0	3	IV	SAE
4.	18ECE06	Communication Engineering	3	0	0	3	IV	GE
5.	18CST45	Data Structure and Algorithms	3	0	0	3	IV	SAE
6.	18MET46	Thermodynamics and Fluid Mechanics	3	0	0	3	IV	GE
		Elective 2						

6.	18EEE04	Advanced Microprocessors and Microcontrollers	3	0	0	3	VII	ECE
7.	18EEE05	Digital System Design	3	0	0	3	VII	ECE
8.	18EEE06	Non conventional Energy Sources	3	0	0	3	VII	EPSE
9.	18EEE07	CAD of Electrical Machines	3	0	0	3	VII	PEEM
10.	18EEE08	Electrical System Design, Estimation and Costing	3	0	0	3	VII	PEEM
11.	18EEE09	Substation Engineering and Automation	3	0	0	3	VII	EPSE
		Elective 3						
12.	18EEE10	VLSI Design	3	0	0	3	VII	ECE
13.	18EEE11	Advanced Control Theory	3	0	0	3	VII	ECE
14.	18EEE12	Special Electrical Machines	3	0	0	3	VII	PEEM
15.	18EEE13	Electric Vehicle Technology	3	0	0	3	VII	PEEM
16.	18EEE14	Restructured Power System	3	0	0	3	VII	EPSE
17.	18EEE15	Power System Operation and Control	3	0	0	3	VII	EPSE
18.	18EEE16	Design, installation and Commissioning of Solar and Wind Energy Systems	3	0	0	3	VII	EPSE
		Elective 4						
19.	18EEE17	PLC, SCADA and DCS	3	0	0	3	VII	ECE
20.	18EEE18	Generalized Machine Theory	3	0	0	3	VII	PEEM
21.	18EEE19	Power Plant Instrumentation	3	0	0	3	VII	SAE
22.	18EEE20	Digital Image Processing and Multi Resolution Analysis	3	0	0	3	VII	ECE
23.	18EEE21	Electrical Engineering Drawing	3	0	0	3	VII	SAE
24.	18EEE22	Energy Storage Systems	3	0	0	3	VII	EPSE
25.	18EEE23	Computer aided Power System Analysis	3	0	0	3	VII	EPSE
26.	18EEE24	Smart grid	3	0	0	3	VII	EPSE
27.	18GEE01	Fundamentals of Research	3	0	0	3	VII	GE
		Elective 5						
28.	18MBE49	Entrepreneurship Development	3	0	0	3	VIII	GE
29.	18EEE25	Digital signal Processors and its applications	3	0	0	3	VIII	ECE
30.	18EEE26	Power Electronic Interfaces to Renewable Energy	3	0	0	3	VIII	PEEM
31.	18EEE27	Power Quality	3	0	0	3	VIII	PEEM
32.	18EEE28	High Voltage Engineering	3	0	0	3	VIII	EPSE
33.	18EEE29	Biomass Energy Systems	3	0	0	3	VIII	EPSE
34.	18EEE30	HVDC and EHVAC	3	0	0	3	VIII	EPSE
Total Credits to be earned						**15**		

EMPLOYABILITY ENHANCEMENT COURSES							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	18GEL51/ 18GEI51	Professional Skills Training I / Industrial Training I	0	0	0	2	V
2.	18GEL61/ 18GEI61	Professional Skills Training II / Industrial Training II	0	0	0	2	VI
3.	18GEP71	Comprehensive Test and Viva	0	0	0	2	VII
4.	18EEP61	Project Work I Phase I	0	0	6	2	VI
5.	18EEP71	Project Work I Phase II	0	0	12	4	VII
6.	18EEP81	Project Work II / Internship	0	0	18	6	VIII
Total Credits to be earned						**18**	

***** Domain/Stream Abbreviations: GE – General Engineering, ECE- Electronics and Control Engineering, EPSE- Energy and Power Systems Engineering, PEEM- Power Electronics and Electrical Machines, SAE- Software and Allied Engineering

OPEN ELECTIVE COURSES OFFERED TO OTHER DEPARTMENTS (OE)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	18EEO01	Electrical Wiring and Lighting	3	1	0	4	V
2.	18EEO02	Solar and Wind Energy Systems	3	1	0	4	V
3.	18EEO03	Energy Conservation and Management	3	1	0	4	VI
4.	18EEO04	Micro Grid and Smart Grid	3	0	0	3	VII
5.	18EEO05	Electrical Safety	3	0	0	3	VII
6.	18EEO06	Electric Vehicle Technology	3	0	0	3	VIII

OPEN ELECTIVE COURSES OFFERED BY OTHER DEPARTMENTS (OE)

S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**OFFERED BY**
		SEMESTER V					
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.	18ECO01	PCB Design and Fabrication	3	0	2	4	ECE
15.	18ECO02	Neural Networks and Fuzzy Logic for Engineering Applications	3	0	2	4	ECE
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.	18ECO03	Principles of Quantum Computing	3	0	2	4	ECE
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	Introducing 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.	18ECO04	Electronic Hardware and Troubleshooting	2	0	2	3	ECE
59.	18ECO05	Principles of Communication Techniques	3	0	0	3	ECE
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.	18ECO06	Bioinspired Computing Technologies	2	0	2	3	ECE
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 (Electrical and Electronics Engineering) Total Credits :171

Sem	Course1	Course2	Course3	Course4	Course5	Course6	Course7	Course8	Course9	Course10	Credits
I	18EGT11 English for Communi-cation I (3-0-0-3)	18MAC11 Mathematics I (3-1*-2*-4)	18PHC11 Applied Physics (3-0-2*-3.5)	18CYC11 Applied Chemistry (3-0-2*-3.5)	18GET11 Introduction to Engineering (3-0-0-3)	18CSC11 Problem Solving and Programming (2-0-2-3)	18VEC11 Value Education (2-0-1-1				**21**
II	18EGT21 English for Communi-cation II (3-0-0-3)	18MAC21 Mathematics II (3-1*-2*-4)	18PHC25 Materials Science and Opto Electronic Devices (3-0-2*-3.5)	18CYC25 Environmental Science and Organic Electronic Materials (3-0-2*-3.5)	18MEC11 Engineering Drawing (2-0-2-3)	18EET21 Principles of Electrical and Electronics Engineering (3-0-0-3)	18MEL11 Engineering Practices Laboratory (0-0-2-1))				**21**
III	18MAC31 Mathematics III (3-1*-2*-4)	18EET31 Electrical Machines I (3-1-0-4)	18EET32 Analog Electronics (3-0-0-3)	18EET33 Electrical Measurements (3-0-0-3)	18EET34 Circuits and Networks (3-1-0-4)	18EEL31 Electrical Machines I Laboratory (0-0-2-1)	18EEL32 Analog Electronics Laboratory (0-0-2-1)	18EEL33 Circuits and Networks Laboratory (0-0-2-1)	18EGL31 English for Work Place Communicatio n (0-0-2-1)		**22**
IV	18MAC41 Statistics and Numerical Methods (3-1-2*-4)	18EET41 Electrical Machines II (3-1-0-4)	18EET42 Electromagneti c Theory (3-1-0-4)	18EET43 Digital Logic Circuits (3-0-0-3)	18CST44 Object Oriented Programming using C++ (3-0-0-3)	Professional Elective I (3-0-0-3)	18EEL41 Electrical Machines II Laboratory (0-0-2-1)	18EEL42 Digital Circuit Design Laboratory (0-0-2-1)	18CSL43 Object Oriented Programming using C++ Laboratory (0-0-2-1)		**24**
V	18EET51 Control Systems (3-1-0-4)	18EET52 Power Electronics (3-1-0-4)	18EET53 Micro processors and Microcontrolle rs Interfacing (3-0-0-3)	18EET54 Generation, Transmission and Distribution (3-1-0-4)	Open Elective I (3-1/0-0/2-4)	18EEL51 Control and Instrumenta tion Laboratory (0-0-2-1)	18EEL52 Power Electronics Laboratory (0-0-2-1)	18EEL53 Micro controller and Interfacing 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)	**26**
VI	18EET61 Signals and Systems (3-0-0-3)	18EET62 Power System Analysis (3-1-0-4)	18EET63 Electric Drives and Control (3-0-0-3)	18EET64 Power System Protection and Switchgear (3-0-0-3)	Open Elective II (3-1/0-0/2-4)	18EEL61 Signals and Systems Laboratory (0-0-2-1)	18EEL62 Power Systems Laboratory (0-0-2-1)	18EEL63 Electrical Drives Laboratory (0-0-2-1)	18GEL61/ 18GEI61 Professional Skills Training II / Industrial Training II (0-0-0-2)	18EEP61 Project Work I Phase I (0-0-4-2)	**24**
VII	18MBT71 Engineering Economics and Management (3-0-0-3)	Open Elective III (3-0-0-3)	Professional Elective II (3-0-0-3)	Professional Elective III (3-0-0-3)	Professional Elective IV (3-0-0-3)	18GEP71 Comprehen-sive Test& Viva (0-0-0-2)	18EEP71 Project Work I Phase II (0-0-8-4)				**21**
VIII	Open Elective IV (3-0-0-3)	Professional Elective V (3-0-0-3)	18EEP81 Project Work II / Internship (0-0-12-6)								**12**

MAPPING OF COURSES WITH PROGRAM OUTCOMES

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	18EGT11	English for Communication I						✓			✓	✓	✓	✓		
1	18MAC11	Mathematics I	✓	✓	✓	✓	✓									
1	18PHC11	Applied Physics	✓	✓	✓	✓										
1	18CYC11	Applied Chemistry	✓	✓	✓	✓										
1	18GET11	Introduction to Engineering	✓	✓	✓	✓		✓	✓					✓		
1	18CSC11	Problem Solving and Programming	✓	✓	✓	✓	✓					✓				
1	18VEC11	Value Education						✓		✓				✓		
2	18EGT21	English for Communication II						✓			✓	✓	✓	✓		
2	18MAC21	Mathematics II	✓	✓	✓		✓									
2	18PHC25	Materials Science and Opto Electronic Devices	✓	✓	✓	✓										
2	18CYC25	Environmental Science and Organic Electronic Materials	✓	✓	✓	✓			✓							
2	18MEC11	Engineering Drawing	✓	✓	✓	✓					✓	✓	✓	✓		
2	18EET21	Principles of Electrical and Electronics Engineering	✓	✓											✓	✓
2	18MEL11	Engineering Practices Laboratory	✓	✓	✓	✓	✓				✓	✓	✓	✓		
3	18MAC31	Mathematics III	✓	✓	✓	✓	✓									
3	18EET31	Electrical Machines I	✓	✓	✓	✓	✓								✓	✓
3	18EET32	Analog Electronics	✓	✓	✓	✓									✓	✓
3	18EET33	Electrical Measurements	✓	✓	✓	✓									✓	✓
3	18EET34	Circuits and Networks	✓	✓	✓	✓	✓								✓	✓
3	18EEL31	Electrical Machines I Laboratory	✓	✓	✓	✓	✓								✓	✓
3	18EEL32	Analog Electronics Laboratory	✓	✓	✓	✓	✓								✓	✓
3	18EEL33	Circuits and Networks Laboratory	✓	✓	✓	✓									✓	✓
3	18EGL31	English for Work Place Communication									✓	✓		✓	✓	✓
4	18MAC41	Statistics and Numerical Methods	✓	✓	✓	✓	✓									

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
4	18EET41	Electrical Machines II	✓	✓	✓	✓	✓								✓	✓
4	18EET42	Electromagnetic Theory	✓	✓	✓										✓	✓
4	18EET43	Digital Logic Circuits	✓	✓	✓										✓	✓
4	18CST44	Object Oriented Programing using C++	✓	✓	✓	✓									✓	
4	18EEL41	Electrical Machines II Laboratory	✓	✓	✓	✓	✓								✓	✓
4	18EEL42	Digital Circuit Design Laboratory	✓	✓	✓	✓	✓								✓	✓
4	18CSL43	Object Oriented Programming using C++ Laboratory	✓	✓	✓	✓						✓	✓		✓	✓
5	18EET51	Control Systems	✓	✓	✓										✓	✓
5	18EET52	Power Electronics	✓	✓	✓	✓	✓								✓	✓
5	18EET53	Microprocessors and Microcontrollers Interfacing	✓	✓	✓	✓	✓								✓	✓
5	18EET54	Generation, Transmission and Distribution	✓	✓	✓										✓	✓
5	18EEL51	Control and Instrumentation Laboratory	✓	✓	✓	✓	✓								✓	✓
5	18EEL52	Power Electronics Laboratory	✓	✓	✓	✓									✓	✓
5	18EEL53	Microcontroller and Interfacing Laboratory	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓
5	18GEL51/ 18GEI51	Professional Skills Training 1 / Industrial Training 1	✓	✓				✓	✓		✓	✓	✓	✓		
5	18GET51	Universal Human Values						✓	✓	✓	✓	✓				
6	18EET61	Signals and Systems	✓	✓	✓	✓	✓								✓	✓
6	18EET62	Power System Analysis	✓	✓	✓	✓	✓								✓	✓
6	18EET63	Electric Drives and Control	✓	✓	✓	✓									✓	✓
6	18EET64	Power System Protection and Switchgear	✓	✓	✓	✓	✓								✓	✓
6	18EEL61	Signals and Systems Laboratory	✓	✓	✓	✓									✓	✓
6	18EEL62	Power Systems Laboratory	✓	✓	✓	✓	✓								✓	✓
6	18EEL63	Electrical Drives Laboratory	✓	✓	✓	✓	✓								✓	✓
6	18EEP61	Project Work I Phase I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6	18GEL61/ 18GEI61	Professional Skills Training II / Industrial Training II	✓	✓				✓	✓		✓	✓	✓	✓		
7	18MBT71	Engineering Economics and Management	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
7	18GEP71	Comprehensive Test and Viva	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
7	18EEP71	Project Work I Phase II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	18GEP81	Project Work II / Internship	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Professional Elective Courses														
4	18EEE01	Electronic Circuit Analysis	✓	✓	✓	✓									✓	✓
4	18EEE02	Fundamentals of Solar cell	✓	✓	✓										✓	✓
4	18EEE03	Electronic Measurements and Instrumentation	✓	✓	✓	✓									✓	✓
4	18ECE06	Communication Engineering	✓	✓	✓	✓									✓	✓
4	18CST45	Data Structure and Algorithms	✓	✓	✓	✓									✓	✓
4	18MET46	Thermodynamics and Fluid Mechanics	✓	✓	✓		✓		✓						✓	✓
7	18EEE04	Advanced Microprocessors and Microcontrollers	✓	✓	✓	✓									✓	✓
7	18EEE05	Digital System Design	✓	✓	✓	✓	✓								✓	✓
7	18EEE06	Non conventional Energy Sources	✓	✓	✓			✓	✓				✓	✓	✓	✓
7	18EEE07	CAD of Electrical Machines	✓	✓	✓	✓	✓								✓	✓
7	18EEE08	Electrical System Design, Estimation and Costing	✓	✓	✓	✓									✓	✓
7	18EEE09	Substation Engineering and automation	✓	✓	✓	✓									✓	✓
7	18EEE10	VLSI Design	✓	✓	✓	✓	✓	✓							✓	
7	18EEE11	Advanced Control Theory	✓	✓	✓	✓									✓	✓
7	18EEE12	Special Electrical Machines	✓	✓	✓	✓									✓	✓
7	18EEE13	Electric Vehicle Technology	✓	✓	✓	✓									✓	✓
7	18EEE14	Restructured Power System	✓	✓	✓	✓									✓	
7	18EEE15	Power system operation and control	✓	✓	✓	✓									✓	✓
7	18EEE16	Design, installation and commissioning of Solar and Wind Energy Systems	✓	✓	✓	✓	✓								✓	✓
7	18EEE17	PLC, SCADA and DCS	✓	✓	✓	✓									✓	✓
7	18EEE18	Generalized Machine Theory	✓	✓	✓	✓									✓	✓
7	18EEE19	Power Plant Instrumentation	✓	✓	✓	✓	✓		✓			✓			✓	
7	18EEE20	Digital Image Processing and Multi Resolution Analysis	✓	✓	✓	✓									✓	✓

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
7	18EEE21	Electrical Engineering Drawing	✓	✓	✓	✓	✓									
7	18EEE22	Energy Storage Systems	✓	✓	✓	✓									✓	✓
7	18EEE23	Computer aided Power System Analysis	✓	✓	✓	✓	✓								✓	✓
7	18EEE24	Smart grid	✓	✓	✓	✓									✓	
7	18GEE01	Fundamentals of Research	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	18MBE49	Entrepreneurship Development											✓			
8	18EEE25	Digital signal Processors and its applications	✓	✓	✓	✓	✓								✓	✓
8	18EEE26	Power Electronic Interfaces to Renewable Energy	✓	✓	✓	✓	✓								✓	✓
8	18EEE27	Power Quality	✓	✓	✓	✓	✓								✓	✓
8	18EEE28	High Voltage Engineering	✓	✓	✓	✓									✓	✓
8	18EEE29	Biomass Energy Systems	✓	✓	✓	✓									✓	✓
8	18EEE30	HVDC and EHVAC	✓	✓	✓	✓	✓								✓	✓

		Open Elective Courses														
5	18MAO01	Mathematical Foundations of Machine Learning	✓	✓	✓	✓	✓									
5	18PHO01	Thin film Technology	✓	✓	✓											
5	18CYO01	Corrosion Science and Engineering	✓	✓	✓	✓										
5	18CEO01	Remote Sensing and its Applications	✓	✓	✓	✓	✓									
5	18MEO01	Renewable Energy Sources	✓	✓	✓	✓			✓			✓		✓		
5	18MTO01	Design of Mechatronics Systems	✓	✓	✓	✓	✓							✓		
5	18AUO01	Automotive Engineering	✓	✓	✓		✓									
5	18ECO01	PCB Design and Fabrication	✓	✓	✓	✓	✓				✓					
5	18ECO02	Neural Networks and Fuzzy Logic for Engineering Applications	✓	✓	✓	✓	✓				✓					
5	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	✓	✓	✓	✓	✓									

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
5	18ITO01	Python Programming			✓		✓									
5	18ITO02	Advanced Java Programming			✓		✓									
5	18CHO01	Polymer Technology	✓	✓												
5	18CHO02	Introduction to Drugs and Pharmaceuticals Technology	✓	✓	✓	✓	✓									
5	18FTO01	Food Processing Technology	✓	✓	✓	✓										
5	18FTO02	Baking Technology	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓		
6	18MAO02	Graph Theory and its Applications	✓	✓	✓											
6	18MAO03	Number Theory and Cryptography	✓	✓	✓		✓									
6	18CYO02	Instrumental Methods of Analysis	✓	✓	✓	✓										
6	18CEO02	Disaster Management	✓	✓	✓			✓	✓					✓		
6	18MEO02	Design of Experiments	✓	✓	✓	✓	✓						✓	✓		
6	18MTO02	Factory Automation	✓	✓	✓	✓	✓	✓			✓	✓		✓		
6	18MTO03	Data Acquisition and Virtual Instrumentation	✓	✓	✓	✓	✓				✓	✓		✓		
6	18AUO02	Autonomous Vehicles	✓	✓	✓											
6	18ECO03	Principles of Quantum Computing	✓	✓	✓	✓	✓									
6	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	Introducing 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	✓	✓	✓		✓	✓		✓	✓	✓		✓		

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
6	18FTO04	Processing of Fruits and Vegetables	✓	✓	✓		✓	✓		✓	✓	✓		✓		
7	18MAO04	Advanced Linear Algebra	✓	✓	✓											
7	18MAO05	Optimization Techniques	✓	✓	✓											
7	18PHO02	Structural and Optical Characterization of Materials	✓	✓	✓											
7	18CYO03	Waste and Hazardous Waste Management	✓	✓	✓	✓			✓							
7	18CEO03	Introduction to Smart Cities	✓	✓	✓				✓							
7	18CEO04	Environmental Health and Safety	✓	✓	✓	✓										
7	18MEO03	Fundamentals of Ergonomics	✓	✓	✓	✓		✓	✓			✓		✓		
7	18MEO04	Principles of Management and Industrial Psychology			✓			✓	✓	✓	✓	✓				
7	18MTO04	3D Printing and Design	✓	✓	✓	✓	✓						✓	✓		
7	18MTO05	Drone System Technology	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓		
7	18AUO03	Alternate Fuels for Automobile	✓	✓												
7	18ECO04	Electronic Hardware and Troubleshooting	✓	✓	✓	✓	✓	✓								
7	18ECO05	Principles of Communication Techniques	✓	✓	✓	✓	✓									
7	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	✓	✓	✓			✓	✓			✓	✓	✓		

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
8	18MTO06	Robotics	✓	✓	✓	✓	✓							✓		
8	18MTO07	Virtual and Augment Reality in Industry 4.0	✓	✓	✓	✓	✓	✓						✓		
8	18AUO04	Automotive Electronics	✓	✓	✓											
8	18AUO05	Vehicle Maintenance	✓		✓			✓								
8	18ECO06	Bioinspired Computing Technologies	✓	✓	✓	✓										
8	18EIO06	Measurements and Instrumentation	✓	✓	✓	✓	✓									
8	18EIO07	Graphical Programming using Virtual Instrumentation	✓	✓	✓	✓	✓									
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. ELECTRICAL AND ELECTRONICS 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
18PHC25	Materials Science and Opto Electronic Devices	3	0	2*	3.5	50	50	100	BS
18CYC25	Environmental Science and Organic Electronic Materials	3	0	2*	3.5	50	50	100	BS
18MEC11	Engineering Drawing	2	0	2	3	50	50	100	ES
18EET21	Principles of Electrical and Electronics Engineering	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**

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING CURRICULUM – R2018

SEMESTER – III									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
18MAC31	Mathematics III	3	1*	2*	4	50	50	100	BS
18EET31	Electrical Machines I	3	1	0	4	50	50	100	PC
18EET32	Analog Electronics	3	0	0	3	50	50	100	PC
18EET33	Electrical Measurements	3	0	0	3	50	50	100	ES
18EET34	Circuits and Networks	3	1	0	4	50	50	100	PC
Practical / Employability Enhancement									
18EEL31	Electrical Machines I Laboratory	0	0	2	1	100	0	100	PC
18EEL32	Analog Electronics Laboratory	0	0	2	1	100	0	100	PC
18EEL33	Circuits and Networks 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					**22**				

***Alternate Weeks**

SEMESTER – IV									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
18MAC41	Statistics and Numerical Methods	3	1*	2*	4	50	50	100	BS
18EET41	Electrical Machines II	3	1	0	4	50	50	100	PC
18EET42	Electromagnetic Theory	3	1	0	4	50	50	100	PC
18EET43	Digital Logic Circuits	3	0	0	3	50	50	100	PC
18CST44	Object Oriented Programming using C++	3	0	0	3	50	50	100	ES
	Professional Elective I	3	0	0	3	50	50	100	PE
Practical / Employability Enhancement									
18EEL41	Electrical Machines II Laboratory	0	0	2	1	100	0	100	PC
18EEL42	Digital Circuit Design Laboratory	0	0	2	1	100	0	100	PC
18CSL43	Object Oriented Programming using C++ Laboratory	0	0	2	1	100	0	100	ES
Total Credits to be earned					**24**				

*** Alternate Weeks**

B.E. ELECTRICAL AND ELECTRONICS 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									
18EET51	Control Systems	3	1	0	4	50	50	100	PC
18EET52	Power Electronics	3	1	0	4	50	50	100	PC
18EET53	Microprocessors and Microcontrollers Interfacing	3	0	0	3	50	50	100	PC
18EET54	Generation, Transmission and Distribution	3	1	0	4	50	50	100	PC
	Open Elective I	3	1/0	2/0	4	50	50	100	OE
Practical / Employability Enhancement									
18EEL51	Control and Instrumentation Laboratory	0	0	2	1	100	0	100	PC
18EEL52	Power Electronics Laboratory	0	0	2	1	100	0	100	PC
18EEL53	Microcontroller and Interfacing 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					**26**				

***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									
18EET61	Signals and Systems	3	0	0	3	50	50	100	PC
18EET62	Power System Analysis	3	1	0	4	50	50	100	PC
18EET63	Electric Drives and Control	3	0	0	3	50	50	100	PC
18EET64	Power System Protection and Switchgear	3	0	0	3	50	50	100	PC
	Open Elective II	3	1/0	0/2	4	50	50	100	OE
Practical / Employability Enhancement									
18EEL61	Signals and Systems Laboratory	0	0	2	1	100	0	100	PC
18EEL62	Power Systems Laboratory	0	0	2	1	100	0	100	PC
18EEL63	Electrical Drives Laboratory	0	0	2	1	100	0	100	PC
18GEL61/ 18GEI61	Professional Skills Training II / Industrial Training II *	---	---	---	2	100	0	100	EC
18EEP61	Project Work I Phase I	0	0	4	2	100	0	100	EC
Total Credits to be earned					**24**				

***80 Hours of Training**

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING CURRICULUM – R2018

SEMESTER – VII									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
18MBT71	Engineering Economics and Management	3	0	0	3	50	50	100	HS
	Professional Elective II	3	0	0	3	50	50	100	PE
	Professional Elective III	3	0	0	3	50	50	100	PE
	Professional Elective IV	3	0	0	3	50	50	100	PE
	Open Elective III	3	0	0	3	50	50	100	OE
Practical / Employability Enhancement									
18GEP71	Comprehensive Test and Viva	---	---	---	2	100	0	100	EC
18EEP71	Project Work I Phase II	0	0	8	4	50	50	100	EC
Total Credits to be earned					**21**				

SEMESTER – VIII									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
	Professional Elective V	3	0	0	3	50	50	100	PE
	Open Elective IV	3	0	0	3	50	50	100	OE
Practical / Employability Enhancement									
18EEP81	Project Work II / Internship	---	---	12	6	50	50	100	EC
Total Credits to be earned					**12**				

Total Credits: 171

LIST OF PROFESSIONAL ELECTIVE COURSES (PE)							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
		Elective I					
1.	18EEE01	Electronic Circuit Analysis	3	0	0	3	IV
2.	18EEE02	Fundamentals of Solar cell	3	0	0	3	IV
3.	18EEE03	Electronic Measurements and Instrumentation	3	0	0	3	IV
4.	18ECE06	Communication Engineering	3	0	0	3	IV
5.	18CST45	Data Structure and Algorithms	3	0	0	3	IV
6.	18MET46	Thermodynamics and Fluid Mechanics	3	0	0	3	IV
		Elective II					
7.	18EEE04	Advanced Microprocessors and Microcontrollers	3	0	0	3	VII
8.	18EEE05	Digital System Design	3	0	0	3	VII
9.	18EEE06	Non Conventional Energy Sources	3	0	0	3	VII
10.	18EEE07	CAD of Electrical Machines	3	0	0	3	VII
11.	18EEE08	Electrical System Design, Estimation and Costing	3	0	0	3	VII
12.	18EEE09	Substation Engineering and Automation	3	0	0	3	VII
		Elective III					
13.	18EEE10	VLSI Design	3	0	0	3	VII
14.	18EEE11	Advanced Control Theory	3	0	0	3	VII
15.	18EEE12	Special Electrical Machines	3	0	0	3	VII
16.	18EEE13	Electric Vehicle Technology	3	0	0	3	VII
17.	18EEE14	Restructured Power System	3	0	0	3	VII
18.	18EEE15	Power System Operation and Control	3	0	0	3	VII
19.	18EEE16	Design, installation and Commissioning of Solar and Wind Energy Systems	3	0	0	3	VII
		Elective IV					
20.	18EEE17	PLC, SCADA and DCS	3	0	0	3	VII
21.	18EEE18	Generalized Machine Theory	3	0	0	3	VII
22.	18EEE19	Power Plant Instrumentation	3	0	0	3	VII
23.	18EEE20	Digital Image Processing and Multi Resolution Analysis	3	0	0	3	VII
24.	18EEE21	Electrical Engineering Drawing	3	0	0	3	VII
25.	18EEE22	Energy Storage Systems	3	0	0	3	VII

