RGM COLLEGE OF ENGINEERING AND TECHNOLOGY

AUTONOMOUS

Affiliated to JNTUA-Ananthapuramu, Approved by AICTE-New Delhi,
Accredited by NBA-New Delhi, Accredited by NAAC with A+ Grade-New Delhi
Nandyal – 518501, AP, India

DEPARTMENT OF
ELECTRICAL AND ELECTRONICS ENGINEERING

Regulations, Course Structure and Detailed Syllabus

RGM-R-2020

(ESTD-1995)

Applicable for students admitted into
B.Tech (Regular) from 2020-2021
B.Tech (Lateral Entry Scheme) from 2021-22

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
AUTONOMOUS
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

ACADEMIC REGULATIONS, COURSE STRUCTURE AND DETAILED SYLLABI
B.Tech. (Regular) from 2020-21 and B.Tech. (Lateral Entry Scheme) from 2021-22

For pursuing four year Bachelor Degree Program (under graduate) of study in Engineering (B.Tech.), Two-year Master (post graduate) Degree of study in Engineering (M.Tech), Two year Master (post graduate) degree of study in Business Administration (MBA), Two year Master (post graduate) Degree of study in Computer Applications (MCA) offered by Rajeev Gandhi Memorial College of Engineering and Technology, Nandyal - 518501 under Autonomous status and herein referred to as RGMCET (Autonomous).

All the rules specified herein approved by the Academic Council will be in force and applicable to students admitted from the Academic Year 2020-21 onwards. Any reference to "Institute" or "College" in these rules and regulations shall stand for Rajeev Gandhi Memorial College of Engineering and Technology (Autonomous).

All the rules and regulations, specified hereafter shall be read as a whole for the purpose of interpretation. As and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies, the Principal, Rajeev Gandhi Memorial College of Engineering and Technology shall be the Chairman, Academic Council.

The candidate seeking admission into the first year of study of four year B.Tech degree Program should have:

i) Passed either Intermediate Public Examination (IPE) conducted by the Board of Intermediate Education, Andhra Pradesh with Mathematics, Physics and Chemistry as optional subjects (or any equivalent examination certified by Board of Intermediate Education) or a Diploma in Engineering in the relevant branch conducted by the Board of Technical Education, Andhra Pradesh (or any equivalent examination certified by State Board of Technical Education) for admission.

ii) Secured a rank in the EAMCET/EAPCET

iii) examination conducted by AP State Council for Higher Education (APSCHE) for allotment of a seat by the Convener, EAMCET/EAPCET, for admission.

Admission Procedure:

As per the norms of A.P. State Council of Higher Education (APSCHE), Government of Andhra Pradesh, admissions are made to the first year of Four year B.Tech. Degree program as follows:

a) As per the norms of Government of Andhra Pradesh, A-Category (based on the rank obtained in EAMCET/EAPCET) seats will be filled by the Convener, EAMCET/EAPCET.

b) As per the norms of Government of Andhra Pradesh, B-Category seats will be filled by the management.

Admission to the Second year of Four year B.Tech. Degree Program in Engineering:

i) Candidates qualified in ECET and admitted by the Convener, ECET, in such cases for admission, when needed permission from the statutory bodies is to be obtained.

ii) 10% of the sanctioned strength in each program of study (of RGMCET) shall be filled by the Convener, ECET as lateral entry.

List of Programs offered

1. B.Tech – Regular & Lateral Entry
2. M.Tech – Regular
3. MBA – Regular
4. MCA – Regular

Academic Regulations for 2020-21 B. Tech. (Regular)

(Effective for the students admitted into the I year from the Academic Year 2020-2021)
The B.Tech. Degree be conferred by the Jawaharlal Nehru Technological University Anantapur, Anantapuramu, students who are admitted to the program and fulfill all the requirements for the award of the Degree as specified below:

1.0 Award of B.Tech. Degree

1.1. The student will be declared eligible for the award of the B. Tech. degree if he fulfils the following academic regulations:

1.2. Pursued a course of study for not less than prescribed course work duration and not more than double the prescribed course work duration.

1.3. Registered for 160 credits and secured 160 credits with compulsory subjects as listed in Table-1.

Table 1: Compulsory Subjects

S.No	Subject Particulars		
1	All the subjects offered in B.Tech course / MOOCs	7	Technical Seminar
2	**Mandatory Learning Courses** [Environmental Science, Environmental Engineering, Universal Human Values, Indian Heritage and Culture, Constitution of India, Induction Program, Essence of Indian Traditional Knowledge]	8	2 Months Internships - Two
3	All Practical Subjects	9	6 Month Internship
4	All Skill Oriented Courses /Skill Advanced Courses/ Soft Skill Courses	10	Main Project Work
5	Comprehensive Viva	11	Universal Human Values as 03 credits course with effective from 2021 admitted students.
6	Environmental Sciences/ Universal Human Values/ Environmental Engineering/ Indian Heritage and Culture/ Constitution of India/ Constitution, Essence of Indian Traditional Knowledge etc., shall be included in the curriculum as non-credit mandatory courses.		

2.0 Forfeit of seat

Students, who fail to fulfill all the academic requirements for the award of the degree within **eight academic years** from the year of their admission, shall forfeit their seat in

B.Tech. Course.

3.0 Courses of study

The following courses of study are offered at present as specializations for the B.Tech. Course: and any other course as approved by the authorities of the University from time to time.