26.	18EEE23	Computer aided Power System Analysis	3	0	0	3	VII
27.	18EEE24	Smart grid	3	0	0	3	VII
28.	18GEE01	Fundamentals of Research	3	0	0	3	VII
		Elective V					
29.	18MBE49	Entrepreneurship Development	3	0	0	3	VIII
30.	18EEE25	Digital signal Processors and its applications	3	0	0	3	VIII
31.	18EEE26	Power Electronic Interfaces to Renewable Energy	3	0	0	3	VIII
32.	18EEE27	Power Quality	3	0	0	3	VIII
33.	18EEE28	High Voltage Engineering	3	0	0	3	VIII
34.	18EEE29	Biomass Energy Systems	3	0	0	3	VIII
35.	18EEE30	HVDC and EHVAC	3	0	0	3	VIII

LIST OF OPEN ELECTIVE COURSES (OE) OFFERED TO OTHER DEPARTMENTS							
S. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	18EEO01	Electrical Wiring and Lighting	3	1	0	4	V
2.	18EEO02	Solar and Wind Energy Systems	3	1	0	4	V
3.	18EEO03	Energy Conservation and Management	3	1	0	4	VI
4.	18GEO11	NCC Studies (Army Wing) – I	3	0	2	4	V/ VI
5.	18EEO04	Micro Grid and Smart Grid	3	0	0	3	VII
6.	18EEO05	Electrical Safety	3	0	0	3	VII
7.	18EEO06	Electric Vehicle Technology	3	0	0	3	VIII

18EGT11 - ENGLISH FOR COMMUNICATION I

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

Programme & Branch	B.E. & Electrical and Electronics 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. & Electrical and Electronics 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. & Electrical and Electronics 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. & Electrical and Electronics 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	3	1										3		
CO2	3	2	1	1		2	1					3		
CO3	3	2	1	1		2	1					3		
CO4	3	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. & Electrical and Electronics 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. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	1	HS	2	0	1	1

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

List of Exercises / Experiments:

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

Lecture:20, Practical:10, Total:30

TEXT BOOK:

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

REFERENCES:

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

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

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18EGT21 - ENGLISH FOR COMMUNICATION II

(Common to All Engineering and Technology Branches)

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

Preamble	This course is designed to impart required levels of fluency in using the English Language at B1 level in the CEFR.	
Unit - I	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – VI:**	**9**
Listening – Job and career related descriptions and conversations – requests of different kinds and the responses – Speaking - Career choices and professional skills – making requests and responding to requests – Reading – Using texts about jobs and careers – about different societies and cultural differences – Writing – Resumes, CVs and job oriented advertisements – business and career related emails – Grammar & Vocabulary – Gerunds and elements of comparison – requests and indirect requests.		
Unit - II	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – VII:**	**9**
Listening – Expository and narrative descriptions – information about different cultures, nations and societies - Speaking – Narrating and describing – talking about other countries and other cultures – Reading – Using texts about media and information technology – living abroad and experiencing different cultures – Writing – Blog writing – brochures and tourist pamphlets – Grammar & Vocabulary – The past tense forms - noun phrases and relative clauses.		
Unit - III	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – VIII:**	**9**
Listening – Consumerism – product description – complaints and redressal – environmental issues – ecology – saving the planet – Speaking – Talking about problems, issues, complaints – solutions and redressal – talking about environmental issues – Reading – Using texts on segregating wastes – recycling and reusing – texts on environmental issues – Writing – Online reviews, articles and writing web content – Grammar & Vocabulary – Phrases and sentences used for describing problems – passives – prepositions and infinitives.		
Unit - IV	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – IX:**	**9**
Listening – Education, learning and the choice of courses – various services needed in daily life – self-improvement for success in life – Speaking - Discussions about educational and career oriented issues – talking about everyday services – giving advice and self improvement – Reading – Reading about learning strategies and learning styles – using texts about personality development – Writing – Writing about hobbies – pastime and individual skills – writing short articles on everyday life and personality development – Grammar & Vocabulary – Using of “would” and certain gerund forms – use of modals, verbs, gerunds, negative questions and infinitives.		
Unit - V	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – X:**	**9**
Listening – Historical narratives – biographies and learning about the future – important life events, milestones and happenings of the past – Speaking – Talking about the past, present and the future – talking about important events in life – Reading – Texts about new technologies and future science – using texts about social organization, culture and social practices – Writing – Biographical sketches – historical events – famous personalities, stages of life and getting along with people – Grammar & Vocabulary – Future tense forms – time clauses and certain “if clauses”.		

Total:45

TEXT BOOK:

1. Jack C. Richards, "Interchange, Student’s Book 3", 4th Edition, Cambridge University Press, New York, 2017.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	use functional grammar for improving communication skills	Applying (K3)
CO2	listen and comprehend different spoken excerpts critically and infer unspoken and implied meanings.	Applying (K3)
CO3	read different genres of texts, infer implied meanings and critically analyze and evaluate them for ideas as well as for method of presentation.	Analyzing (K4)
CO4	write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.	Creating (K6)
CO5	speak effectively, to express opinions clearly, initiate and sustain a discussion and also negotiate using appropriate communicative strategies.	Creating (K6)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	3	3	30	40		24	100
CAT2	3	3	33	43		18	100
CAT3	3	3	33	43		18	100
ESE	3	3	31	45		18	100

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

18MAC21 - MATHEMATICS II

(Common to All Engineering and Technology Branches)

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

18PHC25 - MATERIALS SCIENCE AND OPTO ELECTRONIC DEVICES
(Common to EEE & EIE branches)

Programme & Branch	B.E. & Electrical and Electronics 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, nano materials, biocompatible and thermoelectric materials. It also describes the working of the select optoelectronic devices and the applications of aforementioned materials in electrical and electronics, and instrumentation engineering 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 and Dielectric Materials: Semiconducting Materials: Types of semiconductor - Intrinsic semiconductor: Carrier concentration - electrical conductivity and band gap (qualitative) - Extrinsic semiconductors: Carrier concentration in n-type and p-type semiconductors (qualitative). Dielectric Materials: 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 –III		9

Magnetic and Nano Materials: Magnetic Materials: Origin of magnetism - Types of magnetic materials – Domain theory of ferromagnetism – Hysteresis - Soft and hard magnetic materials – Transformer core. Nanomaterials: Low dimensional structures - quantum dot, quantum wire and quantum well – Synthesis: Top down and bottom up approaches – Lithographic method – Physical vapor deposition method - Applications of Nanomaterials.

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

Biocompatible and Thermoelectric Materials: Biocompatible Materials: Biocompatibility - Ni-Ti alloy and their applications - Thermoelectric Materials: Physics of thermoelectricity, Peltier, Seebeck and Thomson effects - Thermoelectric generators.

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 the thickness of a nano-structured thin film using air-wedge arrangement.
4. Determination of hysteresis loss in a ferromagnetic material.
5. Determination of thermo emf of a thermocouple.

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. Che C.H., "Ultrasonic and Advanced Methods for Nondestructive Testing and Materials Characterization", World Scientific Pub. Co. Inc., Chennai, 2007.
3. Tamilarasan K. and Prabu K., "Physics Laboratory Manual", SCM Publishers, Erode, 2018.

* Alternate week

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	apply the concepts of classical and quantum free electron theory of metals to compute the electrical conductivity of metals and to explain band theory of solids, and to expound the types, properties, applications of superconductor and the working of magnetic levitation	Applying (K3)
CO2:	use the concept of density of states to elucidate the types and innate characteristics of semiconductor, and to describe the phenomena related to dielectrics and their select applications	Applying (K3)
CO3:	outline the attributes of magnetic materials, the features and the select preparation methods of nano materials with their application	Understanding (K2)
CO4:	make use of the theory of p-n junction to interpret the materials, construction, working and applications of optoelectronic devices (LED, LDR and solar cell) and the application of Opto-electric effect in modulator	Applying (K3)
CO5:	rephrase the phenomenon related to the select biocompatible materials, thermoelectric materials and their applications	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 thickness of nano-crystalline thin films using the concept of interference of light	Applying (K3), Precision (S3)
CO8:	determine the hysteresis loss in a ferromagnetic materials using the concept of domain theory of ferromagnetism, and to determine the thermo emf of a thermocouple using the concepts of Seebeck, Peltier and Thomson effects	Applying (K3), Precision (S3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

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

Programme & Branch	BE – Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Applied Chemistry	2	BS	3	0	2*	3.5

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

UNIT - I		9

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

UNIT - II		9

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

UNIT – III		9

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

UNIT – IV		9

E-Waste and its Management: E- Waste – definition - sources of e-waste– hazardous substances in e-waste – effects of e-waste on environment and human health- need for e-waste management– e-waste handling rules - waste minimization techniques for managing e-waste – recycling of e-waste - disposal treatment methods of e-waste - case studies.

UNIT – V		9

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

List of Experiments:

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

Lecture:45, Practical:15, Total: 60

TEXT BOOK:

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

REFERENCES / MANUALS:

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

* Alternate week

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

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

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

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

18EET21 - PRINCIPLES OF ELECTRICAL AND ELECTRONICS ENGINEERING

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

Preamble: This subject is introduced to provide fundamental knowledge on the basics of Electrical and Electronics Engineering

UNIT – I		**9**

Principles of DC Circuits: Electric current and Ohm's law, Kirchhoff's law – Resistance and Resistivity - DC circuits - series and parallel circuits- Source Transformation - loop and nodal analysis - Problems

UNIT – II		**9**

Principles of AC Circuits: RMS and Average value of sine waveform, Peak factor, Form factor – Simple problems, Single Phase AC Circuits: Impedance, Power, Power factor, Analysis of RL, RC, RLC Circuits- Problems

UNIT – III		**9**

Introduction to Electromagnetism: Magnetic Circuit - Analysis of Magnetic Circuits – Magnetomotive force - Reluctance – Permeance - Comparison between Electric and Magnetic field. Electromagnetic Induction: Faraday's law of electromagnetic induction – Direction of Induced E.M.F and Current- Induced E.M.F - Statically Induced E.M.F – Dynamically Induced E.M.F - Self-inductance - Mutual inductance – Problems

UNIT – IV		**9**

Systems and their Representation: Basic elements in control systems – Concept of open and closed loop systems - Examples and application of open loop and closed loop systems - Introduction to mathematical modelling of physical systems - Differential equations -Transfer function (Electrical system).

UNIT – V		**9**

Introduction to Electronics: Construction, characteristics and applications of PN diode - Zener diode – Bipolar Junction Transistor: Construction and operation of a Transistor – Current gain – Input and Output characteristics of a transistor in CE, CB and CC configurations.

Total: 45

TEXT BOOK:

1. Muthusubramanian R. and Salivahanan S., "Basics of Electrical and Electronics Engineering", 1st Edition, Tata McGraw Hill, 2009.

REFERENCES:

1. Mehta V.K., and Rohit Mehta, "Principles of Electrical Engineering", 2nd Revised Edition, S. Chand, 2008.
2. Sedha R.S., "A Textbook of Applied Electronics", 4th Edition, S.Chand & Co. Ltd., New Delhi, 2009.
3. Nagrath I.J. and Gopal M., "Control Systems Engineering", 5th Edition, New Age International Publishers, New Delhi, 2011.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	acquire the knowledge in principles of DC circuits	Understanding (K2)
CO2:	analyze the operation of AC circuits	Applying (K3)
CO3:	examine the principle of electro magnetism	Understanding (K2)
CO4:	summarize the basic concepts of control system	Understanding (K2)
CO5:	outline the fundamentals of basic electronics	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											1	2
CO2	3	1											2	3
CO3	3	1											1	2
CO4	2												1	2
CO5	2												1	2

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

ASSESSMENT PATTERN - THEORY

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

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

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

18EET31 - ELECTRICAL MACHINES I

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

Preamble	This course aims in imparting knowledge of DC machines construction and working principle. It also aims in imparting fundamental knowledge of Transformer construction, types, operation and design concepts required for electrical engineers.	
UNIT – I		**9+3**
Principles of Electromechanical Energy Conversion: Review of Magnetic Circuits – Magnetic Circuit Calculations and Magnetization Curves – Energy in Magnetic-field System: Energy and Co-energy – Field Energy and Mechanical Force – Singly excited and doubly excited system – Forces/Torques Calculation.		
UNIT – II		**9+3**
DC Generators: Constructional Details – Working Principle – Types of Armature Winding and Connections – EMF Equation – Methods of Excitation – Characteristics of Series and Shunt Generators – Armature Reaction and Commutation – Losses, Efficiency and Power Stages in DC Generator – Condition for Maximum Efficiency – Applications.		
UNIT – III		**9+3**
DC Motors: Principle of Operation – Back EMF and Torque Equations – Types of DC Motors – Characteristics of Series, Shunt and Compound Motors – Applications – Starters – Speed Control Methods – Testing of DC Machines – Testing Standards – IEC, NEMA.		
UNIT – IV		**9+3**
Transformers: Constructional Details – Types – Principle of Operation – EMF Equation – Transformation Ratio – Phasor Diagram – Transformer on No Load and Load – Equivalent Circuit – OC and SC Test – Regulation and Efficiency – Parallel Operation – Auto Transformer – Saving of Copper.		
UNIT – V		**9+3**
Testing of Transformer: Losses and Efficiency in Transformers – Condition for Maximum Efficiency – Testing of Transformers – Polarity Test, Load Test – Phasing out Test – Sumpner's Test – IEC/IEEE Standard Practices of Testing transformers – Separation of Losses – All day Efficiency – Instrument Transformers – Three Phase Transformers – Types of Connections.		
		Lecture: 45, Tutorial: 15, Total: 60
TEXT BOOK:		
1.	Kothari D.P. and Nagrath I.J., "Electric Machines", 5th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2018.	
REFERENCES:		
1.	Theodore Wildi, "Electrical Machines, Drives and Power Systems", 6th Edition, Pearson Publications, 2014.	
2.	Fitzgerald, Kingsley and Umans, "Electric Machinery", 6th Edition, Tata McGraw Hill, New Delhi, 2015.	

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1:	interpret the concepts of magnetic circuits and electromechanical energy conversion	Understanding (K2)
CO2:	demonstrate the construction and working principle of DC machines	Applying (K3)
CO3:	select suitable starters, speed control and testing methods applicable to DC motors	Understanding (K2)
CO4:	determine the performance of transformers	Applying (K3)
CO5:	examine the losses and efficiency of transformer by applying various testing methods	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	2
CO2	3	2	1										2	3
CO3	2	1											1	2
CO4	3	2	1	2									2	3
CO5	2	3	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	50	30				100
CAT2	15	40	35	10			100
CAT3	15	40	35	10			100
ESE	15	40	35	10			100

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

18EET32 - ANALOG ELECTRONICS

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Principles of Electrical and Electronics Engineering	3	PC	3	0	0	3

Preamble: Analog Electronics examines the principles and operations of essential semiconductor devices used in today's electronics: diodes, bipolar junction transistors and MOSFETs, UJT. It includes analysis of different amplifiers and op-amp characteristics and its basic applications which is the prerequisite for next level courses.

UNIT – I		9

Semiconductor Devices: Diode Current Equation – Special Purpose Diodes: Varactor Diode, Tunnel Diode, Solar Cell – Applications of Diodes: Clipper, Clamper and Voltage Multiplier – Operation and Characteristics of UJT – UJT as Relaxation Oscillator. **Transistor Biasing and Stability:** Transistor Biasing: Operating Point – Stability and Stability Factor: Fixed Bias Circuits and Voltage Divider Bias

UNIT – II		9

Differential, Tuned and Power Amplifiers: Differential Amplifier using BJT – Differential and Common Mode Gain, CMRR – Characteristics of Tuned Amplifiers – Frequency Response of Single and Double Tuned Amplifier – Classification of Power Amplifiers – Transformer Coupled Class A, Class B and Push Pull Amplifiers

UNIT – III		9

Feedback Amplifiers and Oscillators: Principle, Advantages of Negative Feedback Amplifiers – Types of Feedback Connections: Voltage / Current, Series / Shunt Feedback – Classification of Oscillators – Stability of Feedback Circuits using Barkhausen Criteria – Phase Shift and Wien Bridge Oscillators – Colpitts, Hartley Oscillators – Astable and Monostable Multivibrator

UNIT – IV		9

Introduction to Operational Amplifier: Basic Information of Operational Amplifier – Block Diagram and Internal Circuits of Operational Amplifier – Circuit Schematic of IC741 – Ideal Operational Amplifier Characteristics, Transfer Characteristics – DC Characteristics – AC Characteristics – Frequency Response, Stability – Frequency Compensation Techniques – CMRR and Slew Rate

UNIT – V		9

Basic Op-amp Applications: Inverting and Non-Inverting Amplifiers, Voltage Follower – Adder – Subtractor – Instrumentation Amplifier – Differentiator – Integrator –V/I and I/V Converter – Comparator – Regenerative Comparator – Square Wave Generator – Triangular Wave Generator – Schmitt Trigger. Timer (IC 555): Functional block, Characteristics of 555 Timer - Application

Total: 45

TEXT BOOK:

1. Millman J., Halkias C.C., Jit S., "Electronic Devices and Circuits", Tata-McGraw Hill, 4th Edition, 2015.

REFERENCES:

1. Roy Choudhry D. and Shail Jain, "Linear Integrated Circuit", 4th Edition, New Age International, New Delhi, Reprint 2014.
2. Boylestad and Nashelsky, "Electronic Devices and Circuit Theory", 11th Edition, Pearson Education, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	explain the working of semiconductor devices and biasing methods of BJT	Understanding (K2)
CO2:	elaborate the working and characteristics of differential, tuned and power amplifiers	Understanding (K2)
CO3:	select a feedback amplifier and oscillator for the specific application and determine the frequency of oscillations	Applying (K3)
CO4:	sketch the DC/AC characteristics and frequency response of Op-Amp	Applying (K3)
CO5:	make use of an Op-Amp for various linear 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											1	2
CO2	2	1											1	2
CO3	3	2	1	1									2	3
CO4	3	2	1	1									2	3
CO5	3	2	1	1									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	15	70	15				100
CAT2	20	60	20				100
CAT3	20	60	20				100
ESE	20	60	20				100

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

18EET33 - ELECTRICAL MEASUREMENTS

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Principles of Electrical and Electronics Engineering	3	ES	3	0	0	3

Preamble: To acquire knowledge in different measurement techniques and usage of various equipments being used in industries and electrical system. To make students for better understanding of transducers and sensors.

UNIT – I		9

Science of Measurements: Importance of Measurement – Purpose of Measurement – Methods of Measurement – Functional blocks of a Measurement System – Types of Errors – Error Analysis – Units and Standards – Static and Dynamic Characteristics. Types of Instruments – Operating Forces in Analog Instruments.

UNIT – II		9

Measurement of Voltage and Current: Permanent Magnet Moving Coil (PMMC): Construction and Working Principle – Torque Equation and Problems – Ammeter Shunts – Voltmeter Multipliers (Simple Problems) – Moving Iron Instruments: General Torque Equation – Classification – Construction, Working and Comparison of Attraction and Repulsion Type Instruments – Errors in MI Instruments – Advantages and Disadvantages – Digital Voltmeter

UNIT – III		9

Measurement of Power, Power factor and Energy: Electrodynamometer Wattmeter: Construction –Theory – Errors – Low Power Factor Wattmeter – Three Phase Wattmeter – Power Measurement by Two Wattmeter Method – Digital Power factor meter – Single Phase Induction Type Energy Meters: Construction – Theory of Operation – Problems – Trivector Meter – Applications.

UNIT – IV		9

Transducers: Introduction to Transducers: Principle of Transduction – Classifications of Transducers – Resistive Transducers: Strain Gauges – Theory of Strain Gauge – Types: Semiconductor Strain Gauge. Construction and Working of Thermistor – Thermocouple – RTD – Linear Variable Differential Transformers (LVDT) – Piezoelectric Transducer – Hall Effect Sensor: Construction – Working Principle – Advantages and Disadvantages – Application of Piezo Electric Sensor in Automobile

UNIT – V		9

Bridges and Special Instruments: Classification of Resistances – Wheatstone Bridge – Limitations of Wheatstone Bridge – Kelvin‘s Double Bridge – Megger (Earth tester) – A.C Bridges: Introduction – Sources and Detectors – Measurement of Self Inductance and Capacitance: Maxwell‘s Inductance Bridge – Capacitance Bridge – Wien‘s Bridge – Block diagram of Digital Multimeters – Weston Type Frequency Meter – Digital Frequency Meter – Maximum Demand Indicators.

Total: 45

TEXT BOOK:

1. Sawhney A.K., “Electrical and Electronic Measurements and Instrumentation”, 19th Revised Edition, Dhanpath Rai & Co., New Delhi, 2013 (Reprint).

REFERENCES:

1. David A. Bell, “Electronic Instrumentation and Measurements”, 3rd Edition, Oxford University Press, 2013.

2. Albert D. Helfrick, William D. Coooper, “Modern Electronic Instrumentation and Measurement Techniques”, 1st Edition, Pearson Education, 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	categorize the characteristics of instruments and the Errors occurring in an Instrument	Understanding (K2)
CO2:	concept of different measuring Instrument and its working principle	Understanding (K2)
CO3:	make use of the instruments for measuring electrical parameters	Applying (K3)
CO4:	select appropriate Transducer for different applications	Applying (K3)
CO5:	utilize the bridges, special Instruments and oscilloscopes for measuring quantities	Applying (K3)

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	2
CO3	3	2	1	1									2	3
CO4	3	2	1	1									2	3
CO5	3	2	1	1									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	80					100
CAT2	20	60	20				100
CAT3	20	60	20				100
ESE	20	60	20				100

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

18EET34 - CIRCUITS AND NETWORKS

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

Preamble: Circuits and networks is the fundamental for many areas of electrical engineering, such as power, electric machines, control, electronics, communications, and instrumentation because of the applied mathematics, physics, and topology involved. To expose basic circuit concepts, circuit modeling and methods of circuit analysis for solving complex circuits.

UNIT – I	**9+3**

Three Phase Circuits: Review of Star and Delta Systems: Line, Phase Quantities **–** Three Phase Power **–** Star Delta Transformation **–** Three Phase Balanced and Unbalanced Circuit **–** Significance of 'a' Operator **–** Symmetrical Component – Problem Solving using Symmetrical Component Three Wire and Four Wire Systems.

UNIT – II	**9+3**

Circuit Analysis (DC and AC): Mesh and nodal analysis – Superposition Theorem – Thevenin's Theorem – Norton's Theorem – Maximum Power Transfer Theorem – Reciprocity Theorem.

UNIT–III	**9+3**

AC and DC Response Analysis: Steady State and Transient Analysis of RL, RC and RLC circuits. **Resonance Circuits:** Resonant Frequency, Current and Voltage Variations, Bandwidth, Q factor for Series and Parallel Resonance Circuits.

UNIT– IV	**9+3**

Network Topology: Introduction – Tree and Co-Tree – Twigs and Links – Incidence Matrix – Properties of Incidence Matrix – Link Currents – Cut-set and Tree Branch Voltages – Tie-set Matrix – Duality.

UNIT – V	**9+3**

Two-Port Networks: Open Circuit Impedance Parameter – Short Circuit Admittance Parameter – Transmission (ABCD) Parameters – T and Π Representation. Coupled Circuits: Mutual inductance – Dot Convention – Coefficient of Coupling – Analysis of Simple Coupled Circuits.

Lecture: 45, Tutorial:15, Total: 60

TEXT BOOK:

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

REFERENCES:

1. Smarajit Ghosh, "Network Theory: Analysis and Synthesis", 9th Print, PHI Learning Pvt. Ltd., 2015.
2. William H. Hayt, Jack Kemmerly, Steven M. Durbin, "Engineering Circuit Analysis", 8th Edition, Tata McGraw-Hill, 2013.

	COURSE OUTCOMES: On completion of the course, the students will be able to	**BT Mapped (Highest Level)**
CO1:	differentiate balanced and unbalanced load condition in three phase AC circuits	Understanding (K2)
CO2:	apply various theorems for the analysis of DC and AC circuits	Applying (K3)
CO3:	analyze DC and AC transient response and resonating circuits	Analyzing (K4)
CO4:	solve network equilibrium equations using graph theory approach	Applying (K3)
CO5:	compute the parameters of different two port networks and coupled circuits	Applying (K3)

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	3	2	1	1									2	3
CO3	2	3	2	2	1								3	2
CO4	3	2	1	1									2	3
CO5	3	2	1	1									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	15	25	60				100
CAT2	15	20	50	15			100
CAT3	15	30	55				100
ESE	10	30	50	10			100

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

18EEL31 - ELECTRICAL MACHINES I LABORATORY

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	3	PC	0	0	2	1

Preamble: This laboratory gives a practical exposure to the students to learn the characteristics of transformers and DC machines that are used nowadays in electrical systems. The students also learn to select the suitable DC electrical machines for an application based on its characteristics and they can able to apply the standard testing procedures of DC machines and transformers.

List of Experiments:

1. Load characteristics of DC series motor
2. Speed control of DC shunt motor
3. Open circuit and load characteristics of DC shunt generator
4. Swinburne's test
5. Hopkinson's test
6. Load test on single phase transformer
7. OC and SC test of transformers
8. Sumpner's test
9. Load test on three phase transformer
10. Computer aided analysis of electrical machines

Total: 30

REFERENCES/ MANUALS:

1. Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	execute the various methods of speed control in DC machines	Applying (K3), Manipulation(S2)
CO2:	perform suitable tests and analyze the performance of rotating machines and transformers	Analyzing(K4), Manipulation(S2)
CO3:	analyze the machines and estimate the parameters using computer aided 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	3
CO2	2	3	2	2	1								3	2
CO3	2	3	2	2	1								3	2

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

18EEL32 - ANALOG ELECTRONICS LABORATORY

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Engineering Practices Laboratory	3	PC	0	0	2	1

Preamble: This laboratory gives a practical exposure to the students to learn the characteristics of various electronic devices such as diodes, BJT and op-amp that are used nowadays in most of the electronic circuits. This course will help the students to learn the design and construction of different electronic circuits and to validate the experimental results using simulation tools.