1) **Civil Engineering**
2) **Electrical and Electronics Engineering**
3) **Mechanical Engineering**
4) **Electronics and Communication Engineering**
5) **Computer Science and Engineering**
6) **Computer Science and Engineering (Data Science)**
7) **Computer Science and Engineering and Business Systems**

Table 2: Credits

Subject	Semester			
	Periods/ Week	Credits	Internal Marks (IM)	External Marks (EM)
Theory	2+1*	3	30	70
Mandatory Learning Courses (Internal Evaluation)	2	-	-	-
Practical	3	1.5	25	50
Drawing	1+4 P	3	30	70
Skill Development Courses (Internal Evaluation)	1+2*	2**	30	70
Summer Internship /CSP Two months (Mandatory) after second year (to be evaluated along with 5th Semester end examinations)/ Community Service Project (Internal Evaluation)	-	1.5	-	100 Certificate from Internship Agency/ signed by any authorized person. Evaluation will be carried as per the guidelines of APSCHE
Industrial/Research Internship Two months (Mandatory) after third year (to be evaluated along with 7th Semester end examinations)	-	3	-	100 Certificate from Internship Agency Evaluation will be carried as per the guidelines of APSCHE ***40% for report, 60% Oral Presentation***
Comprehensive Viva (CV) in VII Semester	-	1	-	50
Major Project	-	6	50	100
Technical Seminar	-	1	50	-
6 Months Internship in Industry	-	5	-	Certificate from Internship Agency/ Industry

Note: * Tutorial

Note: ** [Skill Development Course/ Mandatory Learning Course credits will not be considered for the award of division. However, all these courses have to be cleared through

internal evaluation by scoring minimum of 40% marks. The credits obtained in Skill development courses will be taken in to account for the award of degree]

Note: - EAA will not carry any credits but attendance requirements of 75% should be fulfilled otherwise they have to reregister to fulfill academic requirements.

4.0 Distribution and Weightage of Marks

4.1. The performance of the student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory and 75 marks for practical subject. Comprehensive Viva-Voce (CV) shall be evaluated for 50 marks each and the project work shall be evaluated for 100 marks.

4.2. For theory subjects, the distribution shall be 30 marks for Internal Evaluation (20 marks for internal test and 10 marks for assignment or field work/group task / online test) and 70 marks for the End-Examination.

4.3. During the semester there shall be 2 tests for theory subjects. In each Internal test there shall be one compulsory (short answers) question and 3 descriptive questions are to be answered. The duration of internal test will be for 2 hours. First test to be conducted in 3 units and second test to be conducted in the remaining 3 units of each subject. For awarding of 20 Internal marks the performance of the student in two Internal examinations conducted one in the middle of the semester and the other towards the end of the semester giving a weight age of 0.75 for the better score and 0.25 for the other score will be considered. There shall be two assignments (***only online submission of Assignments will be accepted***) in each subject (problem based/ field work/group task/Online test) for award of 10 marks so that internal Component (marks) will be 30 marks (20 marks for internal test+10 marks for assignments / field work/group task). ***Out of these two internal tests one internal test for 20 marks will be conducted in online mode.***

Table 3: Units for Internal Tests

Semester	
3 Units - First Internal test	3 Units - Second Internal test

4.4. In the case of Skill Development Courses/ Mandatory Learning courses, two Internal examinations shall be conducted one in the middle of the semester and the other at the end of the semester for 30 marks and the marks scored by the student in these exams with a weight age of 0.75 for better score and 0.25 for the other score will be awarded as Internal marks for 30. For the remaining 70 marks an end examination will be conducted along with other theory examinations. However, skill development courses/Value added courses/ Mandatory Learning Courses, end examination will be evaluated internally.

4.5. No makeup test for internal examination or assignments/group tasks will be conducted in any subject or practical. The student, who is absent for any test shall be deemed to have scored zero marks in that subject.

4.6. Open and Professional Electives will commence from 3rd year first semester onwards. The open elective offered in 3-1 semester will be based on self-study/MOOCs. All the students have to opt for the MOOCs (Self Study) and should acquire the required credits. If the student fails to opt for MOOCs, (Under unavoidable circumstances) he/she has to write two internal tests besides the end examination conducted by the institute (Elective offered in place of MOOCs by the Dept.) like other subjects. However, he/she has to obtain the certificate from the organization in which he has registered. Any MOOCs course selected by the student should be of more than 45 hours duration / 12 weeks course with a minimum of 3 credits and also from the reputed organization. Attendance of the student who has opted for MOOCs will be taken from the remaining subjects and labs only in that semester while finalizing the attendance for fulfilling the minimum requirements of attendance for promotion to the next semester. Attendance will not be recorded for MOOCs.

{Massive open online Courses (MOOCs') B.Tech students can avail the facility of earning up to a maximum of 5% credits of their degree requirements through MOOCs. MOOC courses eligible for this purpose are the courses offered by NPTEL / SWAYAM / EDX / Course by any other reputed organisation approved by the department only. The student shall obtain prior approval of the Head of the Department before registering for MOOC's. MOOC courses can be taken in lieu of Elective courses such as Open Electives & Professional Electives (pertaining to their branch only) and Employability Enhancement Courses. No Core, Lab or Project Course can be dropped in lieu of MOOC. The student shall submit course Title, institute which offered MOOC, Examination system and Credits of the Course, duration of course. After deciding on the MOOC and a course which is approved as its equivalent in the curriculum a student can enrol for it and clear it any time as per his/her convenience and obtain the assessment certificate.

If the assessment certificate is submitted

i) Before the commencement of the semester in which the equivalent course is offered, the student will be exempted from attending the regular class work and internal assessment exams of the equivalent subject.

ii) During the semester the student is permitted to withdraw from the remaining part of the course work and internal assessment tests.

iii) After the semester is over but before the results of that semester are declared the student can request for considering his performance in the MOOC in lieu of its equivalent.

The student shall submit to the HOD the original certificate issued by MOOC authorities along with a photocopy of the same. The original will be returned after verification and verification shall be certified by the Head of the Department on the photocopy which shall be kept in records. An equivalent Grade corresponding to grade/marks awarded by MOOC agency shall be determined by a committee consisting

of Principal, Controller of Examinations, Dean Student affairs and HOD concerned. This equivalent Grade shall be shown in the grade sheet and accounted in the SGPA and CGPA calculations.

4.7. Gap Year – Concept of student Entrepreneur in Residence shall be introduced and the outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after I/II/III year to pursue full time entrepreneurship. This period may be extended for another one year (two years in total) and this period would not be counted for the maximum duration for completion of graduation. An evaluation committee shall be constituted to evaluate the proposal submitted by the student and committee shall decide on permitting the student for having the Gap Year. The committee consists of Principal as Chairman and all HODs as members.

4.8. In the open electives offered from III year I Sem onwards student has to select the subjects among the list of open elective subjects by the other departments (inter - department). Student has to clear the subject as per norms to get the required credits. At least minimum of 40 students should register for any open elective; otherwise, that open elective will not be offered.

4.9. Out of the professional electives offered from III Year I Semester onwards again one Professional elective in IV Year I Sem will be a MOOCs (Self Study) and the student has to acquire the required credits to clear the subject as specified in 4.6.

4.10. There shall be mandatory student induction program for freshers, with a three-week duration before the commencement of first semester. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept. / Branch & Innovations etc., shall be included in the guidelines issued by AICTE.

4.11. All undergraduate students shall register for Extra - Academic Activity (EAA) such as

a) NCC/NSS
b) Games and Sports
c) Yoga/Meditation
d) Extension Activities
e) Literary/ Cultural Activities
f) Any other which may be offered in future.

A student will be required to participate in an activity for two hours in a week during second and third semesters. The activities shall be carried out in the allotted hours. The activities will be monitored by the respective faculty in charge, senior faculty member of the department and the Department HOD. Grades will be awarded on the basis of participation, attendance, performance and behaviour. Grades shall be entered in the marks statement as **Good**, **Satisfactory** and **Unsatisfactory** and shall not be counted towards CGPA calculation. If any student gets an Unsatisfactory

Grade, he / she has to repeat the activity in the immediate subsequent Semester / year.

4.12. Courses like Environmental Sciences, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc., shall be included in the curriculum as non-credit mandatory courses. Environmental Sciences is to be offered compulsorily as mandatory course for all branches. A student has to secure 40% of the marks allotted in the internal evaluation for passing the course. No marks or letter grade shall be allotted for all mandatory non-credit courses. **Universal Human Values course** shall be included in the curriculum as credit course in place of any open elective as per the convenience of department.

4.13. Students shall undergo **two mandatory summer internships for a minimum of two months** duration at the end of **second and third** year of the Programme. There shall also be **mandatory 6 months internship** in the **final semester** of the Programme along with the project work and seminar.

4.14. **Curricular Framework for Skill oriented**

i) For skill oriented/skill advanced course, one theory and 2 practical hours or two theory hours may be allotted as per the decision of concerned BOS.

ii) Out of the five skill courses two shall be skill-oriented courses from the same domain and shall be completed in second year. Of the remaining 3 skill courses, one shall be necessarily be a soft skill course and the remaining 2 shall be skill-advanced courses either from the same domain or Job oriented skill courses, which can be of inter disciplinary nature.

iii) A pool of interdisciplinary job-oriented skill courses shall be designed by a common Board of studies by the participating departments/disciplines and the syllabus along with the pre requisites shall be prepared for each of the laboratory infrastructure requirements. The list of such courses shall be included in the curriculum structure of each branch of Engineering, so as to enable the student to choose from the list.

iv) The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/ Professional bodies /APSSDC or any other accredited bodies as approved by the concerned BoS.

v) The Board of studies of the concerned discipline of Engineering shall review the skill advanced courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest courses based on industrial demand.

vi) If a student chooses to take a Certificate Course offered by industries/ Professional bodies/ APSSDC or any other accredited bodies, in lieu of the skill advanced course offered by the Department, the credits shall be awarded to the

student upon producing the Course Completion Certificate from the agency/professional bodies as approved by the Board of studies.

vii) If a student prefers to take a certificate course offered by external agency, the department shall mark attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the concerned Board of Studies, the student is deemed to have fulfilled the attendance requirement of the course and acquire the credits assigned to the course.

viii) A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades. The recommended conversions and appropriate grades/marks are to be approved by the University/Academic Council.

4.15. **Curricular Framework for Honours Programme**

i) Students of a Department/Discipline are eligible to opt for Honors Programme offered by the same Department/Discipline.

ii) A student shall be permitted to register for Honors program at the beginning of 4^{th} semester provided that the student must have acquired a minimum of 8.0 SGPA up to the end of 2^{nd} semester without any backlogs. In case of the declaration of the 3^{rd} semester results after the commencement of the 4^{th} semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Honors Programme stands cancelled and he/she shall continue with the regular Programme.

iii) Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completes the selected advanced courses from same branch under this scheme, he/she will be awarded B.Tech. (Honors) in Mechanical Engineering.

iv) In addition to fulfilling all the requisites of a Regular B.Tech Programme, a student shall earn 20 additional credits to be eligible for the award of B. Tech (Honors) degree. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).

v) Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12 weeks as recommended by the Board of studies.

vi) It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool shall be domain specific courses and advanced courses.

vii) The concerned BoS shall decide on the minimum enrolments for offering Honors program by the department. If minimum enrolments criteria are not met then the students shall be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.

viii) Each pool can have theory as well as laboratory courses. If a course comes with a lab component, that component has to be cleared separately. The concerned BoS shall explore the possibility of introducing virtual labs for such courses with lab component.

ix) MOOC courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Students have to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned will be as decided by the university/academic council.

x) The concerned BoS shall also consider courses listed under professional electives of the respective B. Tech programs for the requirements of B. Tech (Honors). However, a student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

xi) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.

xii) In case a student fails to meet the CGPA requirement for Degree with Honors at any point after registration, he/she will be dropped from the list of students eligible for Degree with Honors and they will receive regular B.Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xiii) Honors must be completed simultaneously with a major degree program. A student cannot earn Honors after he/she has already earned bachelor's degree.

4.16. **Curricular Framework for Minor Programme:**

i) **a)** Students who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in minor specialization groups offered by a department other than their parent

department. For example, If Mechanical Engineering student selects subjects from Civil Engineering under this scheme, he/she will get Major degree of Mechanical Engineering with minor degree of Civil Engineering.

b) Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech Mechanical student can opt for the industry relevant tracks like Data Mining track, IoT track, Machine learning track etc.

ii) The BOS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE, CE, ME etc. or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, Robotics, VLSI etc.

iii) The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BoS.

iv) There shall be no limit on the number of programs offered under Minor. The University/Institution can offer minor programs in emerging technologies based on expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the program.

v) The concerned BoS shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.

vi) A student shall be permitted to register for Minors program at the beginning of 4^{th} semester subject to a maximum of two additional courses per semester, provided that the student must have acquired 8 SGPA (Semester Grade point average) up to the end of 2^{nd} semester without any history of backlogs. It is expected that the 3^{rd} semester results may be announced after the commencement of the 4^{th} semester. If a student fails to acquire 8 SGPA up to 3^{rd} semester or failed in any of the courses, his registration for Minors program shall stand cancelled. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.