List of Experiments:

1. Characteristics of BJT
2. Design and Analysis of Complementary Symmetry Class B Power Amplifier
3. Design an Astable Multivibrator using BJTs
4. Design of RC Phase Shift Oscillators using BJT
5. Design of Op-amp Based Inverting, Non-Inverting Amplifiers and Voltage follower circuits for the given Specifications
6. Design of Half-Wave and Full Wave Rectifiers using Op-Amps.
7. Monostable multivibrator using Op-Amps/IC 555
8. Design and Analysis of Schmitt Trigger.
9. Simulation of Transfer Characteristics of Differential Amplifier using BJT
10. Design and Simulation of Clipper and Clamper Circuits using Diodes

Total: 30

REFERENCES/ MANUALS:

1. Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	estimate and interpret the characteristics of electronic devices (BJT, OP-AMP)	Applying (K3), Manipulation (S2)
CO2:	build and implement the power amplifier and oscillator circuits using BJT	Applying (K3), Manipulation (S2)
CO3:	perform the simulation and analyze the waveforms of clipper, clamper and differential amplifier	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	3
CO2	3	2	1	1									2	3
CO3	2	3	2	2	1								3	2

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

18EEL33 - CIRCUITS AND NETWORKS LABORATORY

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	3	PC	0	0	2	1

Preamble: This laboratory gives practical exposure to various theorems and resonance circuits.

List of Experiments:

1. Computation of Current in a Loop using Mesh analysis
2. Verification of Superposition Theorem
3. Verification of Thevenin's Theorem
4. Verification of Norton's Theorem
5. Verification of Maximum Power Transfer Theorem
6. Simulation of Frequency Response of Series Resonance Circuit
7. Simulation of Frequency Response of Parallel Resonance Circuit
8. Calculation of Transfer Parameters of a Two Port Network
9. Simulation of Transient Response of RL and RC circuits
10. Application and verification of circuit analysis in speed control of DC Motor

Total: 30

REFERENCES/ MANUALS:

1. Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	select and apply various theorems for the specific electric circuits	Applying (K3), Manipulation(S2)
CO2:	build DC and AC circuits using Simulation tools and determine different parameters for the network	Applying (K3), Manipulation(S2)
CO3:	apply mesh analysis and estimatevarious electrical parameters for real time networks	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	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3

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

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

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

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

Total:30

REFERENCES/ MANUALS:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	acquire effective listening and reading skills	Understanding (K2), Imitation (S1)
CO2	acquire and demonstrate appropriate professional skills for the workplace	Applying (K3), Naturalization (S5)
CO3	speak fluently and write meaningfully in English in the given context	Applying (K3), Articulation (S4)

Mapping of COs with POs and PSOs

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

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

18MAC41 - STATISTICS AND NUMERICAL METHODS

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

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

Preamble	To impart knowledge in testing of samples, ANOVA and interpolation. Also develop skills to apply numerical algorithms to identify roots of algebraic and transcendental equations and solve linear and ordinary differential equations.	
Unit - I	**Testing of Hypothesis:**	**9**
Introduction – Critical region and level of significance – Types of Errors – Large sample tests: Z-test for single mean and difference of means – Small sample tests: Student's t-test for significance of means – F-test for comparison of variances – Chi-square test for goodness of fit and independence of attributes		
Unit - II	**Design of Experiments:**	**9**
Analysis of variance – One way classification: Completely Randomized Design – Two way classification: Randomized Block Design – Three way classification: Latin Square Design.		
Unit - III	**Solution to Algebraic and Transcendental Equations:**	**9**
Method of false position – Newton-Raphson method – Solution of linear system of equations – Direct methods: Gauss elimination method and Gauss - Jordan method – Iterative methods: Gauss Jacobi and Gauss-Seidel methods.		
Unit - IV	**Interpolation, Numerical Differentiation and Integration:**	**9**
Interpolation: Interpolation with equal intervals: Newton's forward and backward difference formulae – Interpolation with unequal intervals: Lagrange's interpolation formula – Newton's divided difference formula. Numerical Differentiation and Integration: Differentiation using Newton's forward and backward interpolation formulae – Numerical integration: Trapezoidal rule – Simpsons 1/3rd rule.		
Unit - V	**Numerical Solution of First order Ordinary Differential Equations:**	**9**
Single step methods: Taylor series method – Euler method – Modified Euler method – Fourth order Runge-Kutta method – Multi step methods: Milne's predictor corrector method – Adam's Bashforth method.		

List of Exercises / Experiments:

1.	Testing significance of means by student's t - test
2.	Testing the independence of attributes by Chi-square test
3.	Analyze the difference in means is statistically significant by Completely Randomized Design
4.	Finding positive root by Regula – Falsi method
5.	Solving simultaneous linear equations by Gauss – Seidel Method
6.	Evaluating definite integrals by Trapezoidal and Simpson's rules
7.	Solution of ODE by Euler and Modified Euler methods
8.	Solution of ODE by Runge-Kutta method

***Alternate Weeks**

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

TEXT BOOK:

1. Veerarajan T. & Ramachandran T. , "Statistics and Numerical Methods ", 1st 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. Steven C. Chapra & Raymond P. Canale. , "Numerical Methods for Engineers ", 7th Edition, McGraw-Hill Education, New York, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	identify large and small samples and apply suitable tests for solving engineering problems	Applying (K3)
CO2	handle experimental data with the knowledge of ANOVA	Applying (K3)
CO3	apply various numerical techniques to solve algebraic and transcendental equations	Applying (K3)
CO4	compute intermediate values of given data, numerical derivatives and integral values	Applying (K3)
CO5	obtain the solution of ordinary differential equations numerically	Applying (K3)
CO6	test whether the given data is significant by hypothesis testing and ANOVA using MATLAB	Applying (K3), Manipulation (S2)
CO7	use MATLAB for determining numerical solutions of algebraic equations and integral values	Applying (K3), Manipulation (S2)
CO8	obtain the numerical solution of 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	2	1	2										
CO2	3	1	2	2										
CO3	3	2	1	1										
CO4	3	1	1	1										
CO5	3	2	1	1										
CO6					3									
CO7					3									
CO8					3									

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

ASSESSMENT PATTERN - THEORY

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

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

18EET41 - ELECTRICAL MACHINES II

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Electrical Machines I	4	PC	3	1	0	4
Preamble	This course aims in imparting knowledge on construction and working principle of AC machines and some special electrical machines. It also explores on various methods of speed control of AC machines.						

UNIT – I	9 +3
Alternator: Introduction to Rotating MMF – Construction and Operation Details – Types of Rotors – EMF Equation – Synchronous Reactance – Armature Reaction – Voltage Regulation: EMF, MMF and ZPF Methods – Synchronizing and Parallel Operation – Synchronizing Power – Power Output Equations – Change of Excitation and Mechanical Input.	
UNIT – II	**9+3**
Synchronous Motor: Principle of Operation – Torque Equation – Starting Methods – Operation on Infinite Bus bars – V and Inverted V Curves – Input and Output Power Equations – Power/Power Angle Relations – Hunting– Applications: Synchronous Condenser – Power factor correction.	
UNIT – III	**9+3**
Three Phase Induction Motor: Construction and Operation Details – Types of Rotors – Squirrel Cage and Slip Ring – Slip – Torque Equations – Slip Torque Characteristics – Losses and Efficiency – Load Test – No Load and Blocked Rotor Tests – Equivalent Circuit – Circle Diagram – Separation of No Load Losses – Crawling and Cogging – Double Cage Rotors – Induction Generator – Applications.	
UNIT – IV	**9+3**
Starting and Speed Control of Three Phase Induction Motor: Need for Starters – Types of Starters – Rotor Resistance, Autotransformer, Star-Delta and DOL Starters – Speed Control by Varying Voltage, Frequency, Poles and Rotor Resistance – Slip Power Recovery Scheme.	
UNIT – V	**9+3**
Single Phase Induction Motors and Special Machines: Construction and Operation Details – Double Revolving Field Theory – Equivalent Circuit – Simple Problems **Starting Methods:** Split Phase, Capacitor Start, and run, Shaded Pole – Applications – Servo Motor, Stepper Motor and Universal Motor	
	Lecture:45, Tutorial:15, Total: 60

TEXT BOOK:

1. Kothari D.P. and Nagrath I.J., “Electric Machines”, 5th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2018.

REFERENCES:

1. Fitzgerald A.E., Charles Kingsley Jr, and Stephen D. Umans, “Electric Machinery”, 6th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2015.
2. Theodore Wildi, “Electrical Machines, Drives and Power Systems”, 6th Edition, Pearson Publications, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	explain the basic constructional and working principle of synchronous and induction machines	Understanding (K2)
CO2:	compute the performance of AC machines with different parameters	Applying (K3)
CO3:	analyze the performance characteristics of induction machines	Analyzing (K4)
CO4:	apply starting and speed control methods to AC motors	Applying (K3)
CO5:	demonstrate the operation of single phase induction machine and special electrical machines	Applying (K3)

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	3	2	1	1									2	3
CO3	2	3	2	2	1								3	2
CO4	3	2	1	1									2	3
CO5	3	2	1	1									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	50	40				100
CAT2	10	50	30	10			100
CAT3	10	60	30				100
ESE	15	50	25	10			100

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

18EET42 - ELECTROMAGNETIC THEORY

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Principles of Electrical and Electronics Engineering, Applied Physics	4	PC	3	1	0	4
Preamble	This course explores the concepts of electric, magnetic fields and its applications.						

UNIT – I		9+3
Review of Vector Algebra: Scalar and Vector Fields – Calculus of Scalar and Vector Fields in Cartesian and Curvilinear Coordinates – Divergence – Divergence Theorem – Curl – Stoke's Theorem. **Coulomb's law and Electric field intensity:** Electric Charge – Types of Charge Distribution – Coulomb's Law – Electric Field Intensity Due to Point Charge, Line Charge and Surface Charge Distribution.		
UNIT – II		**9+3**
Electric Flux Density, Gauss's Law and Potential: Electric Flux Density – Gauss's Law – Application of Gauss's Law – Potential Difference – Potential – Conservative Property – Potential Gradient – Energy Stored. **Conductors, Dielectrics and Capacitors:** Conduction Current, Displacement Current – Polarization – Law of Continuity – Boundary Condition: Conductor-Dielectric and Dielectric-Dielectric – Capacitors: Parallel Plate, Coaxial Cable, Transmission Line – Poisson's and Laplace's Equations.		
UNIT – III		**9+3**
Steady Magnetic Fields: Biot-Savart's Law – Ampere's Circuital Law – Magnetic Field due Straight Conductors , Circular Loop, Infinite Sheet of Current – Magnetic Flux – Magnetic Flux Density – Energy Stored. **Force, Torque and Inductance:** Magnetic Force, Moving Charge in a Magnetic Field, Lorentz Force – Force Between Two Parallel Current Carrying Conductors – Torque on a Closed Loop in Magnetic Field, Magnetic Boundary Conditions – Magnetic Circuit – Self and Mutual Inductance – Inductance of Solenoid, Co-axial Cable and Transmission Line		
UNIT – IV		**9+3**
Time varying fields: Time Varying Fields – Transformer and Rotational EMF. **Maxwell's equation:** Maxwell's Equation in Point Form and Integral Form – Comparison of Circuit Theory with Field Theory **Electromagnetic Waves (Elementary Ideas only):** Introduction – Wave Equations and Parameters – Wave Propagation in Lossless Dielectrics and Lossy Dielectric – Poynting Theorem –Numerical Methods-FDM, FEM and Moment Method.		
UNIT – V		**9+3**
Electromagnetic Interference and Compatibility (Theoretical Aspects only): Introduction to Electromagnetic Interference and Electromagnetic Compatibility (EMI & EMC) – Sources and Characteristics of EMI – Control Techniques of EMI – Grounding – Shielding – Filtering.		
		Total: 45

TEXT BOOK:

1. Sadiku, Matthew N.O., "Principles of Electromagnetics", 4th Edition, Oxford University Press, New Delhi,2015

REFERENCES:

1. Meenakumari R. and Subasri R., "Electromagnetic Fields", 2nd Edition, New Age International Publishers (P) Ltd., New Delhi, 2007.
2. Kraus John D. and Fleishch Daniel, "Electromagnetics", 5th Edition, McGraw Hill, New York, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	recognize the various coordinate systems and charge distribution	Understanding (K2)
CO2:	apply Gauss's law for the evaluation of EFI for different configurations and its application in capacitor	Applying (K3)
CO3:	interpret the MFI and inductance for different configurations	Applying (K3)
CO4:	examine the electromagnetic wave propagation in different mediums	Applying (K3)
CO5:	summarize the sources of EMI and the control techniques to reduce EMI	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											1	2
CO2	3	2	1										2	3
CO3	3	2	1										2	3
CO4	3	2	1										2	3
CO5	2	1											1	2

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

ASSESSMENT PATTERN - THEORY

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

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

18EET43 - **DIGITAL LOGIC CIRCUITS**

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Introduction to Engineering	4	PC	3	0	0	3
Preamble	The objective of the course is to impart knowledge about the design of combinational and sequential logic circuits that aids the students to perform the analysis and design of various digital electronic circuits						

UNIT – I		**9**
Boolean Algebra and Minimization of Switching functions: Review of Number Systems: Number Base Conversion - Binary arithmetic. Theorems & Laws of Boolean Algebra - Reducing Boolean Expressions - SOP and POS forms - Design Procedure - Gate Level minimization – NAND and NOR implementation. K-map Simplification procedure: Four Variable K-map Simplification - Quine McCluskey Procedure - Don't care condition.		
UNIT – II		**9**
Combinational Circuits: Design Procedure: Adders – Subtractors - Code converters: Binary to Gray code - BCD to Gray code. Design of Multiplexers – Demultiplexers – Encoders: Octal to Binary Encoder – Decoders: 3 Line to 8 Line Decoder – 2 bit Comparators.		
UNIT – III		**9**
Synchronous Sequential Circuits: Latches and Flipflops: Triggering and Characteristics equations of Flipflops. Race around condition - Master slave J-K Flipflop - Flipflop Excitation Tables - Conversion of Flipflops - Synchronous Sequential Logic: Analysis of Clocked Sequential Circuits - State Reduction and Assignment - Design Procedure. Design of a Synchronous 3-bit Up-down Counter Using J-K FFs - Ring counter. Registers: Universal shift registers.		
UNIT – IV		**9**
Asynchronous Sequential Circuits: Asynchronous Sequential Logic: Analysis of unclocked sequential circuits - Design Procedure – Primitive flow table - Reduction of State and Flow Tables – Implication table - Merger graph - State Assignments – Hazards: Static Hazards - Dynamic Hazards – Hazard free Realization- Essential Hazards.		
UNIT – V		**9**
Logic Families and Memory devices: Transistor Transistor Logic (TTL): Two-input TTL NAND Gate – Emitter Coupled Logic (ECL) - Inverter: Complementary Metal Oxide Semiconductor (CMOS) Logic – Comparison of Logic families for their performance. Memory Types: Memory Devices: Static RAMs (SRAMs) - Dynamic RAMs (DRAMs). Read-Only Memory (ROM) organization – Types of ROMs: PROM, EPROM & EEPROM. Introduction to Verilog HDL, Structural level modeling – Basic gates.		
		Total: 45

TEXT BOOK:

1. Soumithra Kumar Mandal, "Digital Electronics Principles and Applications", 11th Edition, Mc Graw Hill, 2017.

REFERENCES:

1. Morris Mano M., "Digital Design with an Introduction to the Verilog", 5th Edition, Pearson Education, 2013.
2. Anand Kumar A., "Fundamentals of Digital Circuits", Prentice Hall of India, 4th Edition (Revised), 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	convert numbers with positional weights from/to binary, decimal, Octal and hexadecimal & apply the minimization procedure for the design of digital circuits	Applying (K3)
CO2:	construct and Implement the Combinational Circuits using Logic Gates	Applying (K3)
CO3:	build and Implement the Synchronous Sequential Circuits using Logic Gates & Flip-flops	Applying (K3)
CO4:	construct and implement circuits using Asynchronous Techniques	Applying (K3)
CO5:	identify the logic families and memory devices	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	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3
CO4	3	2	1	1									2	3
CO5	2	1											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	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)**

18CST44 - OBJECT ORIENTED PROGRAMMING USING C++

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	4	ES	3	0	0	3
Preamble	This course mainly focuses on the basic concepts of object oriented, the methodology of problem solving and developing skills in programming using C++ language.						

UNIT – I		**9**
Principles of Object Oriented Programming : Object Oriented Programming Paradigm - Basic concepts and benefits of OOP - Object Oriented Languages - Applications of OOP - Structure of C++ - Tokens -Expressions and Control Structures - Operators in C++. Functions in C++ - Call by Reference - Return by Reference - Inline Functions – Default and const Arguments - Function Overloading.		
UNIT – II		**9**
Classes and Objects: Specifying a Class – Defining Member Functions - Nesting of Member Functions - Private Member Functions - Memory Allocation for Objects - Static Data Members - Static Member Functions - Array of Objects - Objects as Function Arguments - Friend Functions - Returning Objects - const Member Functions.		
UNIT – III		**9**
Constructors and Destructors: Constructors - Parameterized Constructors – Multiple Constructors in a Class – Constructors with Default Arguments – Dynamic Initialization of Objects - Copy and Dynamic Constructors – Destructors. Overloading: Defining Operator Overloading - Overloading Unary and Binary Operators – Overloading Binary Operators using Friend Functions.		
UNIT – IV		**9**
Inheritance: Defining Derived Classes – Single Inheritance – Multilevel Inheritance - Multiple Inheritance – Hierarchical Inheritance - Hybrid Inheritance - Virtual Base Classes – Abstract Classes. Pointers, Virtual functions and Polymorphism: Pointers to Objects - this Pointer - Pointers to Derived Classes - Virtual Functions - Pure Virtual Functions.		
UNIT – V		**9**
Managing Console I/O Operations: Introduction – C++ Streams – C++ Stream Classes – Unformatted I/O Operations- Formatted Console I/O Operations- Managing Output with Manipulators. Working with Files: Introduction- Classes for File Stream Operations- Opening and Closing a File- Detecting End-of-File - File Modes- File Pointers and Manipulations- Sequential File- Random Access File- Command line Arguments.		
		Total: 45

TEXT BOOK:

1. Balagurusamy E., “Object Oriented Programming with C++”, 7th Edition, Tata McGraw Hill Education (India) Pvt. Ltd., 2018.

REFERENCES:

1. Hubbard John R., Atul Kahate, “Schaum‘s Outline Programming with C++”, 3rd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2017.
2. Venugopal K.R. and Raj Buyya, “Mastering C++”, 2nd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	outline the basic concepts of object oriented programming and apply them to develop object oriented programs	Applying (K3)
CO2	demonstrate the programs using member functions	Applying (K3)
CO3	make use of constructor and destructor functions and apply operator overloading to overload operators for user defined types	Applying (K3)
CO4	demonstrate various types of inheritance and virtual functions to build class hierarchies	Applying (K3)
CO5	develop simple applications using files and use I/O operations	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									2	
CO2	3	2	1	1									2	
CO3	3	2	1	1									2	
CO4	3	2	1	1									2	
CO5	3	2	1	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	15	25	60				100
CAT2	15	25	60				100
CAT3	15	25	60				100
ESE	15	25	60				100

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

18EEL41 - ELECTRICAL MACHINES II LABORATORY

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	4	PC	0	0	2	1
Preamble	The significance of this course renowned in the various fields of engineering applications. For an electrical engineer, it is obligatory to have the practical experience about the synchronous and asynchronous machines.						

List of Experiments :

1. Regulation of three-phase alternator by EMF and MMF methods.
2. Regulation of three-phase alternator by ZPF method.
3. Synchronizing and load/power sharing of alternator
4. V and inverted V curves of three phase synchronous motor.
5. Load test on cage induction motors (1Φ and 3Φ)
6. Speed control of three phase induction motor
7. No load and blocked rotor test on induction motors (1Φ equivalent circuit) – Virtual Lab
8. Performance study of induction generator
9. Analysis of AC machines using software tools

Total: 30

REFERENCES / MANUALS / SOFTWARES:

1. Laboratory Manual
2. Virtual Laboratory

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1:	evaluate the performance and select the rotating machines based on their characteristics curves of AC machines	Evaluate (K4), Manipulation (S2)
CO2:	predict the regulation and demonstrate the synchronization of two alternators for its power sharing	Applying (K3), Precision (S3)
CO3:	utilize the knowledge on computer-aided engineering design of machines	Applying (K3), Manipulation (S2)

Mapping of COs with POs and PSOs

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

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

18EEL42 - DIGITAL CIRCUIT DESIGN LABORATORY

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	4	PC	0	0	2	1
Preamble	The course aims in imparting practical knowledge to design, implement and analyze the digital circuits and systems.						

List of Experiments :

1. Verification of Logic Gates (Discrete components/Verilog HDL)
2. Implementation of given boolean function using logic gates in both SOP and POS forms (Discrete components & Virtual Lab).
3. Implementation of Gray to Binary code converter and 1 bit comparator.
4. Design and implementation of adders and subtractors (Discrete components & Virtual Lab).
5. Realization of D and T flip flop using JK/SR flip flop.
6. Design and implementation of Shift registers using flip flops.
7. Verification of Random Access Memory for its R/W operation.
8. Design and implementation of synchronous up and down counters using flip flops.
9. Implementation of Combinational/Sequential logic circuit using FPGA.
10. Implementation of mini-project using discrete digital components / FPGA Board.

Total: 30

REFERENCES / MANUALS / SOFTWARES:

1. Laboratory Manual
2. Virtual Laboratory
3. Vivado 2018.1 Software, Basys 3 Kit

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	examine and implement the various logic gates and circuits for its operation	Applying (K3, Manipulation (S2)
CO2:	construct and build the combinational and sequential circuits using Logic gates to realize to realize its operation.	Applying (K3), Manipulation (S2)
CO3:	analyze the behavior of combinational & sequential circuits and select the appropriate hardware and software tool for the design of digital circuits.	Analyze (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	3
CO2	3	2	1	1									2	3
CO3	2	3	2	2	1								3	2

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

18CSL43 - OBJECT ORIENTED PROGRAMMING USING C++ LABORATORY

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	4	ES	0	0	2	1
Preamble	This course helps to solve real world problems using object oriented programming concepts with C++ language.						

List of Experiments :

1. Develop C++ function to find Simple Interest using default arguments
2. Implement call by value, call by reference and call by address for exchanging two values
3. Develop a C++ program to demonstrate the use of function overloading for finding sum of the given numbers.
4. Develop a C++ program using array of objects for employee payroll application
5. Design a class timer with constructors and destructor
6. Implement unary and binary operator overloading on the class complex
7. Develop a C++ program to demonstrate the use of friend function between two different classes for temperature conversion.
8. Implement matrix class with dynamic memory allocation and necessary methods
9. Design an application for student mark analysis using various types of inheritance.
10. Develop a program to perform file copy and file compare operations.

Total: 30

REFERENCES / MANUALS / SOFTWARES:

1. Laboratory Manual
2. Linux/Windows operating system
3. C++ Compiler

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	identify and create objects and members for the real world problem	Applying (K3), Manipulation (S2)
CO2:	develop programs using friend function, static function, constructor, destructor and overloading	Applying (K3), Manipulation (S2)
CO3:	demonstrate the use of inheritance and files	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						1	2		2	
CO2	3	2	1	1						1	2		2	
CO3	3	2	1	1						1	2		3	

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

18EET51 - CONTROL SYSTEMS

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	PC	3	1	0	4

Preamble	This course provides the concepts of the mathematical modeling, response and stability analysis of linear systems in time and frequency domain	
Unit - I	**Mathematical Modeling:**	**9+3**
Open loop and closed loop systems-Derivation of transfer function models and state space models(phase variable): Electrical Systems and Mechanical Systems with single and two degree of freedom, Electromechanical Systems: DC Motor - conversion of state model to transfer function- Electrical Analogy of Mechanical Systems. Block diagram reduction using signal flow graphs		
Unit - II	**Time response of Systems:**	**9+3**
Poles, Zeros and System Response-Type and Order of System -Significance of Test Signals-Step response analysis and specifications of first order system and second order System. Steady State Error and Error Constant –State Transition Matrix- time domain solutions of state models of second order systems with step input.		
Unit - III	**Stability Analysis in Time Domain:**	**9+3**
Concepts of Stability - Pole Locations and Stability - Routh Hurwitz Criterion - Root Locus Technique : conditions – angle and magnitude criterion – root locus construction –design of control loop gain.		
Unit - IV	**Frequency Response of Systems:**	**9+3**
Concept of Frequency Response, Frequency Response Analysis: Bode Plot and Polar Plot-gain margin and phase margin-deriving transfer function model from bode plot-Stability analysis in Frequency Domain: Nyquist Stability Criterion.		
Unit - V	**Compensators and Controllers in time domain:**	**9+3**
Effect of addition of poles and zeros on second order system response and system stability - Need for Compensator - Ideal Compensation on Time Response: P, PI, PD and PID controller - Design procedure of Lag and Lead Compensator via Root Locus.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Norman S. Nise, "Control Systems Engineering", 7th Edition, Wiley-India Publishers, India, 2017.

REFERENCES:

1. Nagrath I.J. & Gopal M., "Control Systems Engineering", 6th Edition, New Age International Pvt. Ltd., New Delhi, 2017.
2. Ogata K., "Modern Control Engineering", 5th Edition, Pearson Education, New Delhi, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	derive mathematical models by identifying various components of the control system	Applying (K3)
CO2	analyze transient and steady state response of first and second order systems	Analyzing (K4)
CO3	examine the stability of the systems in time domain.	Analyzing (K4)
CO4	analyze the frequency response of the systems	Analyzing (K4)
CO5	examine the performance of Compensators	Analyzing (K4)

Mapping of COs with POs and PSOs														
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2											2	3
CO2	2	3											3	2
CO3	2	3	2										3	2
CO4	2	3	2										3	2
CO5	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	10	40	50				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)**

18EET52 - POWER ELECTRONICS

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Analog Electronics	5	PC	3	1	0	4

Preamble	This course is designed to impart knowledge about the characteristics of power semiconductor devices, working principle of rectifier, chopper , DC to AC converter and AC to AC converter	
Unit - I	**Power Semi Conductor Devices:**	**9+3**
Introduction – Power Diode – Power BJT - Power MOSFET and IGBT - SCR - TRIAC - GTO - Construction, Principle of operation, Static and Dynamic characteristics - Thyristor Protection – Series and parallel connections of thyristors.		
Unit - II	**Single Phase AC to DC Converters:**	**9+3**
Introduction to uncontrolled rectifier - Single Phase and three phase Controlled Rectifiers with R, RL, RL with freewheeling diode and RLE Load – Estimation of performance parameter: RMS load voltage, RMS load current, Power Factor and Distortion Factor – Effect of source inductance.		
Unit - III	**DC to DC Converters:**	**9+3**
Principle of Step Up and Down Chopper– Chopper Control Strategies – Quadrant of Operation: single quadrant, two quadrant and four quadrant DC Choppers – Introduction to Voltage regulator - Buck, Boost, Buck – Boost – Cuk Regulator		
Unit - IV	**DC to AC Converters:**	**9+3**
Single Phase Bridge Inverters – Three Phase Bridge Inverters: 180^o and 120^o Mode of operation – voltage control of single phase inverter - PWM Inverters: Single, Sinusoidal and Multiple PWM technique – Reduction of harmonics in the inverter output voltage – CSI: Single phase CSI – Basic series inverter.		
Unit - V	**AC Voltage Controllers and Cycloconverters:**	**9+3**
Principle of AC voltage controller (phase control) - Control Strategy (Integral cycle control) – Single Phase AC Voltage Controllers – Cycloconverters: Principle of cycloconverter (operation) - Single Phase to Single Phase Cycloconverter: step down and step up, Midpoint and Bridge – Three Phase to Single Phase Cycloconverter.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Bimbra P.S., "Power Electronics", 6th Edition, Khanna Publishers, New Delhi, 2015.

REFERENCES:

1. Singh M.D. and Kanchandani, "Power Electronics", 2nd Edition, Tata McGraw-Hill, New Delhi, 2016.
2. Rashid M.H., "Power Electronics: Circuits Devices and Applications", 4th Edition, Pearson Education, New Delhi, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	choose various power semiconductor devices based on their construction, operation and characteristics	Understanding (K2)
CO2	explain the working principle of single phase and three phase rectifier and compute its performance parameter	Applying (K3)
CO3	classify and explain the operation of DC to DC converters	Understanding (K2)
CO4	inspect the operation of different type of inverters	Applying (K3)
CO5	categorize different type of AC voltage controllers and cycloconverters	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	2
CO2	3	2	1	1									2	3
CO3	2	1											2	3
CO4	3	2	1	1									1	2
CO5	2	1											2	3

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

ASSESSMENT PATTERN - THEORY

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

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

18EET53 - MICROPROCESSORS AND MICROCONTROLLERS INTERFACING

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

Preamble	To get acquaintance with the architecture of 8085 processor and 8051 controller, apply the embedded programming concepts for interfacing peripherals with the controller and to understand the applications of microcontrollers	
Unit - I	**8085 Microprocessor:**	**9**
Introduction to 8085 Microprocessor-Architecture-Pin configuration-Interrupts–Instruction Set –Addressing Modes–Timing Diagrams–Memory Interfacing –Simple Assembly Language Programs for arithmetic operations.		
Unit - II	**8051 Microcontroller:**	**9**
Introduction to 8051 Microcontroller – Architecture – Memory Organization–Special Function Registers – Program Counter – PSW register –Stack – Instruction set –Addressing modes.		
Unit - III	**8051 Programming:**	**9**
I/O Ports – Timer (Mode 1) / Counter– Serial Communication –Interrupt (Timer, Serial communication) – Programming in Embedded C: I/O port programming–Timer programming-Counter programming-Serial port programming-Interrupt programming.		
Unit - IV	**Interfacing I/O Peripherals with 8051:**	**9**
Programming in Embedded C: LED – Push button switch – Necessity of Relay and Opto-coupler – Keypad – LCD – Seven segments LED – A/D and D/A converters – DC Motor – Stepper motor.		
Unit - V	**Case Study Applications:**	**9**
Microcontroller based Washing machine Control – RS232 Serial communication: MAX 232 for I/O text message communication – Microcontroller based Calculator with extended features using MAX232. Simple Street Light control system, Water Level Indicator and Burglar Alarm System - Mobile phone controlled ROBOT (block diagram with programming approach).		

Total:45

TEXT BOOK:

1. Senthil Kumar N., Saravanan M. & Jeevananthan S., "Microprocessor and Microcontroller", 12th Edition, Oxford University Press, New Delhi, 2015 for Unit I.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi & Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems Using Assembly and C", 2nd Edition, Pearson Education, New Delhi, 2013 for Unit II, III, IV,V.

REFERENCES:

1. Krishna Kant, “Microprocessors and Microcontrollers: Architecture, programming and system design 8085, 8086, 8051, 8096”, 2nd Edition, PHI Learning Pvt. Ltd, New Delhi, 2012.
2. Soumitra Kumar Mandal, “Microprocessors and Microcontrollers Architecture, Programming and System Design 8085,8086 and 8051”, 8th Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain the basic concepts of 8085 microprocessor	Understanding (K2)
CO2	summarize the basic concepts of 8051 microcontroller	Understanding (K2)
CO3	develop embedded c programs for 8051	Applying (K3)
CO4	interface peripheral devices with 8051 microcontroller	Applying (K3)
CO5	recognize microcontroller based case study 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											1	3
CO2	2	1											1	3
CO3	3	2	1	1	1								1	3
CO4	3	2	1	1	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	15	85					100
CAT2	10	45	45				100
CAT3	10	45	45				100
ESE	5	50	45				100

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

18EET54 – GENERATION, TRANSMISSION AND DISTRIBUTION

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Principles of Electrical and Electronics Engineering, Electromagnetic Theory	5	PC	3	1	0	4

Preamble	This course is aimed to introduce the fundamental concepts and principles in generation, transmission, and distribution of electric power	
Unit – I	**Generation:**	**9+3**
Structure of power system – Indian energy scenario – Load duration curve – Demand factor – Plant capacity – Plant Use factor – Tariff – Types – Conventional source of electrical energy – schematic arrangement of thermal power generation – fuel handling – Ash handling – dust collection- auxiliaries – schematic arrangement of hydroelectric power generation – Classification – IE Rules		
Unit – II	**Electrical Design of Transmission Lines:**	**9+3**
Parameters of Transmission Line – Resistance – Skin and Proximity Effects – Solid, Stranded and Bundled Conductors – Inductance and Capacitance of Single and Three Phase Transmission Lines with Single Circuit – Double Circuit (Solid conductor) – Symmetrical and Unsymmetrical Spacing and Transposition		
Unit – III	**Analysis of Transmission Lines:**	**9+3**
Short Line, Medium Line (PI model) and Long Line; Equivalent Circuits, Attenuation Constant, Phase Constant, Surge Impedance; Transmission Efficiency and Voltage Regulation; Surge Impedance Loading – Ferranti Effect Corona: Phenomena of Corona – Factors Affecting Corona – Disruptive Critical Voltage – Visual Critical Voltage – Corona Loss (Qualitative analysis)		
Unit – IV	**Mechanical Design of Transmission Lines:**	**9+3**
Insulators: Types, Voltage Distribution in Insulator String and Grading, Improvement of String Efficiency – Failure of Insulators Sag and Tension Calculations: Classification of towers, Sag and Tension in OH lines – Equation of Sag- Calculation of Sag – Towers at Equal Heights – Unequal Heights		
Unit – V	**Distribution Systems:**	**9+3**
Components of Distribution System – Types – DC Distribution: DC Distributor – Concentrated and Uniform Loading. AC Distribution: AC Distributor – Concentrated Load – Three Phase Four Wire Distribution System – Sub-Mains – Stepped and Tapered Mains – Kelvin's Law. Underground Cables: Constructional Features of LT and HT Cables, Capacitance, Dielectric Stress and Grading, Thermal Characteristics(Qualitative analysis) – Cable Faults and Testing		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Gupta J.B., "A Course in Power Systems", 11th Edition, S.K. Kataria & Sons, New Delhi, 2017.

REFERENCES:

1. Wadhwa C.L., "Electrical Power Systems", 7th Edition, New Age International Publishers, New Delhi, 2017.
2. Kothari D.P. & Nagrath I.J., "Power System Engineering", 3rd Edition, Mc Graw Hill Education (India) Pvt. Ltd., New Delhi, 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain the various types of generation systems	Understanding (K2)
CO2	calculate the transmission network parameters for various configurations	Applying (K3)
CO3	analyze the performance characteristics of the given transmission line and explain the effect of corona	Analyzing (K4)
CO4	calculate string efficiency of the insulators and Sag of a overhead line for various conditions	Applying (K3)
CO5	calculate the voltage at a point on the given type of distribution system and compute the insulation resistance, capacitance and grading of cables	Applying (K3)

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

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

ASSESSMENT PATTERN – THEORY

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

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

18EEL51 – CONTROL AND INSTRUMENTATION LABORATORY

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	PC	0	0	2	1

List of Exercises / Experiments :

1.	Determination of Transfer Function Parameters of DC Servomotor.
2.	Determination of Transfer Function Parameters of AC Servomotor.
3.	Design of controller.
4.	Design of compensator.
5.	Analysis of second order time domain specifications of system using MATLAB
6.	Effect of Addition of Poles and Zeros on System Stability using MATLAB.
7.	Stability Analysis of Linear Systems Using Bode Plot And Root Locus using MATLAB.
8.	Characteristics of Transducers (LVDT, Strain gauge, Load cell).
9.	Calibration of Energy Meter.
10.	Dynamics of Sensors.

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 controllers and compensator and Estimate the transfer function of AC and DC servo motor	Applying (K3), Manipulation (S2)
CO2	prepare MATLAB coding to find various control system parameters and analyze the stability of the systems	Analyzing (K4), Manipulation (S2)
CO3	analyze the characteristics of various sensors and transducers and select sensor and transducers for various applications	Analyzing (K4), Manipulation (S2)

Mapping of COs with POs and PSOs

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

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

18EEL52 – POWER ELECTRONICS LABORATORY

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	PC	0	0	2	1

List of Exercises / Experiments :

1.	Steady state characteristic of SCR
2.	Single Phase half controlled and fully controlled rectifiers
3.	Three Phase fully controlled rectifiers
4.	Step down and step up converter
5.	Three phase inverters – 180° and 120° mode of operation
6.	Three phase AC voltage controller
7.	Simulation of DC converters (Single phase , three phase controlled converters and choppers)
8.	Simulation of AC converters (inverter and ac voltage regulator)
9.	PWM signal generation using DSPACE
10.	Design of converter

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual
2.	MATLAB Software
3.	DSPACE, PSIM software and Power quality analyzer

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	examine and Estimate the performance of AC and DC converters	Analyzing (K4), Manipulation (S2)
CO2	demonstrate and Execute the performance of Inverter and AC voltage controller	Analyzing (K4), Manipulation (S2)
CO3	design and Build a suitable power converter	Applying (K3), Manipulation (S2)

Mapping of COs with POs and PSOs

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

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

18EEL53 – MICROCONTROLLER AND INTERFACING LABORATORY

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	PC	0	0	2	1
Preamble	To design and develop interfacing circuits for 8051 microcontroller and microcontroller based instrumentation systems.						

List of Exercises / Experiments :

1.	Arithmetic operations using 8085 microprocessor
2.	Interfacing of switches and relays
3.	Interfacing of LED and seven segment LED
4.	Interfacing of Keypad and LCD
5.	Interfacing of ADC/DAC
6.	Interfacing of DC motor
7.	Interfacing of stepper motor
8.	Interfacing of servo motor
9.	Interfacing of different sensors for a given case study
10.	Design of simple closed loop applications using Microcontroller

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual
2.	Microcontroller Programming Software for 89c51 Microcontroller and Dumper kits.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	demonstrate the instructions in 8085	Applying (K3), Precision (S3)
CO2	design interfacing circuits with 8051 microcontroller	Applying (K3), Precision (S3)
CO3	develop microcontroller based systems for instrumentation applications	Analyzing (K4), Precision (S3)

Mapping of COs with POs and PSOs

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

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. & Electrical and Electronics 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. & Electrical and Electronics 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)**

18EET61 - SIGNALS AND SYSTEMS

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

Preamble	This course helps the students to impart the knowledge on various types of signals and systems with their mathematical representations, various transformation techniques and their computations.	
Unit - I	**Continous Time Signals and Systems:**	**9**
Standard continuous time signals –Classification -Mathematical operation on continuous time signals–Impulse signal - Classification of continuous time systems- Response of LTI CT systems in time domain - Response of CT systems using convolution-Convolution properties		
Unit - II	**Discrete Time Signals and Systems:**	**9**
Discrete and digital signals-Standard discrete time signals-Classification of discrete time signal-Mathematical operation on discrete time signal-Classification of discrete time systems- Representation of discrete time signals as summation of impulses-Response of LTI discrete time systems using discrete convolution-Convolution properties-Computation of linear convolution using matrix method-Circular convolution-Computation of circular convolution using matrix method.		
Unit - III	**Z Transform:**	**9**
Z transform- Region of convergence-Properties of Z transform-properties of ROC- Inverse Z transforms- ROC and its properties-Transfer function of LTI discrete time systems using Z-transform – Impulse response and transfer function - Relation between Laplace transform and Z transform.		
Unit - IV	**Fourier Transform of Continuous and Discrete Time Signals and Systems:**	**9**
Fourier Transform– Properties of FT- FT of CT signals - Relation between Fourier and Laplace transform-Fourier transform of discrete time signals-Properties of DTFT-Relation between Fourier transform and Z-transform		
Unit - V	**Discrete Fourier Transform and FFT:**	**9**
Discrete Fourier Transform of discrete time signals-Fast Fourier Transform- Decimation In Time (DIT) radix-2 FFT- Decimation In Frequency (DIF) radix-2 FFT- computation of inverse DFT using FFT		

Total:45

TEXT BOOK:

1. Nagoor Kani. A, "Signals and Systems", 2nd Edition, Tata McGraw-Hill Education, New Delhi, 2010.

REFERENCES:

1. Salivahanan. S, "Digital Signal Processing", 3rd Edition, Tata McGraw Hill Education, New Delhi, 2017.
2. John.G.Proakis & Dimitris.G.Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", 4th Edition, Pearson Education, India, 2007.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	classify the various types of continuous signals and systems with mathematical background	Applying (K3)
CO2	compare various types of discrete time signals and systems.	Applying (K3)
CO3	interpret the importance of Z-transform in DT signals and systems.	Applying (K3)
CO4	analyze CT and DT signals in frequency domain	Analyzing (K4)
CO5	apply DFT using FFT on various discrete time signals	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18EET62 - POWER SYSTEM ANALYSIS

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Circuits and Networks & Generation, Transmission and Distribution	6	PC	3	1	0	4

Preamble	This course imparts knowledge about the modeling of power system components, load flow analysis and stability analysis. The course also describes the various types of faults occurs in power system	
Unit - I	**Modeling of Power System:**	**9+3**
Introduction-per unit quantities-changing the base of per unit quantities-one line diagram-impedance and reactance diagram-per unit impedances of a generator, transformer, synchronous machines, transmission lines-per phase representation.		
Unit - II	**Load Flow studies:**	**9+3**
The bus admittance matrix, network incidence matrix and Y-bus, node elimination, power flow problem, Gauss-Siedel method, Newton-Raphson method, Numerical solution of power flow problem by GS method not more than three buses		
Unit - III	**Symmetrical Faults in Electrical systems:**	**9+3**
Need for short circuit study – bus impedance matrices-symmetrical fault analysis- fault calculation using Thevenin's Theorem –fault calculations using Z-bus –selection of circuit breakers		
Unit - IV	**Unsymmetrical Faults in Electrical systems:**	**9+3**
Synthesis of unsymmetrical phasors from their symmetrical components- sequence impedance and sequence network of power system, synchronous machine, transmission lines and transformers. single line-to -ground fault, line-to- line fault, double line-to- ground fault.		
Unit - V	**Stability Analysis:**	**9+3**
Introduction to power system stability –Rotor dynamics and the Swing equation–power angle equation-equal area criterion of stability-applications of equal area criterion-multimachine stability studies: classical representation step by step solution of the swing curve-transient stability studies-factors affecting transient stability.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Grainger John J.& Stevenson W.D, "Power System Analysis", 1st Edition, Tata McGraw- Hill, New Delhi, 2017.

REFERENCES:

1. Nagrath I.J.& Kothari D.P, "Modern Power System Analysis", 4th Edition, Tata McGraw- Hill, New Delhi, 2011.
2. Wadhwa C.L , "Electrical Power Systems", 7th Edition, New Age International Publishers Pvt. Ltd, New Delhi, 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	model various power system components	Understanding (K2)
CO2	evaluate the bus powers, line flows and line losses using various power flow methods	Applying (K3)
CO3	calculate the symmetrical fault currents	Applying (K3)
CO4	analyze the different types of unsymmetrical faults	Applying (K3)
CO5	Predict the stability of the power system	Understanding (K2)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18EET63 - ELECTRIC DRIVES AND CONTROL

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Electrical Machines I, Electrical Machines II, Power Electronics	6	PC	3	0	0	3

Preamble	This course aims in imparting knowledge about various DC and AC drives and selection of drives for various applications	
Unit - I	**Drive Characteristics:**	**9**
Drive classifications - Advantages of Electric Drives-Equations governing motor load dynamics - Equilibrium operating point and its steady state stability - Mathematical condition for steady state stability and problems - Multi quadrant dynamics in the speed torque plane - Basics of regenerative braking - Typical load torque characteristics - Acceleration, deceleration, starting and stopping.		
Unit - II	**Converter / Chopper Fed DC Motor Drive:**	**9**
DC motor and their performance - Braking - Steady state analysis of the single and three phase fully controlled converter fed separately excited D.C motor drive - Continuous and discontinuous conduction mode - Dynamic braking with DC chopper - Four Quadrant operation - Chopper fed regenerative braking- Effect of Ripples in DC motor performance – Closed loop control of DC drives.		
Unit - III	**Induction Motor Drives:**	**9**
Analysis and performance of three-phase induction motor - Stator voltage - stator frequency control V/F control, controlled current and controlled slip operation - PWM inverter drives - Voltage Source Inverter, Current Source Inverter and cycloconverter fed induction motor drives - Harmonic behaviour of induction motors - Rotor slip power recovery schemes. Closed Loop Control Of Induction Motor Drive		
Unit - IV	**Synchronous Motor Drives:**	**9**
Principle of vector control - Open loop v/f control – self-controlled synchronous motor drive using load commutated thyristor inverter - self-control of CSI and VSI fed synchronous motor - Margin angle control and power factor control - Permanent magnet (PM) synchronous motor- Characteristics of permanent magnet synchronous machines - Drive characteristics and control principles		
Unit - V	**BLDC, Stepper Motor Drives and Applications:**	**9**
Brushless DC motor drives and its applications - Variable reluctance and permanent magnet stepper motor Drives - Selection of drives and control schemes for steel rolling mills, paper mills, PLL, PID based control of drives –Closed loop control of BLDC Drives- Development of sensor less BLDC motor control scheme using PIC Controller – Solar and Battery powered drives		

Total:45

TEXT BOOK:

1. Dubey G.K, "Fundamentals of Electrical Drives", 2nd Edition, Narosa Publishing House, New Delhi, 2019.

REFERENCES:

1. Vedam Subrahmanyam, "Electric Drives: Concepts and Applications", 2nd Edition, McGraw-Hill, New Delhi, 2010.
2. Bose B.K, "Power Electronics and Variable Frequency Drives: Technology and Applications", 1st Edition, Wiley India Pvt. Ltd., , New Delhi, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	analyse the motor load characteristics	Applying (K3)
CO2	apply power converters for speed control of DC drives	Applying (K3)
CO3	understand the operation and control of Induction motor drives	Understanding (K2)
CO4	analyse the performance of synchronous motor drives	Applying (K3)
CO5	understand the operation of special electrical machines and control schemes for various industrial applications	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									2	3
CO2	3	2	1	1									2	3
CO3	2	1											1	2
CO4	3	2	1	1									2	3
CO5	3	2	1	1									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	50	40				100
CAT2	10	60	30				100
CAT3	10	60	30				100
ESE	10	60	30				100

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

18EET64 - POWER SYSTEM PROTECTION AND SWITCHGEAR

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Generation, Transmission and Distribution	6	PC	3	0	0	3

Preamble	The objective of the course is to impact knowledge about the need for protective relays in power systems, protective relays used for the protection of Generators, Transmission line, and Transformers. The course will also describes the various types of circuit breakers used in power system.	
Unit - I	**Introduction:**	**9**
Protective Relays: Need for protection - Zones of protection - Power System Earthing –Types of earthing - Classification of relay: Electromagnetic relays, Over current relays - Distance relay: Impedance, Reactance, Mho Relay - Differential relays -Negative phase sequence relay		
Unit - II	**Protection of Power Equipment:**	**9**
Generator protection: Stator protection: Percentage differential protection- stator inter-turn protection - Stator overheating protection. Rotor protection: Earth fault protection - Loss of excitation - Rotor overheating protection. Transmission line protection: Protection of feeder and ring main system - Pilot wire protection - Carrier current protection - Transformer protection: Incipient fault Protection - Differential protection - over fluxing protection		
Unit - III	**Theory of Circuit Interruption:**	**9**
Physics of arc phenomena and arc interruption – Methods of arc Extinction- Theories of Arc interruption- Arc voltage - Restriking voltage and recovery voltage –Expression for Restriking voltage and Rate of Rise of Restriking Voltage - Current chopping- interruption of capacitive currents - Resistance switching.		
Unit - IV	**Circuit Breakers:**	**9**
Classification of circuit breakers - Circuit breaker operating mechanism: Oil, Air Blast, SF6, Vacuum - Selection of C.B. - Comparative merits of different circuit breakers-Testing of C.B: Type test and Routine test- Direct testing - Indirect testing		
Unit - V	**Advanced relays and FACTS devices:**	**9**
Introduction of microprocessor based protective relay - Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators – Block diagram of Numerical relay – FACTS: Basic FACTS controllers - TCSC, SVC, STATCOM, UPFC		

Total:45

TEXT BOOK:

1. Gupta J.B , "A Course in Power Systems", 11th Edition, S.K.Kataria & Sons, New Delhi, 2017.

REFERENCES:

1. Sunil S Rao, "Switchgear Protection and Power Systems", 13th Edition, Khanna Publishers, New Delhi, 2008.
2. Badri Ramand &Vishwakarma, "Power System Protection and Switchgear", 2nd Edition, Tata McGraw-Hill, New Delhi, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	outline the basic concepts of protection	Understanding (K2)
CO2	select the protection schemes for power system components	Applying (K3)
CO3	analyze the various problems in circuit interruption	Applying (K3)
CO4	compare the different type of circuit breakers performances	Understanding (K2)
CO5	understand the advanced relays and FACTS devices used in power system	Understanding (K2)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18EEL61 - SIGNALS AND SYSTEMS LABORATORY

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	6	PC	0	0	2	1

List of Exercises / Experiments :

1.	Generation and analysis of continuous time signals using MATLAB.
2.	Generation and analysis of discrete time signals using MATLAB.
3.	Verification of sampling theorem using MATLAB.
4.	Verification of linear and time varying system using MATLAB.
5.	Determination of step and impulse responses of LTI systems using MATLAB.
6.	Linear and circular convolution using MATLAB.
7.	Determination of FFT of a discrete time signal using MATLAB.
8.	Generation of discrete time sinusoidal signal using DSP Processor.
9.	Implementation of linear convolution using DSP processors.
10.	Design and development of MATLAB code for any real time discrete time signals and systems applications using MATLAB.

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual
2.	MATLAB
3.	TMS320C54XX DSP Trainer Kit

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	execute various signals and signal processing algorithms using MATLAB	Understanding (K2), Manipulation (S2)
CO2	demonstrate the implementation of various signals and systems using DSP processor.	Applying (K3), Precision (S3)
CO3	develop and simulate MATLAB code for any real time applications	Applying (K3), Precision (S3)

Mapping of COs with POs and PSOs

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

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

18EEL62 - POWER SYSTEMS LABORATORY

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	6	PC	0	0	2	1

List of Exercises / Experiments :

1.	Computation of line parameters for single and double circuits.
2.	Modeling of medium transmission lines.
3.	Formation of bus admittance and impedance matrices.
4.	Load flow analysis using Gauss Seidal method.
5.	Symmetrical and Unsymmetrical fault analysis.
6.	Transient and small signal stability analysis: Single-Machine infinite bus system.
7.	Characteristics of over current/ overvoltage relay.
8.	Bias characteristics of differential relay.
9.	Measurement of breakdown voltage of liquid dielectric.
10.	Characteristics of negative sequence relay.
11.	Study of Buchholz relay, MCB, ELCB.

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual
2.	MATLAB,AU power, Mi-power Software

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	compute the line parameters and evaluate the performance indices	Applying (K3), Manipulation (S2)
CO2	analyze the network matrices to carryout various power system studies	Analyzing (K4), Manipulation (S2)
CO3	compute the time current characteristics of analog/digital/numerical relays	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									1	1
CO2	3	3	2	2	1								2	2
CO3	3	2	1	1									1	1

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

18EEL63 - ELECTRICAL DRIVES LABORATORY

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	6	PC	0	0	2	1

List of Exercises / Experiments :

1.	Simulation of closed loop control of converter/chopper fed DC motor.
2.	Simulation of VSI fed Three phase induction motor.
3.	Simulation of Three phase synchronous motor drive.
4.	Speed control of DC motor using Three phase Rectifier.
5.	Speed control of Three phase induction motor using PWM inverter.
6.	FPGA based drive for induction motor.
7.	DSP based Speed control of BLDC motor drive.
8.	Speed control of SRM Drive in open and closed loop.
9.	DSP based chopper drive for DC Motor(Programming and Implementation).

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual
2.	MATLAB Software
3.	DSPACE, PSIM software and Power quality analyzer

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	examine the performance of DC and AC drives using software tool	Analyzing (K4), Manipulation (S2)
CO2	demonstrate the speed control of DC and AC motor using conventional techniques	Applying (K3), Manipulation (S2)
CO3	execute the modern digital control techniques for the speed control of DC motor, AC motor and special electrical machines.	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	2	1								3	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3

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. & Electrical and Electronics 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)**

18EEP61 - PROJECT WORK I PHASE I

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	--	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 a real world problem and develop the design solutions	Applying (K3)
CO2	select the proper components as per requirements of the design/system	Applying (K3)
CO3	apply the new tools, algorithms, methodologies that contribute to obtain the solution of the project	Analyzing (K4)
CO4	analyze the findings and execute the project with developed prototype as a team	Analyzing (K4)
CO5	defend the findings and conclude with oral/written reports.	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	2	3	2		3	2	3	2		2	1	2	2
CO2	3	2	3	2	2	3	2	3	2		2	1	2	2
CO3	3	3	2	3	3	2	1	2	3	2	3	2	1	1
CO4	3	3	2	2	1	1	1	2	3	2	3	2	1	1
CO5	1		1	1				3	3	3	3	3	2	2

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. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	7	HS	3	0	0	3

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

Total:45

TEXT BOOK:

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

REFERENCES:

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

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

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

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

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

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

Mapping of COs with POs and PSOs

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

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

18EEP71 - PROJECT WORK I PHASE II

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	--	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 a real world problem and develop the design solutions	Applying (K3)
CO2	select the proper components as per requirements of the design/system	Applying (K3)
CO3	apply the new tools, algorithms, methodologies that contribute to obtain the solution of the project	Analyzing (K4)
CO4	analyze the findings and execute the project with developed prototype as a team	Analyzing (K4)
CO5	defend the findings and conclude with oral/written reports.	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	2	3	2		3	2	3	2		2	1	2	2
CO2	3	2	3	2	2	3	2	3	2		2	1	2	2
CO3	3	3	2	3	3	2	1	2	3	2	3	2	1	1
CO4	3	3	2	2	1	1	1	2	3	2	3	2	1	1
CO5	1		1	1				3	3	3	3	3	2	2

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

18EEP81 - PROJECT WORK II

Programme & Branch	B.E. & Electrical and Electronics 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 a real world problem and develop the design solutions	Applying (K3)
CO2	select the proper components as per requirements of the design/system	Applying (K3)
CO3	apply the new tools, algorithms, methodologies that contribute to obtain the solution of the project	Analyzing (K4)
CO4	analyze the findings and execute the project with developed prototype as a team	Analyzing (K4)
CO5	defend the findings and conclude with oral/written reports.	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	2	3	2		3	2	3	2		2	1	2	2
CO2	3	2	3	2	2	3	2	3	2		2	1	2	2
CO3	3	3	2	3	3	2	1	2	3	2	3	2	1	1
CO4	3	3	2	2	1	1	1	2	3	2	3	2	1	1
CO5	1		1	1				3	3	3	3	3	2	2

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

18EEE01 - ELECTRONIC CIRCUIT ANALYSIS

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Principles of Electrical and Electronics Engineering, Analog Electronics	4	PE	3	0	0	3

Preamble	This course enhances the knowledge on the analysis of different amplifiers, characteristics and their applications.	
Unit - I	**Frequency Analysis of BJT and MOSFET Amplifiers:**	**9**
Hybrid model of BJT – Low frequency small signal analysis and Miller effect – MOSFET : Introduction – Biasing – Hybrid model (common source) – Small signal analysis (Common Source) – Power amplifiers.		
Unit - II	**Non-Linear Applications of Operational Amplifiers:**	**9**
Comparators – Zero crossing detector, Window detector – Level Detector – Monostable Multivibrators – Clippers, Clampers, Peak Detector – Sample and Hold circuit.		
Unit - III	**Operational Amplifier in Signal Conditioning Circuits:**	**9**
Active filters – Design of first order low pass and high pass – 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 - IV	**Special ICs:**	**9**
Timer (IC 555): Functional block, characteristics of 555 Timer – Application – IC-566 voltage controlled oscillator – 565-phase locked loop IC – AD633 Analog multiplier ICs.		
Unit - V	**Application ICs:**	**9**
AD623 Instrumentation Amplifier and its application – IC voltage regulators – LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply – LM317, 723 Variability voltage regulators, switching regulator – SMPS – ICL 8038 function generator IC.		