vii) A student shall earn additional 20 credits in the specified area to be eligible for the award of B. Tech degree with Minor. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).

viii) Out of the 20 Credits, 16 credits shall be earned by undergoing specified courses listed by the concerned BoS along with prerequisites. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. If a course comes with a lab component, that component has to be cleared

separately. A student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

ix) In addition to the 16 credits, students must pursue at least 2 courses through MOOCs. The courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned as decided by the university/academic council.

x) Student can opt for the Industry relevant minor specialization as approved by the concerned departmental BoS. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned BOS and should produce course completion certificate. The Board of studies of the concerned discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.

xi) A committee should be formed at the level of College/Universities/department to evaluate the Grades/marks given by external agencies to a student which are approved by concerned BoS. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.

xii) If a student drops (or terminated) from the Minor program, they cannot convert the earned credits into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.

xiii) In case a student fails to meet the CGPA requirement for B.Tech degree with Minor at any point after registration, he/she will be dropped from the list of students eligible for degree with Minors and they will receive B.Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xiv) Minor must be completed simultaneously with a major degree program. A student cannot earn the Minor after he/she has already earned bachelor's degree.

INDUSTRIAL COLLABORATIONS (CASE STUDY)

University-Industry linkages refer to the interaction between firms and universities or public research centers with the goal of solving technical problems, working on R&D, innovation projects and gathering scientific as well as

technological knowledge. It involves the collaboration of Industries and Universities in various areas that would foster the research ecosystem in the country and enhance growth of economy, industry and society at large.

The Universities/Institutions (Autonomous) are permitted to design any number of Industry oriented minor tracks as the respective BoS feels necessary. In this process the Universities/Institutions can plan to have industrial collaborations in designing the minor tracks and to develop the content and certificate programs. Industry giants such as IBM, TCS, WIPRO etc., may be contacted to develop such collaborations. The Universities/Institutions shall also explore the possibilities of collaborations with major Industries in the core sectors and professional bodies to create specialized domain skills.

4.17. All the students have to undergo three mandatory internships namely

i) Summer internship (During 2nd year break)

ii) Industrial/ Research internship (During 3rd year break)

iii) 6 Months internship in industry (During 8th Semester)

The student has to (mandatory) undergo summer internship in II year–II Sem break in a reputed organization for two months. The finalization of the internship organization will be done by HOD, two senior faculty members of the department and same will be recommended to the principal for approval. The outcome of the summer internship will be evaluated during the 5th semester which carries 1.5 credits. The student has to undergo research/ industry internship in III year –II Semester break for a period of two months in a reputed organization. The finalization of the summer internship organization will be done by HOD, two senior faculty members of the department and same will be recommended to the principal for approval. The outcome of the research/industry internship will be evaluated during 7th semester which carries 3 credits. The student has to undergo 6 months internship in IV Year, II Semester for a complete period of 6 months in a reputed organization. The finalization of the summer internship organization will be done by HOD, two senior faculty members of the department and same will be recommended to the principal for approval. The outcome of the research/industry internship will be evaluated during 7th semester which carries 3 credits. Certificate from the organization has to be submitted to this effect attested by HOD and Internship in charge to the academic section before the commencement of 3-2 semester.

4.18. The medium of instruction for all Course work, Examination, Seminar Presentations, Project Reports and all academic activities shall be English.

5.0 Question Paper Pattern

5.1. Each Internal Test question paper shall contain 5 questions, of which the First question is compulsory and three questions are to be answered from the remaining four. Compulsory question carries 5 marks (It contains 5 questions of one marks - no choice

in first question). The remaining 3 questions carry 5 marks each. Each question shall have a,b,c.... parts.

5.2. The End Examination question paper will have 7 questions and students have to answer 5 questions. However, the first question is compulsory and it consists of 7 short answer questions, each carrying 2 marks. The next 4 questions are to be answered from the remaining 6 questions and each carries 14 marks. Each 14 marks question shall have a, b, c .. parts. Evaluation of answer scripts shall be done by either Internal or External examiners appointed by the principal. A minimum of 50% of subjects will be evaluated by external examiners.

5.3. For practical subjects, there shall be a continuous evaluation during the semester for 25 internal marks and End Examination carries 50 marks. Of the 25 marks for Internal, 15 marks shall be awarded for day-to-day work, 5 marks to be awarded by conducting an internal laboratory test and 05 marks will be allotted for any creativity/ innovation/ additional learning in lab beyond prescribed set of experiments etc. The End Examination shall be conducted by the teacher concerned and an external Examiner from other institutions.

5.4. For the subject having design and/or drawing, (such as Engineering Graphics, Machine Drawing etc.) and estimation, the distribution shall be 30 marks for Internal evaluation (15marks for day-to-day work and 5 marks for Internal tests and 10 marks for assignments) and 70 marks for End Examination. There shall be two internal tests in a Semester and the better of the two shall be considered for the award of marks for internal tests.

5.5. The Engineering drawing, wherever offered is to be treated as a theory subject. Evaluation method adopted for theory subjects shall be followed here as well.

5.6. There shall be comprehensive Viva-Voce examination at the end of 7^{th} semester. Comprehensive Viva Examination shall be conducted by the committee consisting of senior faculty (based on the recommendation of HOD), an external Examiner from other institutions and HOD and evaluated for 50 marks.

5.7. The project topic should be approved by Internal Department Committee (IDC) / Identified by organization where the student is carrying out 6 months internship. Out of total 150 marks for the project work, 50 marks shall be for Internal Evaluation and 100 marks for the End Semester Examination. The evaluation of project work shall be conducted at the end of the IV Year, II-Semester. The external project viva voce examination will be conducted by the committee consisting of an external Examiner from other institute, Head of the Department and the supervisor of the project. The Internal evaluation for 50 marks shall be on the basis of one technical seminar (25 marks) and remaining 25 for main project related activities. The Internal evaluation of the project work for 50 marks shall be conducted by the committee consisting of head of the Department or his nominee, senior faculty member and the supervisor of project.

5.8. For all practical /main project/CV etc. the HOD of the concerned dept. shall submit a panel of 4 external examiners from different institutes and one will be selected by the Chief Superintendent of the Examination for conducting of end examination.

5.9. **Revaluation of End Examination Scripts**: Revaluation of End Examination scripts is allowed for theory subjects only by paying requisite fee. Procedure for Revaluation: The script will be revaluated by an examiner appointed by the principal. The maximum of revaluation and regular end examination grade will be awarded for that subject. Student can apply for revaluation in a subject only once.

Table 4: Distribution of weightages for examination and evaluation

S.No	Nature of subject	Marks	Type of examination and mode of assessment		Scheme of Examination
1	Theory	70	End Examination. Both internal and external Evaluation (at least a minimum of 50% subjects will be sent for external evaluation)		End Examination in theory subjects will be for 70 marks.
		30	20	Internal Examinations (Internal evaluation)	These 20 marks are awarded to the students based on the performance in two (per semester) Internal examinations with a weightage of 0.75 for better score and 0.25 for the other score.
			10	Assignments/Field work/Group task/Online Test	Average of two assignments /Field work/group task in a semester each evaluated for 10 marks.
2	Practical	50	End lab examination (External evaluation)		This End Examination in practical subjects will be for a maximum of 50 marks.
		25	15	Internal evaluation	Day-to-day performance in lab experiments and record.
			05	Internal evaluation	Internal lab examination at the end of year/semester.
			05	Internal evaluation	05 marks will be allotted for any creativity/ innovation/ additional learning in lab beyond prescribed set of experiments etc.
4	Comprehensive Viva (CV)	50	External evaluation		This end viva-voce examination in all the subjects for 50 marks
5	Project work	50	Internal evaluation		Project work for 50 marks

		100	External evaluation	This end viva-voce in project work for 100 marks
6	Skill Oriented Courses/ Skill Advanced Courses/ Soft Skill Courses	30	Internal evaluation	These 30 marks are awarded to the students based on the performance of two Internal examinations with a weight age of 0.75 for better score and 0.25 for the other score.
		70	Internal Evaluation	Based on the performance in the end examination.
7	Internship/ Internal Project/ Study Report/ Work shop	100	Internal evaluation	As per the Guidelines of APSCHE
8	Mandatory Learning Courses	-	-	No examinations. Attendance minimum is required.
9	EAA	-	Internal evaluation	Based on performance and committee report.
10	Technical Seminar	50	Internal Evaluation	Based on Seminar Report, performance and committee report.

6.0 Attendance Requirements:

6.1. The student shall be eligible to appear for End examinations of the semester if he acquires a minimum of 75% of attendance in aggregate of all the subjects of that semester.

6.2. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in a semester may be granted by the College Academic Committee.

6.3. The student will not be promoted to the next semester unless he satisfies the attendance requirement of the present semester. They may seek re-admission for that semester when offered next.

6.4. **Shortage of Attendance below 65% in aggregate shall in <u>NO</u> case be condoned.**

6.5. Students whose shortage of attendance is not condoned in any semester are not eligible to take their End Examination of that class and their registration shall stand cancelled.

6.6. The stipulated fee shall be payable towards Condonation of shortage of attendance to the college.

6.7. A student is eligible to write the University examinations if he acquires a minimum of 50% in each subject and 75% of attendance in aggregate of all the subjects after Condonation. In case of the student having less than 50% of attendance in any one of the courses (**One subject / lab only**) during that particular semester, he/she will not be permitted to register and appear for that particular course in that particular semester end examinations. In such cases, the students need to register for makeup classes which will be notified by the CoE office after the completion of that particular

semester or at appropriate time whichever is applicable. The students need to secure **90%** of the attendance in the make-up classes to appear for the supplementary examinations thereafter and this will be treated as a second attempt. The number of makeup classes to be conducted will be at least 35% of the regular class work taken in that particular course. **If the attendance is less than 50% in more than one subject/lab he/she will be completely detained in that semester**.

7.0 Minimum Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item No.6.0.

7.1. The student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory or practical or design or CV or drawing subject or Skill Development Courses or project if he secures not less than 35% of marks in the End Examination (If applicable)) and he has to score minimum of 40% marks from internal and external exam marks put together to clear the subject.

7.2. The student shall be promoted from II to III year only if he fulfils the academic requirement of securing a minimum of 50% (41 credits out of 82) credits from all the exams conducted up to and including II Year II-Semester regular examinations irrespective of whether the candidate takes the examination or not.

7.3. The student shall be promoted from third year to fourth year only if he fulfils the academic requirements of securing minimum of 50% (62.5 credits out of 125) credits from all the exams conducted up to and including III year II semester regular examinations, whether the candidate takes the examinations or not.

Table 5: Promotion rules

Promotion from	Total credits to register	Minimum credits to obtain for promotion
II year to III year	82	41
III year to IV year	125	62.5

7.4. The student shall register and put up minimum attendance in all 160 credits and earn 160 credits. Grades obtained in 160 credits shall be considered for the calculation of CGPA.

7.5. Students who fail to earn 160 credits as indicated in the course structure in Table-1 within eight academic years from the year of their admission shall forfeit their seat in B.Tech. Course and their admission shall stand cancelled.

8.0 Course pattern:

8.1. The entire course of study is of four academic years. Each academic year consists of two semesters

8.2. The student is eligible to appear for the End Examination in a subject, but absent at it or has failed in the End Examination may appear for that subject at the supplementary examination.