Total:45

TEXT BOOK:

1. Roy D. Choudhary & Sheil B. Jain, "Linear Integrated Circuits", 2nd Edition, New Age, New Delhi, 2014.

REFERENCES:

1. Salivahanan S. , Suresh Kumar N. & Vallavaraj A, "Electronic Devices and Circuits", 3rd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2014.
2. Boylestad & Nashelsky, "Electronic Devices and Circuit Theory", 11th Edition, Pearson Education, New Delhi, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain the frequency analysis of BJT and MOSFET amplifiers	Understanding (K2)
CO2	design the non linear applications of Op-amp	Applying (K3)
CO3	elaborate the working of op-amp in signal conditioning circuits	Understanding (K2)
CO4	illustrate the functional blocks and the applications of special ICs like Timers and PLL circuits	Understanding (K2)
CO5	examine and implement the IC's for various 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	1
CO2	3	2	1	1									3	2
CO3	2	1											2	1
CO4	2	1											2	1
CO5	3	2	1	1									3	2

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

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	65	20				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)**

18EEE02 - FUNDAMENTALS OF SOLAR CELL

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

Preamble	This course brings an extensive coverage of solar cell incorporating its types, design procedures and fabrication techniques	
Unit - I	**Introduction:**	**9**
Photovoltaic cells and power generation – Characteristics of a photovoltaic cell – Origin of photovoltaic action – Semiconductor-semiconductor junction – Junctions in organic materials.		
Unit - II	**Analysis of PN Junction:**	**9**
Formation of a pn Junction – Depletion Approximation – Calculation of Carrier and Current Densities – pn Junction in the Dark – pn Junction under Illumination – Effects of pn Junction Characteristics		
Unit - III	**Monocrystalline Solar Cells:**	**9**
Principles of Cell Design – Material and Design Issues – Silicon Material Properties – Silicon Solar Cell Design – GaAs Solar Cell Design.		
Unit - IV	**Thin film Solar Cells:**	**9**
Thin Film photovoltaic Materials – Amorphous Silicon – Amorphous Silicon Solar Cell Design – Defects in Polycrystalline Thin Film Materials – CdTe Thin Film Solar Cells – Thin Film Silicon Solar Cells.		
Unit - V	**Strategies for High Efficiency:**	**9**
Thermodynamic limits to efficiency – Multiple band gaps – Tandem cells – Intermediate band and multiple band cells– Hot carriers – Impact insolation solar cells		

Total:45

TEXT BOOK:

1.	Nelson.J, "The Physics of Solar Cells", Imperial College Press, 2007.

REFERENCES:

1.	Angèle Reinders, Pierre Verlinden, Wilfried van Sark and Alexandre Freundlich, "Photovoltaic Solar Energy: From Fundamentals to Applications", Wiley, 2017.
2.	Sabu Thomas and Aparna Thankappan, "Solar cell- basic to advanced concepts and implementation", 1st Edition, Academic Press, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	outline the fundamental concepts of pn junction	Understanding (K2)
CO2	apply the design techniques for monocrystalline solar cells	Applying (K3)
CO3	apply the design techniques for thin film solar cells	Applying (K3)
CO4	make use of design procedures involved in organic solar cells	Applying (K3)
CO5	utilize the nuances involved in cell fabrication	Applying (K3)

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	3	2	1										2	3
CO3	3	2	1										2	3
CO4	3	2	1										2	3
CO5	3	2	1										2	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

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

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

18EEE03 - ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

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

Preamble	The purpose of this course is to provide basic conceptual knowledge and logics on electronic measurements and instruments. This course provides scope to learn about microprocessor based implementation of specific parameters for better understanding.	
Unit - I	**Electronic Instruments:**	**9**
Voltmeters: AC, DC, Balanced Bridge, Differential, Electrometers – Selection of AC Voltmeters – Ammeters: AC Ammeter, Electronic Analog, Digital, Vector Impedance Meters, Electronic Galvanometers, Q-meter, Electronic Analog Ohmmeter, LCR Meter		
Unit - II	**Electronics Instrument For Measuring Basic Parameters:**	**9**
Digital Frequency Meter – Circuit for Measurement of Frequency – High Frequency Measurements – Period Measurement – Ratio and Multiple Ratio Measurements – Time Interval Measurements – Vector Impedance Meter – Electronic Digital Counters – Phase Meters.		
Unit - III	**Instrument for Generation and Analysis of Waveforms:**	**9**
Introduction – Sine Wave Generator – Audio Frequency Signal Generator – Pulse and Square Wave Generator – Function Generator – Wave Analyzers – Harmonic Distortion Analyzer – Spectrum Analyzer. Cathode Ray Oscilloscope: Introduction – Oscilloscope Block Diagram – Cathode Ray Tube – Delay Line – Multiple Trace – Oscilloscope Scope and Transducers – Measurement Techniques (Frequency, Phase angle and Time Delay) – Digital Storage Oscilloscope.		
Unit - IV	**Transducers:**	**9**
Classification of Transducers – Selection of Transducers – Metallic Strain Gauge Sensing Elements – Oscillation, Potentiometric and Velocity Transducers – Application of Linear Position Sensors – Microprocessor based Measuring Systems: Electrical Quantities (voltage, power). Data Acquisition And Conversion: Introduction to Data Acquisition System – Basic Components of DAS – Typical PC based DAS – Analog and Digital Input/output Sub-system (Qualitative Approach only) – Single Channel DAS – Multi-Channel DAS – IC Based DAS – Data Acquisition – Data Acquisition in PLC.		
Unit - V	**Signal Converters:**	**9**
I To P / P To I Converter – Temperature to Voltage Converter – Conversion to Frequency, Period or Time Duration – Measurement of Phase Difference Using X-OR and SR Flip –Flop Method – Measurement of Active and Reactive Power of Supply Line – Locking Amplifiers – Variable Oscillators – Microcontroller Interfacing using Direct Sensors.		

Total:45

TEXT BOOK:

1. Helfrick Albert D. & Cooper W.D., "Modern Electronic Instrumentation and Measurement Techniques", 1st Edition, Pearson Education, New Delhi, 2016.

REFERENCES:

1. Kalsi H.S., "Electronic Instrumentation", 2nd Edition, Tata McGraw-Hill Education, New Delhi, 2004.
2. Gupta J.B., "A course in Electronics and Electrical Measurements and Instruments", 13th Edition, S.K.Kataria and Sons, New Delhi, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	make use of the conceptual idea behind electronic meters and its operation	Applying (K3)
CO2	identify and use the suitable Electronic instruments for measuring the basic parameters	Applying (K3)
CO3	use appropriate instrument to analyse the waveform generated using suitable techniques	Applying (K3)
CO4	describe the data acquisition and conversion, utilization & interpretation of various transducers	Understanding (K2)
CO5	infer the logics of measurement and instrumentation techniques the electrical parameters	Understanding (K2)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18ECE06 - COMMUNICATION ENGINEERING

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

Preamble	This course provides the basic concepts about analog and digital communication modes and systems that are employed in information transmission between source and destination. A short range wireless communication is also addressed.	
Unit - I	**Amplitude Modulation:**	**9**
Principles of Amplitude Modulation – AM Envelope – Frequency Spectrum and Bandwidth – Modulation Index and Percentage Modulation – AM Power Distribution – AM Current calculation – AM Modulating Circuits: Low Level AM Modulator – AM Transmitters: Low level Transmitter – AM Receivers: Superheterodyne Receivers.		
Unit - II	**Angle Modulation:**	**9**
Angle Modulation – FM and PM waveforms – Phase Deviation and Modulation Index - Frequency Deviation - FM and PM Modulators and Demodulators – Phasor Representation and Average Power of Angle Modulated Waves - Bandwidth Requirement - Narrowband FM and Broadband FM – Angle Modulation vs. Amplitude Modulation – Direct FM Transmitter: Crosby – PLL; Double Conversion FM Receivers - FM Demodulator : PLL FM Demodulator.		
Unit - III	**Digital Modulation:**	**9**
Sampling – Nyquist Rate – Introduction to Analog, Digital Data and Signals – Digital signal: Information Capacity, Bits, Bit Rate – Baud and Maximum Bandwidth – Amplitude Shift Keying – Frequency and Phase Shift Keying – Bit Error Rate Calculation – Pulse Code Modulation – Delta Modulation.		
Unit - IV	**Data Communication:**	**9**
Data Communication Codes: ASCII – BAR codes – Error Control – Error Detection – Error Correction – Hamming – Line coding : AMI – NRZ – RZ – Serial Interfaces : RS232 – RS485 – Data Communication Circuits – Telephone Modems – Types.		
Unit - V	**Bandwidth Utilization:**	**9**
Time and Frequency Division Multiplexing. – Frequency Hopping and Direct Sequence Spread Spectrum. Short range Wireless Technologies: PANs, WiMax and Bluetooth – Zigbee and Mesh Wireless Networks.		

Total:45

TEXT BOOK:

1. Wayne Tomasi, "Electronic Communications Systems: Fundamentals Through Advanced", 5th Edition, Pearson Education, New Delhi, 2008.

REFERENCES:

1. Michael Moher & Simon Haykin, "Communication System", 5th Edition, Wiley India Pvt. Ltd, New Delhi, 2011.
2. Forouzan Behrouz A, "Data Communications and Networking", 4th 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	analyze the various parameters of amplitude modulation techniques.	Analyzing (K4)
CO2	compare various angle modulation techniques.	Understanding (K2)
CO3	explain the concept of digital modulation techniques.	Understanding (K2)
CO4	apply the various data communication codes for error detection and discuss interfaces.	Applying (K3)
CO5	identify the next generation wireless 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	3	2	2									2	2
CO2	2	1											1	2
CO3	2	1											1	2
CO4	3	2	1	1									2	2
CO5	2	1											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	20	50	20			100
CAT2	10	40	30	20			100
CAT3	10	40	30	20			100
ESE	10	40	30	20			100

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

18CST45 - DATA STRUCTURE AND ALGORITHMS

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

Preamble	This is an introductory course for basic Data Structures and Algorithms. It deals with basic concepts and techniques of linear and non-linear data structures.	
Unit - I	**List:**	**9**
Data Structures - Abstract Data Types (ADT) - List ADT and Array Implementation -Singly Linked List - Doubly Linked List - Circular Linked List.		
Unit - II	**Stack and Queues:**	**9**
Stack ADT – Operations – Array and Linked List implementation of Stacks - Evaluation of Expressions - Queue ADT – Operations - Array and Linked List implementation of Queues.		
Unit - III	**Trees:**	**9**
Preliminaries – Binary Trees –Binary Tree Traversals- In order - Pre order - Post order - Search Tree ADT – Binary Search Trees– Insertion-Deletion Operations- Heaps.		
Unit - IV	**Graphs:**	**9**
Definitions – Elementary Graph Operations - Decrease and Conquer Algorithms -Topological Sort - Greedy Algorithms – Shortest-Path Algorithms – Single Source/All Destinations: Non-negative edge costs – Minimum Cost Spanning Tree – Prim‘s Algorithm - Kruskal‘s Algorithm.		
Unit - V	**Sorting:**	**9**
Preliminaries – Insertion Sort – Heapsort – Divide and Conquer Algorithms- Quick sort –Merge sort - Hashing – Static Hashing-Hash Tables- Hash function - Overflow handling.		

Total:45

TEXT BOOK:

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

REFERENCES:

1. Weiss M. A, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education Asia, New Delhi, 1997.
2. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	implement the different types of list and Summarize their operations	Applying (K3)
CO2	make use of ADTs like stacks, queues in different applications	Applying (K3)
CO3	construct trees and binary search trees and apply operations on trees	Applying (K3)
CO4	apply appropriate graph algorithms for solving computational problems	Applying (K3)
CO5	demonstrate various sorting and hashing techniques	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	1
CO2	3	2	1	1									1	1
CO3	3	2	1	1									1	1
CO4	3	2	1	1									1	1
CO5	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	30	60				100
CAT2	10	25	65				100
CAT3	10	25	65				100
ESE	10	30	60				100

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

18MET46 - THERMODYNAMICS AND FLUID MECHANICS

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Applied Physics, Introduction to Engineering	4	OE	3	0	0	3

Preamble	To know the basic concepts of Laws of Thermodynamics, Boilers, Compressors, Refrigeration and overview about the hydraulic machineries.	
Unit - I	**Laws of Thermodynamics:**	**9**
Thermodynamic systems – Macroscopic and Microscopic Approach – Boundary – Control volume – System and surroundings – Universe – Properties – State – Process – Cycle – Point and path functions - Equilibrium – Work and heat transfer – Zeroth Law of Thermodynamics – First law of thermodynamics for open and closed systems – SFEE equations [Steady Flow Energy Equation].		
Unit - II	**Boilers:**	**9**
Introduction – Formation of Steam – Thermodynamic Properties of Steam, Steam Tables and Charts (Usage). Basic Steam Power Cycle (Simple Rankine Cycle). Boiler: Boiler – Classifications: Fire Tube, Water Tube Boilers – Boiler Mountings and Accessories		
Unit - III	**Compressors:**	**9**
Positive Displacement Compressors – Classifications – Reciprocating Compressors. Rotary Compressor – Types – Roots Blower, Sliding Vane, Centrifugal Compressor, Energy conservation in Compressors.		
Unit - IV	**Refrigeration:**	**9**
Unit of Refrigeration – Components of Refrigeration System – Vapour Compression Refrigeration Cycle with (p-h) and (T–s) Diagrams – Working of Vapour Absorption Refrigeration System – Coefficient of Performance – Introduction to Psychrometric terms.		
Unit - V	**Fluid Machineries:**	**9**
Hydro turbines: Definition and classifications – Pelton turbine – Francis turbine – Kaplan turbine – Working principles – Efficiency. Pumps: Classifications – Reciprocating pump, Centrifugal pump – working principle – Rotary pumps: working principles of Gear and Vane pumps.		

Total:45

TEXT BOOK:

1. Rajput R. K, "Thermal Engineering", 10th Edition, Laxmi Publications (P) LTD, New Delhi, 2017 for Units I,II,III,IV.
2. Subramanya K, " Hydraulic Machines", 1st Edition, McGraw Hill Education, New Delhi, 2019 for Units V.

REFERENCES:

1. Yunus A. Cengel, John M. Cimbala, "Fluid Mechanics Fundamentals and Applications", 4th Edition, Tata McGraw Hill, New Delhi, 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply the first law of thermodynamics for closed and open systems	Applying (K3)
CO2	identify the different types of boilers and calculate the thermal efficiency of steam power plant	Applying (K3)
CO3	classify the types and explain the working principles of compressors	Applying (K3)
CO4	explain the concepts of vapour compression and absorption refrigeration systems	Applying (K3)
CO5	illustrate the working principles of hydraulic turbines and pumps	Applying (K3)

Mapping 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		1						2	
CO2	3	3	1		1		1						2	
CO3	3	2	1		1		1						2	1
CO4	3	2	1		1		1						2	1
CO5	3	2	1		1		1						2	1
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

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

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

18EEE04 - ADVANCED MICROPROCESSORS AND MICROCONTROLLERS

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Microprocessors and Microcontrollers Interfacing	7	PE	3	0	0	3

Preamble	This Course explores the knowledge about advanced microprocessor and microcontroller	
Unit - I	**80186, 80286, 80386 and 80486 Microprocessors:**	**9**
80186 Architecture, Enhancements of 80186 –80286 Architecture –Real and Virtual Addressing Modes –80386 Architecture –Special Registers –Memory Management –Memory Paging Mechanism –80486 Architecture –Enhancements –Cache Memory Techniques – Exception Handling –Comparison of Microprocessors (8086 –80186 –80286 –80386 –80486) -Applications and Datasheets		
Unit - II	**Pentium Microprocessors:**	**9**
Pentium Microprocessor Architecture –Special Pentium Registers –Pentium Memory Management –New Pentium Instructions – Pentium Pro Microprocessor Architecture –Special features –Pentium II,III and IV Microprocessor Architecture —Comparison of Pentium Processors. –Applications & Datasheets		
Unit - III	**High Performance CISC Architecture:**	**9**
Pentium CPU Architecture- Bus Operations – Pipelining – Brach predication – floating point unit- Operating Modes –Paging – Multitasking – Exception and Interrupts – Instruction set – addressing modes – Programming the Pentium processor.		
Unit - IV	**8-Bit Micro Controller:**	**9**
Motorola MC68HC11: Architecture-CPU Registers and Internal Buses –Ports –Internal Devices – Memory Addresses- On Chip RAM – Memory Map for on chip registers-General purpose parallel port I/O Interface- Serial I/O devices-Interrupts-Programmable Timer- Input capture-Timing Measurements for External Events-PWM Output-Frequency Measurement.		
Unit - V	**16-Bit Micro Controller:**	**9**
80196:Overview of the 80196 CPU- Architecture- Memory Map-Special Function Registers- Instruction set -I/O Ports-Timers-High Speed inputs and Outputs –ADC Using T1 or T2- Interrupts		

Total:45

TEXT BOOK:

1. Brey B.B, "The Intel Microprocessor 8086/8088 /80186/80188, 80286, 80386, 80486 PENTIUM, PENTIUM Pro, PII, PIII & IV Architecture, Programming & Interfacing", 8th Edition, Pearson Education, New Delhi, 2009 for Units I,II,III.
2. Raj Kamal , “Microcontrollers: Architecture, Programming ,interfacing and System Design” ,2nd Edition, Pearson India, New Delhi , 2011 for Units IV,V.

REFERENCES:

1. Alan Clements, "The Principles of Computer Hardware", 4th Edition, Oxford University Press, NewYork, 2006.
2. Lipovski, G. J. “Introduction to microcontrollers: architecture, programming, and interfacing for the Freescale 68HC12” Elsevier Academic Press, Amsterdam, 2004.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	classify the generalized architecture of various advanced microprocessors	Understanding (K2)
CO2	describe the architecture and functions of Pentium Microprocessors	Understanding (K2)
CO3	describe the architecture, Various operations and instruction set of CISC processor.	Analyzing (K3)
CO4	illustrate the Characteristics, architecture , and Interfacing of various peripherals with 8 bit microcontroller.	Understanding (K2)
CO5	demonstrate the basic architecture and interfacing peripherals with 16 bit microcontroller.	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1										2	1
CO2	3	2	1										2	1
CO3	3	3	2	2									3	3
CO4	3	2	1										2	2
CO5	3	3	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	80					100
CAT2	10	70	20				100
CAT3	10	70	20				100
ESE	10	60	30				100

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

18EEE05 - DIGITAL SYSTEM DESIGN

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

Preamble	This course imparts knowledge on Algorithmic State Machine, VHDL code development, CPLD, Fault modeling and Fault diagnosis.	
Unit - I	**Algorithmic State Machine (ASM):**	**9**
State Machine Chart – Derivation of State Machine chart – Realization of State Machine chart – implementation of the dice game.		
Unit - II	**System Design Using VHDL:**	**9**
VHDL Description of Combinational Circuits – VHDL modules – Sequential statement and VHDL processes – Compilation and Simulation of VHDL Code – VHDL data types and Operators – VHDL model for multiplexer – VHDL Libraries – Variables, Signals and constants – Arrays – Modeling using VHDL: Flip Flops – Registers – Counters.		
Unit - III	**Programmable Devices:**	**9**
Simple Programmable Logic Devices – Complex Programmable logic devices – Field Programmable gate arrays – Implementing functions in FPGA.		
Unit - IV	**Programmable ASIC Logic cell:**	**9**
Actel ACT– ACT1 logic module – Shannon expansion theorem – Multiplexer logic as function generator – ACT2 and ACT3 logic modules – XILINX LCA-XC3000 Configurable Logic Blocks – XILINX XC4000 CLB-XC5200 – Altera FLEX – Altera MAX.		
Unit - V	**Introduction to Testing:**	**9**
Faults in digital circuits – Reliability – Fault Models – Physical faults – stuck at fault model – Logical faults – IDDQ test – Fault collapsing – Example – Fault simulation – Series-Parallel-concurrent-nondeterministic – Built in self test – LFSR – Signature analysis – A simple BIST example.		

Total:45

TEXT BOOK:

1. Roth Jr. Charles H. & LizyKurian John, "Digital System Design Using VHDL", 2nd Edition, Cengage Learning Publication, New Delhi, 2012 for Units I,II,III.
2. Michael John Sebastian Smith, " Application specific integrated circuits", 7th Edition, Pearson Education, New Delhi,2010 for Units IV,V.

REFERENCES:

1. Biswas Nripendra N, "Logic Design Theory", 1st Edition, Prentice Hall of India, New Delhi, 2001.
2. Parag K.Lala, "An Introduction to Logic Circuit Testing", 1st Edition, Morgan and Claypool publishers, San Rafael, California, 2009.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	design and analyze algorithmic state machine for logic circuit.	Analyzing (K4)
CO2	develop VHDL code for any combinational and sequential logic circuits.	Applying (K3)
CO3	compare programmable logic devices and implement various logic functions using PLDs.	Understanding (K2)
CO4	explain the various programmable ASIC logic cells.	Understanding (K2)
CO5	describe the fault models and testing of logic circuits.	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	3	2	2	1								1	2
CO2	3	2	1	1									1	2
CO3	3	2	1	1									1	2
CO4	2	1											1	2
CO5	2	1											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	20	40	30			100
CAT2	10	10	80				100
CAT3	20	80					100
ESE	10	35	35	20			100

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

18EEE06 - NON CONVENTIONAL ENERGY SOURCES

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

Preamble	This course focuses on solar thermal , photovoltaic (PV) energy , wind energy systems and other renewable energy sources which convert renewable energy into a convenient electrical energy and also stand-alone, hybrid schemes with battery energy storage and grid-connected schemes	
Unit - I	**Solar Thermal Energy:**	**9**
Solar Collectors - Solar Flat plate collector - and concentrating collectors - Solar Water Heater - Solar Space Heating and Cooling Systems - Solar Refrigeration and Air-Conditioning Systems - Solar Cookers - Solar Furnaces - Solar Green House - Solar Dryer - Solar Distillation		
Unit - II	**Solar Electrical Energy:**	**9**
Solar Cell Fundamentals - Solar Cell Characteristics - Solar Cell Classification - Solar Cell, Module, Panel and Array Construction - Maximizing the Solar PV Output and Load Matching - Maximum Power Point Tracker (MPPT) - Balance of System Components - Solar PV Applications		
Unit - III	**Wind Energy:**	**9**
Origin of Winds - Nature of Winds - Wind Turbine Siting - power extraction from wind - Wind Turbine Types and Their Construction - Wind Energy Conversion Systems (WECS) - Wind-Diesel Hybrid System - Environmental Aspects - Major Applications of Wind Power		
Unit - IV	**Biomass Energy:**	**9**
Photosynthesis Process - Usable Forms of Biomass, their Composition and Fuel Properties - Biomass Resources - Urban Waste to Energy Conversion - Biomass Gasification -down/up draft - Biomass Liquefaction - Biomass to Ethanol Production		
Unit - V	**Other Renewable Energy Sources:**	**9**
Geothermal Energy - Types of Geothermal Resources - Tidal Energy – ocean thermal energy conversion schemes - Ocean Thermal Energy conversion technology -Small Hydro Resources -Advantages and disadvantages of Small Hydro Schemes - Layout of a Micro-Hydro Scheme		

Total:45

TEXT BOOK:

1. Khan B.H., "Non-Conventional Energy Resources", 2nd Edition, Tata McGraw-Hill Education, New Delhi, 2006.

REFERENCES:

1. Rai G.D., "Non Conventional Energy Sources", 6th Edition, Khanna Publishers, New Delhi, 1999.
2. Kothari D.P.& K.C Singal Rakesh Ranjan, "RenewableEnergy Sources and EmergingTechnologies", 2nd Edition, Tata McGraw-Hill, New Delhi, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	classify the solar energy collectors and methodologies of storing solar energy	Understanding (K2)
CO2	assess the working and applications of solar electrical energy systems	Applying (K3)
CO3	gain knowledge in wind Energy Conversion Systems and its applications	Applying (K3)
CO4	develop an understanding of biomass energy systems	Understanding (K2)
CO5	explore the concepts of OTEC, tidal and geothermal energy 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	1	2	2			2	3					1	1	2
CO2	1	3	3			2	3					1	1	2
CO3	1	3	3			2	3					1	1	2
CO4	1	3	3			2	3					1	1	2
CO5	1	3	3			2	3				1	1	1	2

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

ASSESSMENT PATTERN - THEORY

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

18EEE07 - CAD OF ELECTRICAL MACHINES

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Electrical Machines I, Electrical Machines II	7	PE	3	0	0	3

Preamble	The objective of the course is to identify the design parameter for electromechanical system using various standard design procedures and development constrain and to provide an insight to finite element method and CAD package to design and analyze of various electromechanical systems	
Unit – I	**Fundamental Aspects and Materials:**	**9**
Introduction – Design Factor – Limitations in Design – Windings of Electrical Machines: Salient Pole Winding, Lap and Wave Winding, Three Phase Winding – Electric Conductivity and Resistivity Material – Magnetic Material – Insulating Material – Permanent Magnet and Characteristics		
Unit – II	**Principles of Magnetic and Thermal Design:**	**9**
Fundamental of Magnetic Circuit – Magnetizing Curve – Real and Apparent Flux Density – Determination of Iron Loss – Modes of Heat Dissipation – Newton's Law of Cooling – Thermal State in Electrical Machine		
Unit – III	**Design of DC Motor:**	**9**
Constructional Details – Choice of Flux Density and Ampere Conductor – Main Dimension – Poles and Slots- Design of Field, Armature System and Inter Poles – Design of Commutator and Brushes		
Unit – IV	**Design of Induction Motor:**	**9**
Constructional Details – Choice of Flux Density and Ampere Conductor – Main Dimension – Stator Design – Rotor Design – Length of Air Gap – Design of Shaft		
Unit – V	**Finite Element Modeling and Analysis using ANSYS Software:**	**9**
Maxwell's Equation – Preprocessing – Meshing – Material Assigning – Boundary Conditions – Setting up Solution – Post processing – Design of Actuator – DC Motor – Induction Motor.		