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Table: 6: Course pattern

Year	Sem	No. of Subjects		Number of Labs		Total credits	
		CSE/ CSE(DS) /CSE&BS/ EEE	ECE/ CE/ Mech.	CSE/ CSE(DS) / CSE&BS/ EEE	ECE/ CE/ Mech.		
First	I	1) BSC - LA&AC 2) BSC - AP 3) ESC - PSP 4) ESC - BEE/BEE/BEE/FED 5) ESC - ED	1) BSC - LA &DE/ LA&AC/ LA&AC 2) BSC - MEC/AC/AC 3) ESC - PSP 4) ESC - FEE/EM /ED 5) HSS - English	1) ESC Lab - E&ITW 2) BSC Lab – EP Lab 3) ESC Lab - PSP	1) HSS Lab - DEL Lab 2) BSC Lab - EC Lab 3) ESC Lab - PSP Lab	Subjects - 5X3 = 15 Labs - 3X1.5 = 4.5	19.5
	II	1) BSC - DE&VC 2) BSC - MEC 3) ESC - DS 4) ESC - MFCS/MFCS/MFCS/BEE 5) HSS - English 6) ML - ES	1) BSC - AC&TT/ DE&VC 2) BSC - AP/ EP/ EP 3) ESC - DS 4) ESC - NWA/ BEEE/ MS 5) ESC - ED/ ED/ BEM 6) ML - ES	1) HSS Lab - DEL Lab 2) BSC Lab - EC Lab 3) ESC Lab - DS Lab	1) ESC Lab - E&ITW 2) BSC Lab - EP Lab 3) ESC Lab - DS Lab	Subjects - 5X3 = 15 ML – No Credits Labs - 3X1.5 = 4.5	19.5
Second	I	1) BSC 2) PCC 3) PCC 4) PCC 5) PCC 6) SOC 7) ML	1) BSC 2) PCC 3) PCC 4) PCC 5) PCC 6) SOC 7) ML	1) PCC Lab 2) PCC Lab 3) PCC Lab	1) PCC Lab 2) PCC Lab 3) PCC Lab	Subjects - 5X3 = 15 SOC - 1x2 = 2 ML – No Credits Labs - 3X1.5 = 4.5 EAA - No Credits	21.5
	II	1) ESC 2) BSC/PCC 3) PCC 4) PCC 5) HSS 6) SOC	1) ESC 2) BSC/PCC 3) PCC 4) PCC 5) HSS 6) SOC	1) ESC/PCC - Interdisciplinary Lab 2) PCC Lab 3) PCC Lab	1) ESC/PCC – Interdisciplinary Lab 2) PCC Lab 3) PCC Lab	Subjects - 4X3 = 12 HSS – 1X3 =3 SOC - 1x2 = 2 ML – No Credits Labs - 3X1.5 = 4.5	21.5
Third	I	1) PCC 2) PCC 3) PCC 4) OEC/JOE 5) PEC 6) SAC/SSC 7) ML	1) PCC 2) PCC 3) PCC 4) OEC/JOE 5) PEC 6) SAC/SSC 7) ML	1) PCC Lab 2) PCC Lab 3) Summer Internship/CSP	1) PCC Lab 2) PCC Lab 3) Summer Internship/CSP	Subjects - 3X3 = 9 OEC/JOE - 1X3 = 3 PEC – 1X3 = 3 SAC/SSC - 1x2 = 2 ML – No Credits Labs - 2X1.5 = 3 Internship - 1X1.5=1.5	21.5
	II	1) PCC 2) PCC 3) PCC 4) PEC 5) OEC/JOE 6) SAC/SSC 7) ML	1) PCC 2) PCC 3) PCC 4) PEC 5) OEC/JOE 6) SAC/SSC 7) ML	1) PCC Lab 2) PCC Lab 3) PCC Lab	1) PCC Lab 2) PCC Lab 3) PCC Lab	Subjects - 3X3 = 9 PEC – 1X3 = 3 OEC/JOE - 1X3 = 3 SAC/SSC - 1x2 = 2 ML - No Credits Labs - 3x1.5 = 4.5	21.5
Fourth	I	1) PEC 2) PEC 3) PEC 4) OEC/JOE 5) OEC/JOE 6) SAC/SSC 7) HSSE	1) PEC 2) PEC 3) PEC 4) OEC/JOE 5) OEC/JOE 6) SAC/SSC 7) HSSE	1) Industrial/ Research Internship 2) CVV	1) Industrial/ Research Internship 2) CVV	PEC - 3X3 = 9 OEC/JOE - 2X3 = 6 SAC/SSC - 1X2 = 2 HSSE - 1X2 = 2 Internship - 1X3 = 3 CVV - 1X1 = 1	23
	II	1) Technical Seminar 2) Internship in Industry 3) Major Project	1) Technical Seminar 2) Internship in Industry 3) Major Project			Seminar - 1X1 = 1 Internship - 1X5 = 5 Project - 1X6 = 6	12
						Total Credits	160

Note-1: 1) BSC – Basic Science Course
2) ESC – Engineering Science Course
3) HSS – Humanities and Social Science
4) ML – Mandatory Learning Course
5) SOC – Skill Oriented Course
6) SAC – Skill Advanced Course
7) PCC – Professional Core Courses
8) PEC – Professional Elective Course
9) OEC – Open Elective Course
10) JOE – Job Oriented Elective
11) SSC – Soft Skill Course
12) CSP – Community Service Project

Note-2: **Mandatory Learning Courses**

1) EC - Environmental Science
2) UHV - Universal Human Values
3) IHC - Indian Heritage and Culture
4) CI - Constitution of India

Note-3: 1) Summer Internship Two months (Mandatory) after Second Year (to be evaluated

during 5th Semester).

2) Industrial/Research Internship Two months (Mandatory) after Third Year (to be evaluated during 7th Semester).

3) Internship in Industry (during 8th Semester)

9.0 Transitory Regulations:

Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone this course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered subject to section 2.0 and they continue to be in the academic regulations in which they were readmitted.

10.0 With-holding of results:

If the candidate has any dues not paid to the Institute or if any case of indiscipline of malpractice is pending against him, the result of the candidate shall be withheld and he will not be allowed / promoted into the next higher semester. The issue of degree is liable to be withheld in such cases.

11.0 Award of Class:

After the student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. degree he shall be placed in one of the following four classes:

Table 7: Award of Division

Class Awarded	% of marks to be secured	Division/ Class	CGPA	
First Class with Distinction	70% and above	First class With Distinction	≥ 7.5	CGPA Secured from 160 Credits
First Class	Below 70% but not less than 60%	First Class	≥ 6.5 to < 7.5	
Second Class	Below 60% but not less than 50%	Second Class	≥ 5.5 to < 6.5	
Pass Class	Below 50% but not less than 40%	Pass	≥ 4 to < 5.5	

12.0 Grading*:*

After each subject is evaluated for 100 marks, the marks obtained in each subject will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student falls.

Table 8: Conversion into Grades and Grade points assigned

Range in which the % of marks in the subject fall	Grade	Grade point Assigned	Performance
90 to 100	O	10	Outstanding
80 to 89.9	A^+	09	Excellent
70 to 79.9	A	08	Very Good
60 to 69.9	B^+	07	Good
50 to 59.9	B	06	Above Average
45 to 49.9	C	05	Average
40 to 44.9	P	04	Pass
<40	F	00	Fail
AB	AB	00	Fail

12.1. Requirement for clearing any subject: The students have to obtain a minimum of 35% in End Examination and they have to score minimum of 40% marks from Internal and external exam marks put together to clear the subject. Otherwise, they will be awarded fail grade.

12.2. F is considered as a fail grade indicating that the student has to reappear for the end supplementary examination in that subject and obtain a non-fail grade for clearing that subject.

12.3. In case of Skill Oriented/ Skill Advanced/ Soft Skill Subjects, as there is no end exam, all 100 marks are for internal assessment only. Student has to score 40% in these courses to complete the subject which will be evaluated internally. Marks obtained in these courses shall not be considered for award of Division.

12.4. To become eligible for the award of degree the student must obtain a minimum CGPA of 4.0

13.0 Supplementary Examinations:

Apart from the regular End Examinations, the institute may also schedule and conduct supplementary examinations for all subjects for the benefit of students with backlogs. Such students writing supplementary examinations as supplementary candidates may have to write more than one examination per day. For eighth semester, special (Advance) supplementary examinations will be conducted in second week following the results publication date of regular examination of eighth semester only.

14.0 Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA)

The Grade Point Average (GPA) for each semester and Cumulative Grade Point Average (CGPA) up to any semester is calculated as follows:

i) Semester Grade Point Average will be computed as follows:

$$GPA = \frac{\sum_1^n C_j \times GP_j}{\sum_1^n C_j}$$

Where, n is the number of subjects in that semester. C_j is Credits for the subjects. GP_j is the grade point obtained for the subject and the summation is over all the subjects in that semester.

ii) A Cumulative Grade Point Average (CGPA) will be computed for every student at the end of each semester. The CGPA would give the cumulative performance of the student from the first semester up to the end of the semester to which it refers to and is calculated as follows:

$$CGPA = \frac{\sum_1^m GPA_j \times TC_j}{\sum_1^m TC_j}$$

Where 'm' is the number of semesters under consideration. TC_j the total number of credits for a j^{th} semester and GPA_j is the Grade Point Average of the j^{th} semester. Both GPA and CGPA will be rounded off to the second digit after decimal and recorded as such.

While computing the GPA / CGPA, the subjects in which the student is awarded zero grade points will also be included.

For any academic/employment purpose the following formulae shall be used for conversion of CGPA to % of marks. % of marks = (CGPA –0.5) x 10.

15.0 Grade Sheet:

A grade sheet (Memorandum) will be issued to each student indicating his performance in all subjects of that semester in the form of grades and also indicating the GPA and CGPA.

16.0 Award of Degree

After having admitted into the program, B.Tech degree shall be conferred on a student who has satisfied the following conditions.

i) The student joining with Intermediate qualification must have, after admission into the Regular B.Tech programme of the college, pursued a regular course of study for not less than four academic years and not more than eight academic years.

ii) The student joining under lateral entry scheme with diploma qualification must have, after admission into III Semester B.Tech, pursued a regular course of study for not less than three academic years and not more than six academic years.

iii) The student must have satisfied the minimum academic requirements in appropriate branch of engineering in each semester of the program, herein after prescribed.

iv) Students must register for all the courses and earn the credits specified

v) Students who fail to fulfil all the academic requirements for the award of degree within the specified period from the year of their admission shall forfeit their seat in B.Tech course and their admission stands cancelled.

vi) The student shall successfully complete non-credit courses like EAA / ML / Internship.

vii) The student has no dues to the institution, library, hostels etc.

viii) The student has no disciplinary action pending against him/her.

The Degree will be conferred and awarded by Jawaharlal Nehru Technological University Anantapur, Ananthapuramu on recommendations by the Academic council of RGMCET (Autonomous) basing on the eligibility as in clause 6.0 and 7.0.

17.0 Transcripts:

After successful completion of prerequisite credits for the award of degree, a Transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued if required after the payment of requisite fee and also as per norms in vogue.

18.0 Rules of Discipline:

18.1. Any attempt by any student to influence the teachers, Examiners, faculty and staff of Examination section for undue favours in the exams, and bribing them either for marks or attendance will be treated as malpractice cases and the student can be debarred from the college.

18.2. When the student absents himself, he is treated as to have appeared and obtained zero marks in that subject(s) and grading is done accordingly.

18.3. When the performance of the student in any subject(s) is cancelled as a punishment for indiscipline, he is awarded zero marks in that subject(s).

18.4. When the student's answer book is confiscated for any kind of attempted or suspected malpractice, the decision of the Chief Superintendent is final.

19.0 Minimum Instruction Days:

The minimum instruction days for each semester shall be 95 clear instruction days excluding the days allotted for tests/examinations and preparation holidays declared if any.

20.0 Amendment of Regulations:

The college may, from time to time, revise, amend or change the regulations, scheme of examinations and syllabi. However, the academic regulations of any student will be same throughout the course of study in which the student has been admitted. However, students will continue to be in the academic regulations in which they were readmitted.

21.0 Transfers

There shall be no branch transfers after the completion of admission process.

22.0 General:

22.1. The Academic Regulations should be read as a whole for the purpose of any interpretation.

22.2. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.

22.3. The Institute may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institute.

22.4. Where the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.

Academic Regulations for B.Tech. (Lateral Entry Scheme)

(Effective for the students getting admitted into II year from the Academic Year 2021-2022 onwards)

1.0 The students have to acquire a minimum of 121 credits out of 121 from II to IV year of B.Tech. Program (Regular) for the award of the degree.

2.0 Students, who fail to fulfil the requirement for the award of the degree in 6 consecutive academic years from the year of admission, shall forfeit their seat.

3.0 The same attendance regulations are to be adopted as that of B. Tech. (Regular).

4.0 Promotion Rule:

The student shall be promoted from third year to fourth year only if he fulfils the academic requirements of securing minimum of 43 credits out of 86 credits from all the exams conducted up to and including III-year, II semester regular examinations, whether the candidate takes the examinations or not.

5.0 Award of Class:

After the student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree he shall be placed in one of the following four classes: The marks obtained in the best 121 credits will be considered for the calculation of percentage and award of class.