Total:45

TEXT BOOK:

1. Sawhney A. K., "Electrical Machine Design", 3rd Edition, Dhanpat Rai & Co, New Delhi, 2017 for Units I,II,III,IV.
2. Silvester & Ferrari, "Finite Elements for Electrical Engineers", 3rd Edition, Cambridge University press, United Kingdom, 1996 for Unit V.

REFERENCES:

1. Juha Pyrhonen, Tapani Jokinen & Valeria Hrabovcova, "Design of Rotating Electrical Machines", 3rd Edition, John Wiley & Sons, New Delhi, 2013.
2. Hendershot JR, Miller THE, "Design of Brushless Permanent Magnet Moors", Motor design book LLC, venice,2010

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	classify and compare the various fundamental aspects and materials used for electrical machines	Understanding (K2)
CO2	illustrate the principles of magnetic and thermal design for various electrical machines	Understanding (K2)
CO3	identify the design parameter of dc motor by considering load requirement	Applying (K3)
CO4	identify the design parameter of induction motor by considering load requirement	Applying (K3)
CO5	develop various electrical machines using ANSYS software	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	2
CO2	2	1											1	2
CO3	3	2	1	1									2	3
CO4	3	2	1	1									2	3
CO5	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	20	80					100
CAT2	20	40	40				100
CAT3	20	30	40	10			100
ESE	20	30	40	10			100

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

18EEE08 - ELECTRICAL SYSTEM DESIGN, ESTIMATION AND COSTING

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

Preamble	To enable the students to acquire the knowledge of electrical installations of simple circuits, buildings and small industries. To familiarize the students with the rules and safety of equipments and design of substations	
Unit - I	**Symbols and Simple Electrical Circuits:**	**9**
Introduction – Need of Electrical Symbols – List of Symbols – Electrical Diagrams – Representation for Wiring Diagrams – Simple Light and Fan circuits – Connection of Appliances and Accessories – Series and Parallel Connections – Joint Box System – Looping in system – Examples on Light and Fan Circuits.		
Unit - II	**Design Considerations of Electrical Installations:**	**9**
Introduction – General Requirements of Electrical Installations – General Specifications – Ambient Conditions, Accessories, IS-Item Specifications and Catalogues – Oil /Dry type Transformers – Circuit Breaker, Isolator, Fuse, MCCB, MCB – Testing of Installations – Neutral and Earth Wire – Service Connections – Service Mains – Guidelines for Installation of Fittings – Estimating and Costing of Electrical Installations		
Unit - III	**Electrical Installation for Different Types of Buildings and Small Industries:**	**9**
Introduction – Installation Plan – Schematic and Wiring Diagram – Deciding the number of sub circuits – Deciding the size of wires – Electrical Installation for Commercial Building – Electrical Installation for Small Industries – Cost Estimation of Electrical Installations for different Buildings and Small Industries.		
Unit - IV	**Rules, Safety and Maintenance of Equipment:**	**9**
Indian Electricity Rules 2003 – Earthing – Types,Control of Earth resistance, Step / Touch potential in Switchyards – Protection against Lightning, Static Electricity – Installation Testing – Protections, Insulation – Maintenance: Daily, Weekly, Monthly and Yearly Schedules for Transformers, Switch gears and Motors.		
Unit - V	**Design and Estimation of Substations:**	**9**
Introduction – Types – Outdoor Substations – Earthing Arrangement – Indoor Substations – Requirements – Typical Layout – Metering – Safety Requirements – Simple Problems on Quantity Estimation.		

Total:45

TEXT BOOK:

1. Raina K.B. & Bhattacharya S.K, "Electrical design estimating and costing", 5TH Edition, New Age International (P) Limited, New Delhi, 2018.

REFERENCES:

1. Gupta J.B., "Course in Electrical Installation Estimating & Costing", 9th Edition, S.K.Kataria & Son, New Delhi, 2008.
2. Rao V.S., "Testing, Commissioning, Operation and Maintenance of Electrical Equipments", 6th Edition, Khanna Publishers, New Delhi, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	interpret the importance of symbols and simple electrical circuit design	Understanding (K2)
CO2	explain the various Electrical Installations and costing	Understanding (K2)
CO3	employ the Electrical Installation for different types of buildings and small industries	Applying (K3)
CO4	describe the Rules, Safety and Maintenance of Equipment	Understanding (K2)
CO5	estimate the substation material and quantity for outdoor and indoor substations	Applying (K3)

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

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

18EEE09 - SUBSTATION ENGINEERING AND AUTOMATION

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Generation, Transmission and Distribution & Power System Protection and SwitchGear	7	PE	3	0	0	3

Preamble	The course aims in imparting knowledge of substation and its components	
Unit - I	**Introduction:**	**9**
General background – Functions of a Substation – Substation Layouts, Busbar Schemes – Voltage levels in AC and HVDC substations – Types of Substations – Features of a substation – Substation equipment – Grounding system –Insulation c-ordination and Surge Arresters – Protective Systems		
Unit - II	**Equipments and Earthing:**	**9**
Busbars– Circuit Breakers – Isolators and Earthing switches – Power transformers – CT & VT's – Surge Arresters –Functional requirements and Description of Earthing system – Equipment Earthing – Neutral point Earthing – Dimension of Earth Conductors – Earth mat – Measurement of Earth Resistance		
Unit - III	**Gas Insulated Substations and Cables:**	**9**
Introduction – Applications – Application and range of ratings – Demerits of GIS –Configuration of GIS – Circuit arrangements and Single Line Diagram of GIS – Design aspects – Earthing Switches in GIS – CGIC & CGIT for EHV and UHV Power Transmission – Hybrid Substations		
Unit - IV	**Protection, Control and Automation in Substations:**	**9**
Control room and panels – Protective relaying in Substations – Power transformer protection – Bus Zone protection – Protection of Transmission Lines – Carrier assisted distance protection – Substation Control – Applications of digital computers in Substation control – Microprocessor based Relays		
Unit - V	**Maintenance of EHC-AC and HVDC Substations:**	**9**
Introduction terminologies – Maintenance of Power transformer, Switchgear, Circuit Breakers, SF6 Circuit breaker, Air Blast Circuit breaker, Vacuum Circuit Breaker, Oil circuit breaker, Dielectric oil – Insulation Resistance measurement – Drying out of Power transformer – Preventive Maintenance of HVDC Substation – Live Line Maintenance		

Total:45

TEXT BOOK:

1. Rao S., "Electrical Substation Engineering and Practice EHV-AC, HVDC and SF6 – GIS", 3rd Edition, Khanna Publishers, Delhi, 2015.

REFERENCES:

1. John D. McDonald, "Electric Power Substations Engineering", 2nd Edition, CRC Press, New Delhi, 2007.
2. James A. Momoh, "Electric Power Distribution, Automation, Protection, and Control", 2nd Edition, CRC Press, New Delhi, 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	review the basics of substations and its components	Understanding (K2)
CO2	discuss the different substation equipments and earthing	Understanding (K2)
CO3	infer Gas Insulated Substations and Cables	Understanding (K2)
CO4	develop the different controls and Automation in substations	Applying (K3)
CO5	describe about the maintenance of substations	Understanding (K2)

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

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

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

18EEE10 - VLSI DESIGN

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	6	PE	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- Non ideal 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.		
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. Palnitkar Samir, " Verilog HDL: Guide to Digital Design and synthesis", 2nd Edition, Pearson Education, New Delhi, 2017 for Units I,II.
2. Neil Weste, & David Harris, “CMOS VLSI Design-A circuits & System Perspective” , 4th Edition, Pearson education, New Delhi,2017 for Units III.IV,V.

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	learn Verilog Hardware Description Language Programming	Applying (K3)
CO2	model VLSI systems using Verilog Hardware Description Language	Applying (K3)
CO3	examine the characteristics of MOS transistor	Understanding (K2)
CO4	describe the techniques used for VLSI fabrication, layout design rules and draw layout of logic functions	Applying (K3)
CO5	compare 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	2	2	1	1							1	
CO2	3	2	2	2	1	1							1	
CO3	2	1	1	1	1									
CO4	3	2	2	2									1	
CO5		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	90				100
CAT2	10	45	45				100
CAT3	10	45	45				100
ESE	10	40	50				100

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

18EEE11 - ADVANCED CONTROL THEORY

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

Preamble	This course provides the concepts of the mathematical modeling, feedback control and stability analysis in discrete control systems	
Unit - I	**Discrete Time Systems:**	**9**
Mathematical Representation of the Sampling Process- signal reconstruction, Z-transform analysis of sampled data control system– Inverse Z transform- Z and S domain Relationship -Pulse transfer function- Modified Z Transforms- Jury Stability criterion.		
Unit - II	**State Space Analysis:**	**9**
State space analysis for continuous and discrete systems – Physical variable, Phase variable and Canonical variables forms-Solution of state equation- controllability and observability.		
Unit - III	**State Feedback Controller:**	**9**
Design by state feedback –Pole assignment technique – Design of state feedback controllers – Design of reduced and full order observer.		
Unit - IV	**Stability Analysis:**	**9**
Stability concepts – Equilibrium points – BIBO and asymptotic stability – Direct and indirect method of Liapunov –Liapunov energy function.		
Unit - V	**Non Linear Systems:**	**9**
Types of non-linearity – Typical examples – Equivalent linearization – Phase plane analysis – Limit cycles – Describing functions- Analysis using Describing functions.		

Total:45

TEXT BOOK:

1. Nagrath I.J, Gopal.M, "Control Systems Engineering", 6th Edition, New Age International Pvt Ltd., New Delhi, 2017.

REFERENCES:

1. Norman S Nise, "Control Systems Engineering", 5th Edition, Wiley-India Publishers, New Delhi, 2017.
2. KuoB.C, "Automatic Control Systems", 9th Edition, John Wiley and Sons, New York, 2009.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	analyse the behavior of discrete system	Applying (K3)
CO2	construct the state space for discrete and continuous systems	Analyzing (K4)
CO3	apply pole placement techniques for state space model	Analyzing (K4)
CO4	inspect the stability of discrete system	Analyzing (K4)
CO5	explore the concept of non-linear system	Analyzing (K4)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

18EEE12 - SPECIAL ELECTRICAL MACHINES

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Electrical Machines I, Electrical Machines II	7	PE	3	0	0	3

Preamble	This course imparts knowledge about the construction and working principle of various special electrical machines and provide brief idea about their applications.	
Unit - I	**PERMANENT MAGNET SYNCHRONOUS MOTORS:**	**9**
Permanent Magnet Motors – Classifications – PMSM - Principle of operation – EMF and torque equations– Phasor diagram – Locus diagram and torque speed characteristics - Power controllers - Applications: PMSM for Railway vehicles.		
Unit - II	**PERMANENT MAGNET BRUSHLESS D.C. MOTORS:**	**9**
Principle of operation – Types – Comparison between conventional DC and PMBLDC – Electronic commutation – EMF and torque equations – Sensors for Rotor position – Power controllers – Motor characteristics and control - Applications: PMBLDC for Plug in Electric Vehicles.		
Unit - III	**SYNCHRONOUS RELUCTANCE MOTORS:**	**9**
Constructional features – Synchrel - Types: Axial and Radial motors – Operating principle – Reluctance torque – Phasor diagram - Characteristics - controls of synchrel - Applications: SyRM for Electric ships - Introduction to Vernier motor.		
Unit - IV	**SWITCHED RELUCTANCE MOTORS:**	**9**
Constructional features – Principle of operation – Torque prediction – Inductance profile –Types of Power controllers and converter topologies used – Current control schemes – Torque Speed Characteristics – Hysteresis and PWM – Applications: SRM for Hybrid electric vehicles.		
Unit - V	**STEPPING MOTORS:**	**9**
Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Theory of torque predictions – Linear and non-linear analysis – Characteristics – Drive circuits – Applications: Stepper Motor for Computer printers - Microprocessor based control.		

Total:45

TEXT BOOK:

1. Janardanan E.G., "Special Electrical Machines", 1st Edition, PHI Learning Pvt. Ltd., New Delhi, 2014.

REFERENCES:

1. Kenjo T., "Stepping Motors and Their Microprocessor Controls", 3rd Edition, Oxford University Press, New Delhi, 2009.
2. Miller T.J.E., "Brushless Permanent Magnet and Reluctance Motor Drives", 1st Edition, Clarendon Press, London, 1989.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain the construction, operation and performance of permanent Magnet synchronous motor.	Understanding (K2)
CO2	identify and distinguish the conventional DC and PMBLDC motors based on its performance	Applying (K3)
CO3	distinguish Synchrel and switched reluctance motors based on its performance	Applying (K3)
CO4	demonstrate the performance of stepper motor and characterize its curves	Applying (K3)
CO5	choose special drives for specific 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											1	2
CO2	3	2	1	1									2	3
CO3	3	2	1	1									1	2
CO4	3	2	1	1									2	3
CO5	3	2	1	1									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	50	20				100
CAT2	30	50	20				100
CAT3	30	50	20				100
ESE	30	50	20				100

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

18EEE13 - ELECTRIC VEHICLE TECHNOLOGY

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

Preamble	This course is aimed to introduce the fundamental concepts and principles of various Hybrid Electric Vehicles with an insight into Power electronic converters for battery charging.	
Unit - I	**Electric and Hybrid Electric Vehicles:**	**9**
Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains		
Unit - II	**Energy storage for EV and HEV:**	**9**
Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Super Capacitors		
Unit - III	**Electric Propulsion:**	**9**
EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives		
Unit - IV	**Design of Electric and Hybrid Electric Vehicles:**	**9**
Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design		
Unit - V	**Power Electronic Converter for Battery Charging:**	**9**
Charging methods for battery, Termination methods, charging from grid, The Z-converter, Isolated bidirectional DC-DC converter, Design of Z converter for battery charging, High-frequency transformer based isolated charger topology, Transformer less topology		

Total:45

TEXT BOOK:

1. M. Ehsani, Y. Gao, S. Gay and Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory and Design", 1st Edition, CRC Press , USA, 2010.

REFERENCES:

1. Iqbal Hussain, "Electric and Hybrid Vehicles: Design Fundamentals", 2nd Edition, CRC Press , USA, 2011.
2. Chris Mi, M. Abul Masrur, David Wenzhong Gao, "Hybrid Electric Vehicles Principles And Applications With Practical Perspectives", 1st Edition, Wiley Publication, UK, 2011.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	evaluate the various aspects and performance of Electric and Hybrid Electric vehicles.	Understanding (K2)
CO2	conceptualize the principles of Energy storage for EV and HEVs.	Understanding (K2)
CO3	illustrate the concepts & Principles of Electric propulsion.	Understanding (K2)
CO4	design and develop the electric vehicles with suitable control strategies	Understanding (K2)
CO5	examine different power converter topologies used for electric vehicle application.	Applying (K3)

Mapping of COs with POs and PSOs

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

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

18EEE14 - RESTRUCTURED POWER SYSTEM

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Generation, Transmission and Distribution, Power System Analysis	7	PE	3	0	0	3

Preamble	The objective of the course is to impart knowledge about the restructured power system, electric utility markets, pricing of transmission network and reforms in Indian power sector. The course will also bring out the differences between the conventional power system operation and the restructured power system.	
Unit - I	**OVERVIEW OF KEY ISSUES IN ELECTRIC UTILITIES RESTRUCTURING**	**9**
Introduction-Restructuring Models-Independent System Operator (ISO)-Power Exchange (PX)-Market Clearing Price (MCP)-Market Operations-Market Power-Stranded Costs-Transmission Pricing-Congestion Pricing-Management of Inter-Zonal/Intrazonal Congestion		
Unit - II	**ELECTRIC UTILITY MARKETS IN THE UNITED STATES & OUTSIDE THE UNITED STATES**	**9**
California Markets-New York Market-PJM Interconnection-ERCOT ISO-New England ISO-Midwest ISO- Nord Pool (The Nordic Power Exchange)-Australia National Electricity Market-Restructuring In Canada-Electricity Industry in England and Wales		
Unit - III	**OASIS: OPEN ACCESS SAME-TIME INFORMATION SYSTEM**	**9**
Introduction-FERC Order-Structure of OASIS-Implementation of OASIS Phases-Posting of Information-Transfer Capability on OASIS-Transmission Services-Methodologies to Calculate ATC-Experiences with OASIS in Some Restructuring Models		
Unit - IV	**TAGGING ELECTRICITY TRANSACTIONS & TRANSACTION INFORMATION SYSTEM**	**9**
Introduction-Definition of Tagging-Historical Background on Tagging-How Does a Tagging Process Work?-Identifying Tags-Data Elements of a Tag-Communication during Failure Recovery-Transaction States-Implementation, Curtailment, and Cancellation of Transactions		
Unit - V	**ELECTRIC ENERGY TRADING**	**9**
Introduction-Essence of Electric Energy Trading-Energy Trading Framework: The Qualifying Factors-Derivative Instruments of Energy Trading-Portfolio Management-Energy Trading Hubs-Brokers in Electricity Trading-Green Power Trading		

Total:42

TEXT BOOK:

1. Mohammad Shahidehpour, Muwaffaq Alomoush, "Restructured Electrical Power Systems: Operation, Trading and Volatility", 1st Edition, Taylor & Francis , New York, 2001.

REFERENCES:

1. Loi Lei Lai, "Power System Restructuring and Deregulation", 1st Edition, John Wiley and Sons, New York, 2001.
2. Mohammad Shahidehpour, Hatim Yamin, Zuyi Li, "Market Operations in Electric Power Systems", 1st Edition, John Wiley and Sons, New York, 2002.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain the key issues in electric utilities restructuring	Understanding (K2)
CO2	discuss the concept of electric utility markets in the united states & outside the united states	Applying (K3)
CO3	discuss the concept of open access same-time information system	Applying (K3)
CO4	describe Transaction Information System	Understanding (K2)
CO5	interpret and analyze the Electric Energy Trading	Applying (K3)

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

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

ASSESSMENT PATTERN - THEORY

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

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

18EEE15 - POWER SYSTEM OPERATION AND CONTROL

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Power System Analysis, Control Systems	7	PE	3	0	0	3

Preamble	This course imparts knowledge about the operations of the power systems and various controls methods adapted in power systems. It also imparts the knowledge on computer control of power systems.	
Unit - I	**Introduction:**	**9**
System load variation: System load characteristics, load curves- daily, weekly and annual, load-duration curve, load factor, diversity factor, Plant capacity factor, Utilization factor - Reserve requirements: spinning reserve, cold reserve and hot reserve – Need of voltage and frequency regulation – P-f and Q-V control – Load forecasting: purpose, classification and forecasting procedure.		
Unit - II	**Economic Dispatch and Unit Commitment:**	**9**
Economic Dispatch: Economic Dispatch Problem-Economic Dispatch with Piecewise Linear Cost Functions-LP Method: Piecewise Linear Cost Functions, Economic Dispatch with LP-The Lambda Iteration Method-Economic Dispatch Using Dynamic Programming-Composite Generation Production Cost Function-Base Point and Participation Factors-Thermal System Dispatching with Network Losses. **Unit Commitment:** Introduction – Need of unit commitment – Constraints in unit commitment: Spinning reserve, thermal unit constraint, hydro constraint, must run and fuel constraint – Solution methods: Priority list method, Full load average production cast, dynamic programming approach.		
Unit - III	**Real Power Frequency Control:**	**9**
Necessity of maintaining constant frequency – Load frequency control – Speed governing system – turbine model – generator model – concept of control area – Single area system static and dynamic analysis – Integral control – Two area system static and dynamic response – Area control error – Tie line frequency bias control – State variable model.		
Unit - IV	**Reactive Power Voltage Control:**	**9**
Necessity of voltage control – Generation and absorption of reactive power – Methods of voltage control: shunt capacitor, shunt reactor, series capacitor, tap-changing transformer, synchronous condenser and Static VAR compensators – Excitation control scheme – Types of excitation system: DC, AC and static excitation systems – Modeling and analysis of Automatic Voltage Regulator.		
Unit - V	**Power System Security and State Estimation:**	**9**
Introduction – Concept of system security: long term planning, operational planning and on-line planning – Security analysis: and enhancement – State estimation – various operating states – Energy control centre and data acquisition.		

Total:45

TEXT BOOK:

1. Sivanagaraju S and Sreenivasan G, " Power System Operation and Control ", 1st Edition, Pearson Education, New Delhi, 2009.

REFERENCES:

1. Allen J. Wood and Bruce F Wollenberg, "Power System Operation and Control", 3rd Edition, John Wiley and Sons, New York, 2012.
2. Elgerd O.I, " Electrical Energy System Theory: An Introduction ", 2nd Edition, Tata McGraw-Hill, New York, 2001.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand the overview of power system operation and control	Understanding (K2)
CO2	apply dynamic approaches for solving unit commitment and economic dispatch problems	Applying (K3)
CO3	develop the transfer function model for the speed-governing system	Analyzing (K4)
CO4	analyze the static and dynamics performance of AVR loop	Analyzing (K4)
CO5	understand the concept of power system state estimation and security	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													
CO2	3	2	1											
CO3	2	3	2	2									2	3
CO4	2	3		2									2	3
CO5	2													1

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

ASSESSMENT PATTERN - THEORY

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

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

18EEE16 - DESIGN, INSTALLATION AND COMMISSIONING OF SOLAR AND WIND ENERGY SYSTEMS

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

Preamble	The course aims in imparting the concepts and nuances of design, commissioning and installation of solar and wind energy systems.	
Unit - I	**Solar PV Design and Integration:**	**9**
Types of solar PV systems: stand alone, grid connected and hybrid systems. Design methodology for solar PV system: Approximate design of solar PV system- solar PV system design chart – Look up table for solar PV system design.		
Unit - II	**Stand Alone Solar PV Systems:**	**9**
Introduction – Selection of battery- Battery bank installation and commissioning- Charge controllers – Wire sizing – Junction box.		
Unit - III	**Grid Connected Solar PV Systems:**	**9**
Introduction – Configuration of grid connected solar PV systems- Components of grid connected solar PV systems.		
Unit - IV	**Dynamic Considerations in Wind Turbine Design:**	**9**
Power output from an ideal turbine – Aerodynamics – Power output from practical turbines – Energy production and capacity factor – Methods of generating synchronous power – DC shunt generator with battery load – AC generators.		
Unit - V	**Installation and Commisioning of WECS:**	**9**
Site preparation – Electrical network – Selection of low voltage and distribution voltage equipments – Losses- Wind farm costs.		

Total:45

TEXT BOOK:

1. Chetan Singh Solanki, "Solar Photovoltaic Technology and Systems – A Manual for Technicians, Trainees and Engineers", 1st Edition, PHI learning Private Limited, New Delhi, 2013 for Units I,II,III.
2. Gary L.Johnson, "Wind Energy Systems", Electronic Edition Edition, Manhatan, KS, 2006 for Units IV,V.

REFERENCES:

1. Michael Boxwell, "Solar Electricity Handbook", 1st Edition, GreenStream Publishng, UK, 2012.
2. Spera, D.A, "Wind Turbine Technology: Fundamental concepts of Wind Turbine Engineering", 2nd Edition, ASME , New York, 2009.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	outline the types and design procedures of solar PV design	Understanding (K2)
CO2	inspect the design procedures for standalone PV systems	Analyzing (K4)
CO3	apply the design procedures for grid connected PV systems	Applying (K3)
CO4	analyze the design considerations for WECS	Analyzing (K4)
CO5	identify the installation methods for WECS	Applying (K3)

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

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

18EEE17 - PLC, SCADA AND DCS

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

Preamble	This course imparts knowledge about basic concepts of programmable logic controllers, programming languages, advanced PLC programming, process of SCADA & DCS and also apply this knowledge to develop automation system in industrial applications.	
Unit - I	**Introduction to Programmable Logic Controller:**	**9**
Overview of Programmable Logic Controller - Architecture – Principle of operation - I/O Modules: Discrete, Analog, Special – I/O Specifications – CPU – Memory design and types – Programming devices – Recording and Retrieving data –PLC programming languages.		
Unit - II	**Basic PLC Programming:**	**9**
Fundamentals of Logic – Program Scan– Relay-Type Instructions - Instruction addressing – Branch and Internal relay instructions – Entering the Ladder diagram – Electromagnetic Control relays – Contactors – Motor Starters – Manual operated switches and Mechanically operated switches.		
Unit - III	**Advanced PLC Programming:**	**9**
Programming Timers – Programming Counters – Math Instructions – Sequencer and Shift Register Instructions. PLC Applications: Bottle filling system –Traffic light control system		
Unit - IV	**SCADA:**	**9**
Introduction to SCADA – A brief history of SCADA –Real-time systems – Remote control – Communications – Applications: Real time Revisited – Scanning and communications – Automatic control. Applications - SCADA for Power Utility Network		
Unit - V	**Distributed Control Systems:**	**9**
Aims of plant automation, Evolution –System architectures – System Elements – Field stations-Intermediate stations – central computer station – Monitoring and command facilities – Data Communication Links : Local Area Network - Applications of DCS : DCS in Power plants– Cement plants		

Total:45

TEXT BOOK:

1. Frank D. Petruzella, "Programmable Logic Controllers", 5th Edition, Tata McGraw-Hill , New Delhi, 2019 for Units I,II,III.
2. Popovic D. and Bhatkar V.P , “Distributed Computer Control for Industrial Automation”, 1st Edition, Marcel Dekkar Inc., New York, 1990 for Unit V.

REFERENCES:

1. Stuart A. Boyer, “SCADA: Supervisory Control and Data Acquisition”, 4th Edition, ISA Press, USA, 2009.
2. Webb John W and Reis Ronald A, "Programmable Logic Controllers - Principles and Applications", 5th Edition, PHI Learning Private Limited, New Delhi, 2002.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	identify the PLC hardware and programming languages for various applications	Applying (K3)
CO2	develop PLC ladder logic programming for industrial problems	Applying (K3)
CO3	design a PLC system, component, or process to meet a set of specifications	Applying (K3)
CO4	impart the knowledge of SCADA and apply it in real time applications	Understanding (K2)
CO5	apply DCS in industrial process control	Applying (K3)

Mapping of COs with POs and PSOs

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

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

18EEE18 - GENERALIZED MACHINE THEORY

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Electrical Machines I, Electrical Machines II	7	PE	3	0	0	3

Preamble	This course impart knowledge about various DC, AC and permanent magnet motors fir its modeling and analysis and to apply different reference frame theory and transformation technique to simplify the mathematical modeling of machines	
Unit - I	**Generalized Machine Theory:**	**9**
Essential of Rotating Electrical Machines – Conventions – The Basic Two Pole Machine – Invariance of Power – Transformations from Three Phase to Two Phase – Kron's Primitive Machine – Electrical Torque – Restriction of the Generalized Theory of Electrical Machines – Applications.		
Unit - II	**Modeling of DC Motor:**	**9**
Theory of Operation – Induced EMF – Equivalent Circuit – Electromagnetic Torque – Field Excitation- Steady State and Transient Analysis of DC Motor using software: Separately Excited Motor – Series Motor – Compound Motor – Permanent Magnet DC Motor.		
Unit - III	**Modeling of Induction Motor:**	**9**
Three Phase Induction Motor – Voltage and Torque Equation in Machine Variables – Voltage and Torque Equation of Two Phase Induction Motor - Reference Frame Theory – Arbitrary Reference Frame – Stationary Reference Frame – Rotor Reference Frame – Synchronous Reference Frame.		
Unit - IV	**Modeling of Synchronous Motor:**	**9**
Three Phase Synchronous Motor – Voltage and Torque Equations in Machine Variables – Voltage and Torque Equation in Rotor Reference Frame Variable – Voltage and Torque Equation in Synchronous Reference Frame Variable		
Unit - V	**Modeling of Special Electrical Machines:**	**9**
Permanent Magnet Synchronous Motor (PMSM) – Voltage and Torque Equation in Machine Variable – Single Phase Synchronous Reluctance Motor – Three Phase Synchronous Reluctance Motor – Voltage and Torque in Machine Variable		

Total:45

TEXT BOOK:

1. P S Bimbhra, "Generalized Theory of Electrical Machines", 6th Edition, Khanna Publishers, New Delhi, 2018 for Units I,II.
2. Paul C Krause, "Analysis of Electric Machinery and Drive Systems", 2nd Edition, Wiley India Publication, New Delhi, 2010 for Units III,IV,V.

REFERENCES:

1. Charles Kingsley Jr., A.E. Fitzgerald and Stephen D.Umans, "Electric Machinery", 6th Edition, Tata McGraw-Hill, New Delhi, 2017.
2. R. Krishnan, "Electric Motor Drives: Modeling, Analysis, and Control", 1st Edition, Prentice - Hill, New Delhi, 2001.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	conceptualize the generality and importance of mathematical modeling and its application	Understanding (K2)
CO2	model and analyze the separately excited, shunt, series, compound and PMDC motor using software tool	Applying (K3)
CO3	develop the voltage and torque equation of induction motor using various reference frame theory	Understanding (K2)
CO4	develop the voltage and torque equation of synchronous motor using various reference frame theory	Understanding (K2)
CO5	deduce the voltage and torque equation for permanent magnet synchronous and synchronous reluctance motor	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											1	2
CO2	3	2	1	1									2	3
CO3	2	1											1	2
CO4	2	1											1	2
CO5	2	1											1	2

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

ASSESSMENT PATTERN - THEORY

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

18EEE19 - POWER PLANT INSTRUMENTATION

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

Preamble	To provide an overview of various methods of power generation and the basic concepts and practical aspects of Instrumentation and Control in Thermal Power Plant and Nuclear Power plant.	
Unit - I	**Overview of Power Generation:**	**9**
Brief survey of Conventional and non-conventional methods of power generation – Nonconventional: Wind power – Solar power – Tidal Power – Geothermal Power – Magneto hydrodynamic Power - Fuel cells – Biomass Power. Conventional: Hydropower – Nuclear Power – Steam Power - Comparison of various power plants. Importance of Instrumentation and Control in power generation – Piping and Instrumentation diagram – Cogeneration of Power.		
Unit - II	**Instrumentation and Control in Water Circuit:**	**9**
Water circuit – Boiler Feed water circulation: Forced circulation – combined circulation –Controls in water circuit: Boiler Drum Level Control – Super heated Steam temperature control – Steam pressure control. Impurities in water and Steam: Impurities in Raw water - Effect of impurities – Measurement of impurities.		
Unit - III	**Instrumentation and Control in Air-Fuel Circuit:**	**9**
Air-Fuel circuit – Measurements in air-fuel circuit – Controls in Air- Fuel circuit: Combustion control – Furnace draft control. Analytical Measurement: Oxygen measurement in Flue gas – Measurement of Carbon Dioxide in Flue gas – Combustibles Analyser (CO +H2) – Infrared Flue Gas Analysers – Smoke detector – Dust monitor – Closed circuit Television - Fuel Analysers – Chromatography.		
Unit - IV	**Power Plant Management**	**9**
Power Plant Management: Master control – Boiler Efficiency – Maintenance of Measuring Instruments – Interlocks for Boiler operation – Application of Distributed control system in Power Plants. **Turbine Monitoring and Control**: Turbine Steam inlet system – Turbine Measurements: Process parameters – Turbine control system: Safety control systems - Process control systems –Lubrication for Turbo-Alternator - Turbo-Alternator Cooling System.		
Unit - V	**Instrumentation and Control in Nuclear Power Plant:**	**9**
Nuclear Power Plant components - Sensors and measurement system - Digital architectures in nuclear power plants – Reactor control: Pressurized Water Reactor (PWR) – Boiler Water Reactor (BWR) - Fast breeder reactor (FBR) - Radiation protection and monitoring – Nuclear reactor safety: Case study.		

Total:45

TEXT BOOK:

1. Krishnaswamy K., & Ponni Bala M., "Power Plant Instrumentation", 2nd Edition, PHI Learning Pvt. Ltd, New Delhi, 2013.

REFERENCES:

1. Swapan Basu & Ajay Debnath, "Power Plant Instrumentation and Control Handbook ", 1st Edition, Academic Press Publications, United States, 2014.
2. Philip Kiameh, "Power Plant Instrumentation and Controls", 1st Edition, McGraw-Hill Professional, New Delhi, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	interpret the knowledge about the basics of power plants and various methods of power generation	Understanding (K2)
CO2	infer the importance of Instrumentation and Control in Water circuit of Thermal Power Plant	Understanding (K2)
CO3	recognize various measurement and control techniques applied to Air- Fuel circuit of thermal power plant	Understanding (K2)
CO4	apply DCS, SCADA, Interlock circuits and turbine controls in Thermal Power Plant	Applying (K3)
CO5	develop the concepts of different Reactor controlled methods, safety and radiation measures in nuclear power plants	Applying (K3)

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

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

ASSESSMENT PATTERN - THEORY

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

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

18EEE20 - DIGITAL IMAGE PROCESSING AND MULTI RESOLUTION ANALYSIS

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Signals and Systems	7	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: Translation and Rotation-Periodicity –Symmetry, DCT, DST, Walse Hadamard Transform, Slant Transform.		
Unit - III	**Image Enhancement & Restoration:**	**9**
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 model– 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 & 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	**Wavelets And Multiresolution Processing:**	**9**
Subband coding – The Haar Transform – Multiresolution Expansion – Series Expansion – Scaling Function – Wavelet Function – Wavelet Transform in One Dimension- The Wavelet Series Expansion – The Discrete Wavelet Transform – The Continuous Wavelet Transform – The Fast Wavelet Transform – Wavelet transform in two dimensions– Applications in image denoising and compression.		

Total:45

TEXT BOOK:

1. Rafael C Gonzalez and Richard E Woods, "Digital Image Processing", 4th Edition, Pearson Education, Chennai, 2016.

REFERENCES:

1. Jayaraman S, Esakkirajan S and Veerakumar T, "Digital Image Processing", 1st Edition, Tata McGraw-Hill, New Delhi, 2016.
2. Chanda B, Dutta Majumder D, "Digital Image Processing and analysis", 2nd Edition, PHI Learning Private Limited, New Delhi, 2011.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	illustrate the fundamental concepts of digital image processing , 2D sampling and Colour image models.	Applying (K3)
CO2	apply various 2-D transforms for an image	Applying (K3)
CO3	implement the image enhancement & image restoration techniques	Applying (K3)
CO4	explain image segmentation, representation and description techniques for image classification	Understanding (K2)
CO5	apply the multi resolution processing over images using wavelet transform.	Applying (K3)

Mapping of COs 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
CO2	3	2	1	1									1	2
CO3	3	2	1	1									1	2
CO4	2	1											1	2
CO5	3	2	1	1									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	20	70				100
CAT2	10	20	70				100
CAT3	10	20	70				100
ESE	10	20	70				100

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

18EEE21 - ELECTRICAL ENGINEERING DRAWING

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

Preamble	This subject explores about creating and interpreting electrical drawings	
Unit - I	**Introduction:**	**9**
Symbols for electrical and electronics engineering drawing – dimensioning – review of types of projections, dimensioning, sectional views – Assembly and detailed working drawing – drawing of simple electrical and mechanical items – connection diagram for electrical instruments.		
Unit - II	**Single Line Diagrams:**	**9**
Single line diagrams of Generating Stations and Substations - Incoming Circuits, Outgoing Circuits, Busbar Arrangements (Single, Sectionalised Single, Main and Transfer, Double Bus Double Breaker, Sectionalised Double Bus, One and a Half Circuit Breaker Arrangement, Ring Main),Power Transformers, Circuit Breakers, Isolators, Earthing Switches, Instrument Transformers, Surge or Lightning Arresters, Communication Devices (Power-Line Carrier) and Line Trap		
Unit - III	**Developed Winding Diagrams of D.C. Machines:**	**9**
Developed Winding Diagrams of D.C. Machines:Simplex winding - Double Layer winding - Lap and Wave Windings. Developed Winding Diagrams of A.C. Machines: Single Layer Windings - Double Layer Three Phase Lap and Wave Windings		
Unit - IV	**Transmission and Distribution lines:**	**9**
Poles – steel towers – HT and LT insulators – Stays or Guys		
Unit - V	**Protection and control diagrams:**	**9**
ANSI/ IEC Numbering schemes – Generator Protection – Busbar Protection – Schematic diagram of power and control circuit of DOL starter,Star – Delta starter and electronic soft starters		

Total:45

TEXT BOOK:

1. Bhattacharya,S.K, "Electrical Engineering Drawing", 2nd Edition, New Age International, New Delhi, 2013.

REFERENCES:

1. Narang K L, "Electrical Engineering Drawing", 1st Edition, Satya Prakashan, New Delhi, 2016.
2. Surjit Singh, "Electrical Engineering Drawing-II", 1st Edition, S.K. Kataria & Sons, New Delhi, 2007.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	perform basic sketching techniques and diagram for electrical instruments	Understanding (K2)
CO2	draw single line diagram of various equipments	Applying (K3)
CO3	sketch the winding diagram of DC and AC machines	Applying (K3)
CO4	produce the drawing of transmission and distribution lines	Applying (K3)
CO5	perform different protection and control diagrams	Applying (K3)

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

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

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

18EEE22 - ENERGY STORAGE SYSTEMS

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

Preamble	This course is aimed to introduce the fundamental concepts and principles of various energy storage systems that aids in various electrical applications	
Unit - I	**ENERGY STORAGE SYSTEMS:**	**9**
Introduction – Battery – Components of Cells and Batteries – Classification – Operation of a Cell – Theoretical Cell Voltage, Capacity, and Energy – Electrochemical Principles and Reactions: Cell Polarization – Electrical Double-Layer Capacity and Ionic Adsorption – Mass Transport to the Electrode Surface		
Unit - II	**BATTERY DESIGN AND SELECTION:**	**9**
Designing to Eliminate Potential Safety Problems – Battery Safeguards when Using Discrete Batteries – Battery Construction – Factors Affecting Battery Performance – Major Considerations in Selecting a Battery – Applications of Batteries.		
Unit - III	**PRIMARY & SECONDARY BATTERIES:**	**9**
General characteristics and Applications of Primary batteries – Types and characteristics of Primary & Secondary batteries - Zinc-chloride Lithium Battery – Nickel Cadmium – Lead Acid – Nickel Hydride		
Unit - IV	**ADVANCED BATTERIES FOR EMERGING APPLICATIONS:**	**9**
Performance Requirements for Advanced Rechargeable Batteries - Characteristics and Development - Near-Term Rechargeable Batteries - General Characteristics – Zin/Air batteries – Zinc/Bromine batteries – Lithium/Iron Sulfide Batteries – General characteristics - Performance		
Unit - V	**ULTRA CAPACITORS, FLYWHEELS & FUEL CELLS:**	**9**
Ultracapacitors: Features – Basic Principles of Ultracapacitors – Performance of Ultracapacitors. Ultra-High-Speed Flywheels: Operation Principles of Flywheels - Power Capacity of Flywheel Systems - Flywheel Technologies - Fuel cells: Operating Principles of Fuel Cells - Fuel and Oxidant Consumption - Fuel Cell System Characteristics - Fuel Cell Technologies - Hydrogen Storage.		

Total:45

TEXT BOOK:

1. David Linden, Thomas B. Reddy, "Handbook of Batteries ", 3rd Edition, McGraw-Hill, New Delhi, 2002.
2. Mehrdad Ehsani, YiminGao, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicle", 2nd Edition, CRC Press, New Delhi, 2010.

REFERENCES:

1. James Larminie, Andrew Dick, "Fuel Cell System Explained", 2nd Edition, J. Wiley, New Jersy, 2003.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	evaluate the various aspects and performance of EV battery technologies.	Understanding (K2)
CO2	understand the performance of primary batteries and their design aspects	Understanding (K2)
CO3	conceptualize the principles of Primary & Secondary batteries.	Understanding (K2)
CO4	analyze the requirement of advanced batteries for emerging applications..	Applying (K3)
CO5	illustrate the concepts & Principles of ultracapacitors and fuel cells.	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											1	2
CO2	2	1											1	2
CO3	2	1											1	2
CO4	3	2	1	1									2	3
CO5	2	1											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	30	70					100
CAT2	30	70					100
CAT3	20	60	20				100
ESE	20	60	20				100

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

18EEE23 - COMPUTER AIDED POWER SYSTEM ANALYSIS

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Generation, Transmission and Distribution, Power System Analysis	7	PE	3	0	0	3

Preamble	The course is designed to apply and model the concepts of Generation, Transmission and Distribution of Power system components using numerical methods and simulation.	
Unit - I	**Line Constants:**	**9**
Line Constants: Overhead Transmission Line Parameters -Impedance of Underground Cables. Power Flow Analysis: Introduction - Power Flow Problem - Solution Approach- Criteria for Evaluation - System Data - Example IEEE Six Bus System		
Unit - II	**Short Circuit Studies:**	**9**
Introduction - Sources of Short Circuit Currents - System Impedance Data- Short Circuit Calculations - Computer Aided Analysis - Limiting the Short Circuit Currents		
Unit - III	**Transient Stability Analysis:**	**9**
Introduction - Steady State Stability - Transient Stability - Criteria for Stability - Power System Component Models - Simulation Considerations		
Unit - IV	**EMF Studies:**	**9**
Introduction - Field Exposure - Existing Guidelines on Field Levels - Fields Due to Overhead Lines - Fields Due to Underground Cables - Relation Between Electric and Magnetic Fields.		
Unit - V	**Relay Coordination studies:**	**9**
Introduction – Approach to the study – Acceptance criteria - Computer aided coordination analysis – Data for coordination study – Introduction to Insulation coordination		

Total:45

TEXT BOOK:

1. Ramasamy Natarajan, "Computer aided power system analysis", 1st Edition, Marcel Dekker, New York- Basel, 2002.

REFERENCES:

1. Dr. George Kusic, "Computer aided power system analysis", 2nd Edition, CRC press , Boca Raton, Florida, 2008.
2. Gleen W. Stagg, El-Abiad, "Computer methods in power system analysis", 1st Edition, McGraw Hill, New York, 1968.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	calculate the line constants and power flow parameters of power system	Applying (K3)
CO2	determine the short circuit parameters.	Applying (K3)
CO3	model the transient stability components using simulation considerations.	Applying (K3)
CO4	explain the concepts of electric and magnetic fields in transmission system.	Understanding (K2)
CO5	examine the relay coordination of the power system using simulation consideration.	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									2	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3
CO4	2	1											1	2
CO5	2	3	2	2	1								3	2

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

ASSESSMENT PATTERN - THEORY

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

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

18EEE24 - SMART GRID

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Generation, Transmission and Distribution	7	PE	3	0	0	3

Preamble	The course content is designed to study about smart grid technologies, distribution automation, information and communication Technologies, and operation of transmission system operation. It is used to get familiarized with smart metering and control of smart grid systems	
Unit - I	**Introduction to Smart Grid:**	**9**
Need for smart grid - Smart Grid definitions - Benefits of smart grid - Overview of enabling technologies in smart grid - vision of smart grid - International experience - smart grid demonstration and deployment efforts –Indian Smart Grid –Key Challenges for Smart Grid		
Unit - II	**Smart Grid Architecture:**	**9**
Components and Architecture of Smart Grid Design, Standards for smart Grid –Review of the proposed architectures for Smart Grid. The fundamental components of Smart Grid designs –Transmission Automation – Distribution Automation –Renewable Integration		
Unit - III	**Tools and Techniques for Smart Grid:**	**9**
Computational Techniques – Static and Dynamic Optimization Techniques – Computational Intelligence Techniques –Evolutionary Algorithms – Artificial Intelligence techniques		
Unit - IV	**Distribution Generation Technologies and Communication Technologies:**	**9**
Introduction to Renewable Energy Technologies –Micro grids –Storage Technologies –Electric Vehicles and plug–in hybrids– Environmental impact and Climate Change –Economic Issues. Introduction to Communication Technology –Synchro Phasor Measurement Units (PMUs) –Wide Area Measurement Systems (WAMS).		
Unit - V	**Control of Smart Power Grid System:**	**9**
Load Frequency Control (LFC) in Micro Grid System –Voltage Control in Micro Grid System – Reactive Power Control in Smart Grid. Case Studies and Test beds for the Smart Grids.		

Total:45

TEXT BOOK:

1. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, AkihikoYokoyama, "Smart Grid: Technology and Applications", 1st Edition, Wiley & Sons Ltd , United States, 2012.

REFERENCES:

1. "Smart Grid primer", 1st Edition, Power grid Corporation of India limited, India, 2013.
2. Stuart Borlase, "Smart Grid: Infrastructure, Technology and Solutions", 1st Edition, CRC Press , India, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand the features of small grid in the context of Indian grid.	Understanding (K2)
CO2	assess the role of automation in transmission and distribution.	Understanding (K2)
CO3	apply evolutionary algorithms for smart grid.	Applying (K3)
CO4	interpret the communication technology used in smart grid.	Applying (K3)
CO5	choose the control strategy for smart power grid system.	Applying (K3)

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

18EEE25 - DIGITAL SIGNAL PROCESSORS AND ITS APPLICATIONS

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Signals and Systems	8	PE	3	0	0	3

Preamble	This course helps the students to impart the knowledge on filter design, DSP processor and its real time applications	
Unit - I	**FIR FILTER:**	**9**
FIR Filter Design: Amplitude and phase responses of FIR filters – Linear phase filters – symmetrical linear phase filter, asymmetrical linear phase filter - windowing techniques for design of linear phase FIR filters – Rectangular, Hamming, Hanning		
Unit - II	**IIR FILTER:**	**9**
IIR Filter Design (low pass and high pass): Review of design of analogue Butterworth and Chebychev Filters, frequency transformation in analog domain – design of IIR digital filters using impulse invariance technique – design of IIR digital filters using bilinear transformation technique – pre warping – Frequency transformation in digital domain.		
Unit - III	**DSP PROCESSORS:**	**9**
Architecture and Features of TMS320C5416 DSP Processor, Instruction set, Addressing Modes- Architecture and features of TMS320F2812 DSP processors - Addressing modes- Introduction to Commercial DSP processors.		
Unit - IV	**Realization of Filter Structure and Applications:**	**9**
Realization of FIR filters – Direct, cascade, linear phase structures. IIR Filter structure realization – Direct, cascade, and parallel forms. DSP Applications: Harmonic Analysis, Motor Control, Power line communication.		
Unit - V	**Finite Word Length Effect and Applications:**	**9**
Representation of numbers in digital system: fixed point and floating point – Quantisation by truncation and rounding – Quantisation of input data, filter coefficient – Product quantization error – limit cycles in recursive systems: Zero input limit cycle, overflow limit cycle, scaling to prevent overflow.		

Total:45

TEXT BOOK:

1. Salivahanan S, "Digital Signal Processing", 3rd Edition, Tata McGraw Hill Education, New Delhi, 2017.

REFERENCES:

1. John.G.Proakis, Dimitris.G.Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", 4th Edition, Pearson Education, Chennai, 2007.
2. Baris Bagci, "Programming and Use of TMS320F2812 DSP to Control and Regulate Power Electronic converters", 1st Edition, Grin Publishing, Munich, Germany, 2007.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	design and analyze the FIR filters	Analyzing (K4)
CO2	design the analyze IIR filters	Analyzing (K4)
CO3	explain the architecture of advanced DSP processors	Understanding (K2)
CO4	realize FIR and IIR filter structures	Applying (K3)
CO5	comprehend the finite word length effect in DSP processor implementation and its applications	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	2	1								1	2
CO2	2	3	2	2	1								1	2
CO3	2	1											1	2
CO4	3	2	1	1									1	2
CO5	3	2	1	1									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	10	50	30			100
CAT2	10	10	50	30			100
CAT3	10	40	50				100
ESE	10	10	50	30			100

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

18EEE26 - POWER ELECTRONIC INTERFACES TO RENEWABLE ENERGY

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Electrical Machines I, Electrical Machines II, Power Electronics	8	PE	3	0	0	3

Preamble	This course aims to impart the students, in depth knowledge about the importance of power converters in renewable energy. The course covers design of solar photovoltaic, design of power converter for wind and hybrid system.	
Unit – I	**Photovoltaic Inverter Structures**	**9**
Introduction - Inverter Structures Derived from H-Bridge Topology - Inverter Structures Derived from NPC Topology - Typical PV Inverter Structures - Three-Phase PV Inverters - Control Structures.		
Unit - II	**Grid Synchronization in Single-Phase Power Converters**	**9**
Introduction - Grid Synchronization Techniques for Single-Phase Systems - Phase Detection Based on In-Quadrature Signals - PLLs Based on In - Quadrature Signal Generation - PLLs Based on Adaptive Filtering.		
Unit - III	**Islanding Detection**	**9**
Introduction – Non detection Zone - Overview of Islanding Detection Methods - Passive Islanding Detection Methods - Active Islanding Detection Methods.		
Unit - IV	**Grid Converter Structures and requirements for Wind Turbine Systems**	**9**
Introduction - WTS Power Configurations- Grid Power Converter Topologies - WTS Control - Frequency and Voltage Deviation under Normal Operation - Active Power Control in Normal Operation - Reactive Power Control in Normal Operation.		
Unit - V	**Grid converter control for WTS**	**9**
Introduction – Model of the converter – AC voltage and DC voltage control- Voltage oriented control and direct power control - Stand-alone, Micro-grid, Droop Control and Grid Supporting.		

Total:45

TEXT BOOK:

1. Remus Teodorescu, Marco Liserre, Pedro Rodriguez, "Grid Converters For Photovoltaic and Wind Power Systems",1st Edition Wiley, New Delhi, 2011.

REFERENCES:

1. Chetan Singh Solanki, "Solar Photovoltaics : Fundamentals, Technologies and Applications", 2nd Edition, PHI Learning Pvt. Ltd, New Delhi, 2011.
2. Mukund R Patel, "Wind and Solar Power Systems, “Design, analysis and operation ", 2nd Edition, CRC Press, Boca Raton, 2006.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	recall various type of photovoltaic inverter structure	Understanding (K2)
CO2	explain the grid synchronization in single phase converter	Understanding (K2)
CO3	examine the different islanding techniques	Applying (K3)
CO4	interpret the grid converter structures and requirements for wind turbine systems	Applying (K3)
CO5	explain the grid converter control for wind turbine systems	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											1	2
CO2	2	1											1	2
CO3	3	2	1										2	2
CO4	3	2	1										2	2
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	30	70					100
CAT2	20	60	20				100
CAT3	20	60	20				100
ESE	20	60	20				100

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

18EEE27 - POWER QUALITY

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

Preamble	The aim of the subject is to develop an understanding about different power quality problems occurring in power system and provide brief idea about their solutions with comparative study.	
Unit - I	**Introduction to Power Quality:**	**9**
Definitions – power quality, voltage quality – power quality issues: short duration voltage variations, long duration voltage variations, transients, waveform distortion, voltage imbalance, voltage fluctuation, power frequency variations – power quality terms- Computer Business Equipment Manufacturers Associations (CBEMA) curve – ITI curves.		
Unit - II	**Voltage Sag and Over Voltages**	**9**
Introduction – sources of sag and interruption – estimating voltage sag performance – fundamental principles of protection – solutions at end user level- motor starting sags. Transients: Definition– sources of transient over voltages – principles of over voltage protection – devices for over voltage protection – capacitor switching transients –lightning transients – transients from load switching.		
Unit - III	**Long Duration Voltage Variations and Distributed Generation**	**9**
Long duration voltage variation: Definition – principles of regulating the voltage – voltage regulating devices – utility voltage regulator application – capacitor for voltage regulation – end user capacitor application – regulating voltage with distributed resources. Distributed generation and power quality: Resurgence of DG – DG technologies – interface to utility systems – power quality issues – DG on distributed networks - interconnection standards.		
Unit - IV	**Wiring, Grounding and Harmonics:**	**9**
Definitions-wiring and grounding problems - solutions to wiring and grounding problems. Harmonics: Introduction – definition and terms – harmonics, harmonics indices, inter harmonics, notching – voltage Vs current distortion – harmonics Vs transients – sources and effects of harmonic distortion – mitigation and control techniques – passive and active filters for harmonic reduction. Harmonic filter design: A case study – standards on harmonics.		
Unit - V	**Power Quality Monitoring and Solutions:**	**9**
Introduction – Power quality monitoring: Monitoring considerations – brief introduction to power quality measurement equipments and power conditioning equipments – assessment of power quality - application of intelligent systems – Power quality: Monitoring standards.		

Total:45

TEXT BOOK:

1. Roger C. Dugan, Mark F. McGranaghan, & H.Wayne Beaty, "Electrical Power Systems Quality", 3rd Edition, McGraw-Hill, New York, 2017.

REFERENCES:

1. Kennedy Barry W, "Power Quality Primer", 1st Edition, McGraw-Hill, New York, 2000.
2. Sankaran C, "Power Quality", 1st Edition, CRC Press , Washington D.C, 2002.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand various power quality disturbances and issues in electrical distribution network	Understanding (K2)
CO2	analyze the effect of short and long interruptions	Applying (K3)
CO3	evaluate the severity of voltage sag, voltage swell and transients in distribution networks	Applying (K3)
CO4	identify the wiring-grounding problems and design circuits to mitigate harmonic issues	Analyzing (K4)
CO5	understand the importance of PQ monitoring and select equipments to measure power quality	Applying (K3)

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

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

ASSESSMENT PATTERN - THEORY

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

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

18EEE28 - HIGH VOLTAGE ENGINEERING

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Electromagnetic Theory & Generation, Transmission and Distribution	8	PE	3	0	0	3

Preamble	The course is designed to understand various phenomena related to breakdown study and withstand characteristics of insulating materials. The course also describes the generation and measurement of DC, AC and Impulse voltages as well various testing techniques.	
Unit - I	**Overvoltage Phenomenon in Power Systems:**	**9**
Causes for over voltages – lightning phenomenon, lightning arrester - Over voltages due to switching surges, System faults and other abnormal conditions- Travelling waves on transmission lines(lines terminated with open end, short circuited end, apparatus).		
Unit - II	**Electrical Breakdown in Gases, Solids and Liquids:**	**9**
Ionization processes – Townsend's Criterion - Paschen's law- Breakdown in non-uniform fields, corona discharge and its effects– Vacuum breakdown. Conduction and breakdown in pure and commercial liquids. Intrinsic breakdown in solids - Electromechanical breakdown - Thermal breakdown - Breakdown in composite dielectrics		
Unit - III	**Generation of High Voltages and High Currents:**	**9**
Generation of high DC voltages, alternating voltages, impulse voltages and impulse currents – Tripping and control of Impulse Generators.		
Unit - IV	**Measurement of High Voltage and High Currents:**	**9**
High Resistance with series ammeter – Dividers, Resistance, Capacitance and Mixed dividers – Peak Voltmeter, Generating Voltmeters – Capacitance Voltage Transformers, Electrostatic Voltmeters – Sphere Gaps – High current shunts- Digital techniques in high voltage measurement		
Unit - V	**High Voltage Testing of Electrical Power Apparatus:**	**9**
Testing of Insulator, Bushings, Isolators, Transformers, and Surge Diverters – Partial Discharge measurement –Tan delta measurement, Radio interference measurement -International and Indian Standards. Introduction to electromagnetic interference and compatibility.		

Total:45

TEXT BOOK:

1. Naidu M.S. and Kamaraju V, "High Voltage Engineering", 5th Edition, McGraw-Hill, New York, 2013.

REFERENCES:

1. Kuffel E, Zaengl, W.S. and Kuffel J, "High Voltage Engineering Fundamentals", 2nd Edition, Butterworth-Heinemann, Burlington, 2005.
2. Wadhwa C.L, " High Voltage Engineering", 3rd Edition, New Age Publishers, New Delhi, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain the concepts of over voltage phenomenon	Understanding (K2)
CO2	discuss the conduction and breakdown in gases, liquids and solid dielectrics	Understanding (K2)
CO3	model the various generation circuits of high voltage and high currents.	Applying (K3)
CO4	identify the various measurement techniques of high voltage and high currents.	Applying (K3)
CO5	explain the testing procedure of power apparatus	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											1	2
CO2	2	1											1	2
CO3	3	2	1	1									2	3
CO4	3	2	1	1									2	3
CO5	2	1											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	40	60					100
CAT2	20	40	40				100
CAT3	10	50	40				100
ESE	10	50	40				100

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

18EEE29 - BIOMASS ENERGY SYSTEMS

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

Preamble	Biomass Energy Systems is a subject which touches our lives every day, in a very non-intrusive manner. The biomass energy has evolved a lot using thermo chemical, biological and chemical conversion process. Thus, the requirement of learning this subject has changed significantly over a period of time and in fact, this subject addresses this issue in a comprehensive manner.	
Unit - I	**Introduction:**	**9**
Origin of Biomass–Resources - Classification and characteristics - Techniques for biomass assessment - Application of remote sensing in forest assessment - Biomass estimation.		
Unit - II	**Thermochemical Conversion:**	**9**
Different processes: Direct combustion–Incineration–Pyrolysis -Gasification and Liquefaction - Economics of thermo chemical conversion.		
Unit - III	**Biological Conversion:**	**9**
Biodegradation and biodegradability of substrate - Biochemistry and process parameters of bio-methanation - Biogas digester types - Digester design and biogas utilization - Chemical kinetics and mathematical modeling of bio-methanation process- Economics of biogas plant - Social impacts - Bioconversion of substrates into alcohol: Methanol and Ethanol Production.		
Unit - IV	**Chemical Conversion:**	**9**
Briquetting – Pelletization – Agrochemical - fuel Extraction - Hydrolysis & hydrogenation - Solvent extraction of hydrocarbons - Solvolysis of wood – Bio-crude and Biodiesel - Chemicals from biomass.		
Unit - V	**Power Generation:**	**9**
Utilisation of gasifier for electricity generation - Operation of spark ignition and compression ignition engine with wood gas, methanol, ethanol and biogas - Biomass integrated gasification/combined cycles systems. Sustainable cofiring of biomass with coal. Biomass productivity - Energy plantation and power programme.		

Total:45

TEXT BOOK:

1. Sergio Capareda, "Introduction to Biomass Energy Conversions", 1st Edition, CRC Press, India, 2013.

REFERENCES:

1. Rai G.D., "Non Conventional Energy Sources", 6th Edition, Khanna Publishers, India, 2017.
2. SobhNath Singh, "Non Conventional Energy Resources", 1st Edition, Pearson Education , India, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain the nature and principle of different biomass energy extraction systems	Understanding (K2)
CO2	Illustrate thermo-chemical biomass conversion process	Understanding (K2)
CO3	interpret biological and biochemical conversion methods	Applying (K3)
CO4	choose the suitable biomass fuels for different bio-energy applications	Applying (K3)
CO5	categorize various power generation techniques using biomass	Applying (K3)

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										
CO4	3	2												
CO5	3	2	1										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	80					100
CAT2	10	70	20				100
CAT3	10	70	20				100
ESE	10	70	20				100

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

18EEE30 - HVDC AND EHVAC

Programme & Branch	B.E. & Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Power Electronics & Generation, Transmission and Distribution	8	PE	3	0	0	3

Preamble	With the increasing power generation in the country and long distance power transmission, it is necessary that power should be transmitted at extra and ultra-high voltage. This subject deals to phenomena associated with transmission line at higher voltages, equipments generating high voltage and power control strategy.	
Unit - I	**Introduction of EHV AC transmission:**	**9**
Role of EHV AC Transmission-Brief Description of Energy Sources and their Development – Electrostatic and Magnetic Fields of EHV Lines – Electric Shock and Threshold Currents – Capacitance of Long Object – Calculation of Electrostatic Field of AC Lines – Effect of High E.S. Field on Humans, Animals, and Plants – Meters and Measurement of Electrostatic Fields		
Unit - II	**Corona effects:**	**9**
Power Loss and Audible Noise:I^2R Loss and Corona Loss – Corona Loss Formulae – Charge-Voltage (q–V) Diagram and Corona Loss – Attenuation of Travelling Waves Due to Corona Loss – Audible Noise: Generation and Characteristics – Limits for Audible Noise Radio Interference: Corona Pulses: Their Generation and Properties – Properties of Pulse Trains and Filter Response – Limits for Radio Interference Fields – Design of Filter –Television Interference		
Unit - III	**HVDC Transmission:**	**9**
Introduction – Historical Development – Equipment Required for HVDC Systems – Comparison of AC and DC transmission – Limitations of HVDC Transmission system – Reliability of HVDC Systems – Standard Rated Voltages of HVDC and EHVAC Systems – Choice of EHVAC and UHVAC Lines and Substation – Comparison of HVDC Link with EHVAC Link – HVDC – VSC Transmission Systems – Types of MTDC system.		
Unit - IV	**HVDC Converters:**	**9**
HVDC Voltage Source Converters: Principle and operation – 3-phase 6 pulse converters using SCRs – Power flow in HVDC link Control of HVDC Converter Systems: Principle of control – Necessity of control of HVDC link – Power Reversal in DC link – Starting and stopping of DC link – Firing Angle Control – Constant power control – Generation of Harmonics by Converters – Harmonics in VSC Converters		
Unit - V	**Protection Schemes:**	**9**
Nature and Types of faults – Faults on AC side of converter station – Converter Faults – Faults on DC side of the system – Protection against over voltage and over current –Insulators for HVDC Overhead Line – Lightning Over voltages – Smoothing Reactors – DC breakers: concept of DC circuit interruption.		

Total:45

TEXT BOOK:

1. Rakosh Das Begamudre., “Extra High Voltage AC Transmission Engineering”, 4th Edition, New Age International Publishers, New Delhi, 2014 for Units I,II,III.
2. Kamakshaiah S., Kamaraju, “HVDC Transmission”, 1st Edition, Tata McGrawHill, 2011 for Units IV,V.

REFERENCES:

1. Rao S, "EHV AC & HVDC Transmission Systems", 3rd Edition, Khanna Publishers, New Delhi, 2013.
2. Padiyar K.R, "HVDC Power Transmission Systems", 3rd Edition, New Age International Publishers, New Delhi, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	acquire the basic knowledge on to EHV AC Transmission, Electrostatic and Magnetic Fields of EHV Lines	Understanding (K2)
CO2	develop ability for determining corona, radio interference, audible noise generation and frequency spectrum for single and three phase transmission lines.	Applying (K3)
CO3	identify the different HVDC transmission systems	Understanding (K2)
CO4	examine HVDC converter and inverter stations	Applying (K3)
CO5	list out the various faults in stations	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											1	2
CO2	3	2	1										3	2
CO3	2	1											1	2
CO4	3	2	1										3	2
CO5	2	1											1	

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

ASSESSMENT PATTERN - THEORY

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

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

18EEO01 - ELECTRICAL WIRING AND LIGHTING

(Offered by Department of Electrical and Electronics Engineering)

Programme & Branch	All BE/BTech branches except Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Introduction to Engineering	5	OE	3	1	0	4

Preamble	Lighting becomes one of the essential requirements for the humans on day to day activities. Hence it is necessary to educate an engineer in the aspects of Domestic and Industrial Lighting. The idea of the subject is to educate the electrical engineers on the aspect of Introduction to Wiring and its Design considerations, Installations, Light and Luminaires and Light sources	
Unit - I	**Introduction:**	**9+3**
Electric supply system – List of Electrical Symbols and its interpretation – Electrical Diagrams – System of connection of Appliances and accessories – Example circuits – Panel Boards – Earthing – Different types of wires, wiring system, methods and materials – Fuse Calculation and Circuit breakers – Wiring Tools – IE rules for wiring		
Unit - II	**Domestic Wiring:**	**9+3**
Three phase four wire distribution system – Protection – General requirements of electrical installations – Testing of installations – Types of Loads – Service connections – Service mains – Sub-Circuits – Location of main board and Distribution board – Guidelines for installation of fittings – Voltage drop and size of wires – Tools and safety		
Unit - III	**Industrial Wiring:**	**9+3**
Electrical installation for residential buildings - Estimating and costing of material – Solved examples for residential buildings with Problems – Electrical installations for commercial buildings –Electrical installations for small industries		
Unit - IV	**Illumination:**	**9+3**
Introduction – Terms & Definitions – Laws of Illumination – Polar curves – Photometry – Basic principles of Light control – Types of Lighting Schemes – Design of Lighting Schemes – Methods of Lighting calculation with Problems – Factory, Street & Flood Lighting		
Unit - V	**Light Sources:**	**9+3**
History of the electric lamp – Arc lamps – Incandescent Lamps – Gaseous discharge lamps : Sodium vapour discharge lamp, High pressure mercury vapour discharge lamp, Mercury iodide lamp, Neon lamp, Fluorescent Tubes, CFL – LED's		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Raina K.B.& Bhattacharya S.K, "Electrical Design Estimating and Costing", 2nd Edition, New Age International Publishers, New Delhi, 2017 for Units I,II,III.
2. Gupta J.B, "Utilization of Electric Power and Electric Traction", 10th Edition, S.K.Kataria & Sons, New Delhi, 2012 for Units IV, V.

REFERENCES:

1. Pritchard D.C, "Lighting", 6th Edition, Routledge, 2016.
2. Ronald N. Helms, "Ronald N. Helms", 1st Edition, Prentice – Hall, Inc, 1980.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	discuss the various methods in wiring	Understanding (K2)
CO2	determine the different design considerations in Domestic wiring	Applying (K3)
CO3	examine the various Electrical Installations	Analyzing (K4)
CO4	analyze the various lighting and its controls	Analyzing (K4)
CO5	describe the various types of light sources	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												
CO2	3	2	1	1	1									
CO3	3	3	2	2	2	1								
CO4	3	3	2	2	2	1								
CO5	2	1												

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

ASSESSMENT PATTERN - THEORY

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

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

18EEO02 - SOLAR AND WIND ENERGY SYSTEMS
(Offered by Department of Electrical and Electronics Engineering)

Programme & Branch	All BE/BTech branches except Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Applied Physics	5	OE	3	1	0	4

Preamble	Design, installation and commissioning will always be a joyful content for the engineers of any stream as it incorporates the essence of real time study in practical in lieu of theoretical concepts. This course aims in imparting the concepts and nuances of solar and wind energy systems along with its design procedures.	
Unit - I	**Introduction to Solar PV:**	**9+3**
Solar cell – Parameters of solar cell – Solar PV module– Ratings and parameters – Measuring module parameters – Solar PV module arrays – Factor affecting electricity generation by a solar cell and solar PV module.		
Unit - II	**Types of PV Systems:**	**9+3**
Stand alone, grid connected and hybrid systems – Battery parameters – Battery selection – Charge controllers – DC-DC converters – Inverters – MPPT – Components of grid connected PV systems.		
Unit - III	**Solar PV system Design:**	**9+3**
Design methodology for solar PV system: Approximate design of solar PV system – solar PV system design chart – Look up table for solar PV system design – Installation and troubleshooting of solar PV power plants		
Unit - IV	**Introduction to WECS:**	**9+3**
Power output from an ideal turbine – Aerodynamics – Power output from practical turbines – Energy production and capacity factor – Methods of generating synchronous power – DC shunt generator with battery load – AC generators.		
Unit - V	**Wind Power Plant Design:**	**9+3**
Site preparation – Electrical network – Selection of low voltage and distribution voltage equipments – Losses – Wind farm costs		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Chetan Singh Solanki, "Solar Photovoltaic Technology and Systems – A Manual for Technicians, Trainees and Engineers", 1st Edition, PHI learning Private Limited, Delhi, 2013 for Units I, II, III.
2. Gary L.Johnson, "Wind Energy Systems", Electronic Edition Edition, Manhatan, KS, 2006 for Units IV, V.

REFERENCES:

1. Michael Boxwell, "Solar Electricity Handbook", 1st Edition, GreenStream Publishng, UK, 2012.
2. Spera, D.A, "Wind Turbine Technology: Fundamental concepts of Wind Turbine Engineering", 2nd Edition, ASME , NewYork, 2009.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	outline the parameters and ratings of solar cell and modules	Understanding (K2)
CO2	make use of various components intended for solar PV system design	Applying (K3)
CO3	apply the the design procedures for solar PV systems towards installation	Applying (K3)
CO4	identify the required components for wind energy conversion system	Applying (K3)
CO5	examine the design and installation procedures for WECS	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	1										
CO2	3	3	2	1										
CO3	3	3	3	2										
CO4	3	3	2	1										
CO5	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	30	50	20				100
CAT2	25	25	50				100
CAT3	20	30	25	25			100
ESE	20	30	40	10			100

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

18EEO03 - ENERGY CONSERVATION AND MANAGEMENT
(Offered by Department of Electrical and Electronics Engineering)

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

Preamble	This course aims in imparting the procedures of energy audit, energy management and financial management. Also it aims to impart knowledge on energy conservation opportunities in thermal utilities, electrical system, lighting Systems and in buildings	
Unit - I	**Introduction:**	**9+3**
Classification of Energy - Energy Scenario - Energy Needs of Growing Economy - Energy Pricing in India – Energy and Environment - Energy Conservation Act . Energy Audit: Types and Methodology - Energy Audit Instruments - Role of energy managers and auditors		
Unit - II	**Thermal Utilities:**	**9+3**
Steam – Introduction, Properties of steam, Steam distribution systems , Boilers- Types and Classification- Performance Evaluation of Boilers – Losses in Boiler – Energy Conservation opportunities in boilers, Waste heat recovery - Classification and benefits		
Unit - III	**Electrical and Lighting System:**	**9+3**
Introduction to Electric Power Supply Systems - Electrical Load Management and Maximum Demand Control- Power factor improvement and its benefit, Basic Parameters and Terms in Lighting systems - Luminous performance Characteristics of commonly used luminaries and Energy saving opportunities in lighting systems		
Unit - IV	**Energy Conservation in Buildings and ECBC:**	**9+3**
About ECBC – Building Envelope , Fenestrations, Insulation, HVAC , Lighting , Water pumping , Inverter – Elevators and Escalators – Star Labeling for existing buildings		
Unit - V	**Financial Management:**	**9+3**
Investment – need, Appraisal and criteria, Financial analysis techniques – Simple payback period – Return on investment – Net present value – Internal rate of return – Cash flows, Risk and sensitivity analysis – Financing options – Energy performance contracting and role of ESCOs.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. "Guide Books for National Certification Examination for energy managers and Auditors", 3rd Edition, Bureau of Energy Efficiency, 2010.

REFERENCES:

1. Wayne C. Turner & Steve Doty, "Energy Management Handbook", 6th Edition, The Fairmont Press, GA , 2006.
2. Barny L. Capehart, Wainey C. Turner, William J. Kennedy, "Guide to Energy Management", 7th Edition, The Fairmont Press, GA , 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	interpret the importance of energy, energy conservation and energy audit	Understanding (K2)
CO2	appraise the energy saving opportunities in thermal systems	Understanding (K2)
CO3	predict the energy saving opportunities in lighting systems	Applying (K3)
CO4	appraise the energy conservation in buildings and ECBC	Understanding (K2)
CO5	analyze the different financial management techniques	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												
CO2	2	1												
CO3	3	2	1											
CO4	2	1												
CO5	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	70					100
CAT2	10	70	20				100
CAT3	10	50	30	10			100
ESE	10	60	20	10			100

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

18EEO04 - MICRO GRID AND SMART GRID
(Offered by Department of Electrical and Electronics Engineering)

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

Preamble	The course content is designed to study about micro grid standalone autonomous system, smart grid technologies, distribution automation, information and communication technologies. It is used to get familiarized with smart metering and control of smart grid systems. The course aims in imparting knowledge on control, analysis and protection of smart and micro grid system.	
Unit - I	**Microgrid Concept, Structure And Operating Modes:**	**9**
Introduction – Micro Grid Concept and Structure- Operation Modes- Control Mechanism of the Connected DG in a Micro Grid – Micro Grid Operation and Protection Strategies.		
Unit - II	**Microgrid Control:**	**9**
Hierarchical Power Management and Control - DC Micro Grid for a Residential Area- Low Voltage Bipolar type DC Micro grid - State Space Model – H Infinity Control Design - μ based Control Design.		
Unit - III	**Smart Grid and Communication Technologies:**	**9**
Introduction to Smart grid – Smart grid initiatives – Overview of technologies required for smart grid – Information and communication technologies – Data communication – Communication technologies for smart grid – Information security for smart grid**.**		
Unit - IV	**Sensing, Measurement, Control and Automation Technologies:**	**9**
Smart metering and demand side integration – Distribution automation equipment – Distribution management systems – Transmission system operation.		
Unit - V	**Power Electronics and Energy Storage:**	**9**
Power electronic converters – Power electronics in smart grid – Power electronics for bulk power flows – Energy storage.		

Total: 45

TEXT BOOK:

1. Hassan Bevrani, Bruno Francois and Toshifumi Ise," Microgrid Dynamics and Control", Wiley & Sons Ltd, 2017 for Units I, II.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, AkihikoYokoyama "Smart Grid: Technology and Applications" Wiley & Sons Ltd, 2012 for Units III, IV, V.

REFERENCES:

1. Stuart Borlase," Smart Grid: Infrastructure, Technology and Solutions" CRC Press, 2010.
2. James Momoh, "Smart Grid Fundamentals of Design and Analysisll", 1st Edition, Wiley, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand the features of micro grid.	Understanding (K2)
CO2	assess the control aspects of micro grid.	Understanding (K2)
CO3	analyze the smart grid and its communication technologies.	Applying (K3)
CO4	interpret the sensing, measurement, control and automation technologies.	Applying (K3)
CO5	examine about the power electronics in smart grid and 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	2	1											2	1
CO2	2	1											2	1
CO3	3	2	1	1	1								3	3
CO4	3	2											2	2
CO5	3	2			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	40	60					100
CAT2	30	60	10				100
CAT3	20	60	20				100
ESE	20	60	20				100

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

18EEO05 - ELECTRICAL SAFETY
(Offered by Department of Electrical and Electronics Engineering)

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

Preamble	To explore about electrical hazards and its safety measures	
Unit - I	**Hazards Of Electricity:**	**9**
Introduction: Objective of safety - Safety Oath, National safety day – Types of safety – Common safety measures – Types of Hazards – Hazards associated with electrical current and voltage – Electrical safety Definition of terms: Electric shock, Arc and blast. Shock: Impact of electric shock – Influencing factors. Arc – Initiation of Arc – Impacts of Arc – Arc energy release: Arc energy input – Arcing voltage – incident energy – measurement – copper calorimeter – Stoll curve. Blast – Attributes of blast		
Unit - II	**Personnel Protection Equipment(PPE):**	**9**
Flash and thermal protection : Glossary of terminologies – flame resistant,arc thermal performance value (ATPV), energy breakthrough (EBT) – ASTM standard for clothing materials – choice of clothing – flame and non-flame resistant materials – guidelines for selection – Flash Suit Head Protection: Hard hats – ANSI Z 89.1 standard – Eye Protection - requirements of safety glasses, goggles – selection - Face shield. Hearing Protection – Requirement –ear plugs and ear muffs – Noise reduction ratio – thumb rule. Arm and Hand Protection: Rubber gloves – ASTM standards – leather protective glove – level of protection. Foot and leg protection and respiratory protection		
Unit - III	**Electrical safety equipments:**	**9**
Voltage measuring instruments: Safety voltage measurement – contact and non contact type testers – selection criteria Rubber Insulating equipment: Rubber mats,blankets ,covers,line hoses and sleeves – Inspection techniques – standards Insulated tools – hot sticks – cherry picker – standards for tools – safety barriers and signs – safety tags, lock and locking devices. Fire extinguishers – fire safety against electrical fire – types of extinguishers		
Unit - IV	**Safety Earthing Practices:**	**9**
Distinction between system grounding and equipment grounding – Functional requirement of earthing systems – earth electrodes – types. Earth Mats – Procedure for laying earthmat – earth resistance measurements – procedures and standards – step potential ,touch potential – system grounding practices – advantages – types of grounding		
Unit - V	**First aid and Rescue:**	**9**
First Aid: First aid against electric shock, choking, poisoning, wounds and bleeding, burns and scalds, fractures and dislocations, heat stroke and snake bite. Rescue: Primary rescue methods – American Red Cross method. Types: elevated rescue, confined space rescue and ground level rescue. Regulatory Bodies: Functionality – IEEE,IEC,ASTM,NFPA and OSHA		

Total:45

TEXT BOOK:

1. John Cadick, Mary Capelli Schellpfeffer and Dennis Neitzell, "Electircal Safety Handbook", 4th Edition, Mcgraw Hill Publication, New Delhi, 2012.

REFERENCES:

1. Rao.S, Jain R.K. and Saluja H.L, "Electrical Safety, Fire Safety Engineering and Safety Management", 2nd Edition, Khanna Publishers, New Delhi, 1997.
2. Peter E. Sutherland, "Principles of Electrical Safety", I.K. International Publishing House Pvt. Ltd, New Delhi, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand the various terminologies and hazards related to electrical safety	Understanding (K2)
CO2	identify and apply the personnel protection equipment for a typical industry	Applying (K3)
CO3	develop the knowhow of using the various measuring and insulating equipments	Understanding (K2)
CO4	describe the safety earthing practices for LV and HV system	Understanding (K2)
CO5	understand the functionality of international regulatory bodies , first-aid and rescue procedures	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											
CO2	3	1	2											
CO3	3	1	2										2	
CO4	2	1	3											2
CO5	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	40	40	20				100
CAT2	40	60					100
CAT3	50	50					100
ESE	40	40	20				100

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

18EEO06 - ELECTRIC VEHICLE TECHNOLOGY
(Offered by Department of Electrical and Electronics Engineering)

Programme & Branch	All BE/BTech branches except Electrical and Electronics Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Applied Chemistry	8	OE	3	0	0	3

Preamble	This course is designed to provide insight into the elementary concepts, principles and various drive train topologies of electric and hybrid electric vehicles	
Unit - I	**Introduction to Electric Vehicles:**	**9**
Sustainable Transportation – EV System – EV Advantages – Vehicle Mechanics – Performance of EVs – Electric Vehicle drive train – EV Transmission Configurations and components-Tractive Effort in Normal Driving – Energy Consumption – EV Market – Types of Electric Vehicle in Use Today – Electric Vehicles for the Future		
Unit - II	**Electric Vehicle Design Considerations:**	**9**
General Description of Vehicle Movement - Vehicle Resistance – Dynamic Equation - Power Train Tractive Effort and Vehicle Speed - Vehicle Power Plant and Transmission Characteristics - Vehicle Performance - Brake Performance - EV configurations – General and Typical EV configurations - EV parameters		
Unit - III	**Hybrid Traction:**	**9**
Basic concept of hybrid traction, Introduction to various hybrid drive-train topologies-power flow controls in hybrid drive-train topologies - Basic concept of electric traction- Introduction to various electric drive-train topologies- fuel efficiency analysis.		
Unit - IV	**Hybrid Vehicle Control Strategy:**	**9**
Vehicle Supervisory Controller- Mode Selection Strategy -Mechanical Power-Split Hybrid Modes - Series-Parallel Hybrid Modes - Modal Control Strategies - Introduction to Electric Components & Drives used in Hybrid and Electric vehicles, Configuration and control of DC Motor drives – configuration and control of AC Motor drives, Configuration and control of Switch Reluctance Motor drive.		
Unit - V	**Battery Technologies for Electric Vehicle:**	**9**
Introduction - Power and Energy of Electric Propulsion - Basic Terms of Battery Performance and Characterization - Battery Charging Methods and EV Charging Schemes: Charging Methods - EV Charging Schemes - Basic Operation of a Rechargeable Battery - Battery Modeling - Current Status of Battery in Automobile Applications		

Total:45

TEXT BOOK:

1. Mehrdad Ehsani, Yimin Gao and Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", 2nd Edition, CRC press, Florida, United States, 2010.

REFERENCES:

1. Sira -Ramirez, Silva.R Ortigoza, "Control Design Techniques in Power Electronics Devices", 1st Edition, Springer, New York, 2006.
2. Iqbal Hussain, "Electric and Hybrid Vehicles: Design Fundamentals", 2nd Edition, CRC press, Taylor&Francis Group, Florida, United States, 2011.
3. Chan C. C. and Chau K. T., "Modern electric vehicle technology", 1st Edition, Oxford University Press, New York, 2001.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	summarize about the sustainable transportation through electric vehicle systems	Understanding (K2)
CO2	design and select EV drive for the desirable performance and control	Understanding (K2)
CO3	explain the architecture of various types of hybrid Vehicles	Understanding (K2)
CO4	apply the various control strategies of series & Parallel HEVs using DC and AC Motor drives	Applying (K3)
CO5	examine about the battery technologies for Electric vehicle charging schemes	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1												2
CO2	2	1												2
CO3	2	1												2
CO4	3	2	1	1	1								1	3
CO5	3	2	1	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	50	50					100
CAT2	50	50					100
CAT3	40	30	30				100
ESE	20	60	20				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, Practical:30, Total:75

TEXT BOOK:

1	"National Cadet Corps- A Concise handbook of NCC Cadets" by Ramesh Publishing House, New Delhi,2014.

REFERENCES:

1	"Cadets Handbook – Common Subjects SD/SW" 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.						