Table 1: Award of Division

Class Awarded	% of marks to be secured	Division/ Class	CGPA	
First Class with Distinction	70% and above	First class With Distinction	≥ 7.5	CGPA secured from 121 Credits
First Class	Below 70% but not less than 60%	First Class	≥ 6.5 to < 7.5	
Second Class	Below 60% but not less than 50%	Second Class	≥ 5.5 to < 6.5	
Pass Class	Below 50% but not less than 40%	Pass	≥ 4 to < 5.5	

6.0 All other regulations as applicable for B. Tech. Four-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).

INSTITUTE VISION

- To develop this rural based engineering college into an institute of technical education with global standards
- To become an institute of excellence which contributes to the needs of society
- To inculcate value based education with noble goal of "Education for peace and progress"

INSTITUTE MISSION

- To build a world class undergraduate program with all required infrastructure that provides strong theoretical knowledge supplemented by the state of art skills
- To establish postgraduate programs in basic and cutting edge technologies
- To create conductive ambiance to induce and nurture research
- To turn young graduates to success oriented entrepreneurs
- To develop linkage with industries to have strong industry institute interaction
- To offer demand driven courses to meet the needs of the industry and society
- To inculcate human values and ethos into the education system for an all-round development of students

INSTITUTE QUALITY POLICY

- To improve the teaching and learning
- To evaluate the performance of students at regular intervals and take necessary steps for betterment
- To establish and develop centers of excellence for research and consultancy
- To prepare students to face the competition in the market globally and realize the responsibilities as true citizen to serve the nation and uplift the country's pride.

VISION OF THE DEPARTMENT

- To nurture the students on the fundamentals of Electrical Engineering with a strong focus on applications in technical developments.
- To improve the curriculum of Electrical and Electronics Engineering to meet the changing technological needs of society and industry at the global level.
- To contribute plug-ins for the betterment of humankind by providing value based education with a noble goal of 'Education for Peace and progress.

MISSION OF THE DEPARTMENT

- To produce intellectual and social responsible electrical engineers with sound theoretical knowledge blended with state of the art skills for global development.
- To inculcate knowledge in production, maintenance of electrical power generation through smart innovations to meet the power demand of the society.
- To motivate the student towards research and entrepreneurship in the field of Electrical Engineering.

Program Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **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.
3. **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.
4. **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.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **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.
7. **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.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **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.
12. **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 Educational Objectives (PEOs)

PEO-1: Graduates will have intra-disciplinary comprehension and skills to design and develop products and systems in the field of Electrical and Electronics Engineering.

PEO-2: Graduates will acquire knowledge to meet the needs of operation and continuance of electrical tools used in various industries.

PEO-3: Graduates will be proficient to meet the tasks in public and private sectors of Electrical Engineering.

PEO-4: Graduates will possess the knowledge and motivation to pursue successful professional career for the betterment of humankind.

Program Specific outcomes (PSOs)

PSO-I: Students are able to analyze and design the electrical and electronic circuits with the knowledge of courses related circuits, networks, linear digital circuits and power electronics.

PSO-II: Student can explore the scientific theories, ideas, methodologies in operation and maintenance of electrical machines to bridge the gap between academics and industries.

PSO-III: Students are able to work professionally with new cutting edge Technologies in the fields of power system, generation, operation, and maintenance.

Note: Program Outcomes (POs) and Program Specific Outcomes (PSOs) are mapped with Course Outcomes (COs) and they are correlated in following levels

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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I B.TECH, I-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
Theory Subjects								
A0001201	Linear Algebra and Advanced Calculus	2	1	0	3	30	70	100
A0004201	Applied Physics	2	1	0	3	30	70	100
A0501201	Problem Solving and Programming	2	1	0	3	30	70	100
A0401201	Fundamentals of Electronic Devices	2	1	0	3	30	70	100
A0301201	Engineering Drawing	1	0	4	3	30	70	100
Laboratories								
A0592201	Engineering Workshop & IT Workshop	0	0	3	1.5	25	50	75
A0093201	Engineering Physics Lab	0	0	3	1.5	25	50	75
A0591201	Problem Solving and Programming Lab	0	0	3	1.5	25	50	75
	Total	**9**	**4**	**13**	**19.5**	**225**	**500**	**725**

I B.TECH, II-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
Theory Subjects								
A0007202	Differential Equations and Vector Calculus	2	1	0	3	30	70	100
A0005201	Modern Engineering Chemistry	2	1	0	3	30	70	100
A0502202	Data Structures	2	1	0	3	30	70	100
A0302202	Fluid Mechanics & Hydraulic Machinery	2	1	0	3	30	70	100
A0003201	English for Engineers	2	1	0	3	30	70	100
Mandatory Learning course								
A0010202	Environmental Science	2	0	0	0	0	0	0
Laboratories								
A0091201	Digital English Language Lab	0	0	3	1.5	25	50	75
A0092201	Engineering Chemistry Lab	0	0	3	1.5	25	50	75
A0593202	Data Structures Lab	0	0	3	1.5	25	50	75
	Total	**12**	**5**	**9**	**19.5**	**225**	**500**	**725**

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II B.TECH, I-SEMESTER COURSE STRUCTURE

Subject code	Name of the Subject	Hours/week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
Theory Subjects								
A0013203	Transformation Techniques and Complex Variables	2	1	0	3	30	70	100
A0402203	Analog Electronics and Op-Amp Circuits	2	1	0	3	30	70	100
A0205203	Circuit Theory	2	1	0	3	30	70	100
A0504203	Python Programming	2	1	0	3	30	70	100
A0206203	Electrical Machines-I	2	1	0	3	30	70	100
Skill Development Course								
A0012203	Design Thinking and Innovations	1	2	0	2	30	70	100
Mandatory Learning Course								
A0015203	Universal Human Values	2	0	0	0	0	0	0
Laboratories								
A0491203	Electronic Devices & Circuits lab	0	0	3	1.5	25	50	75
A0291203	Electrical Circuit Theory & Simulation lab	0	0	3	1.5	25	50	75
A0571203	Python Programming Lab	0	0	3	1.5	25	50	75
	Total	**13**	**7**	**9**	**21.5**	**255**	**570**	**825**

II B.TECH, II-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
Theory Subjects								
A0207204	Field Theory	2	1	0	3	30	70	100
A0208204	Electrical Machines-II	2	1	0	3	30	70	100
A0407204	Digital Electronics	2	1	0	3	30	70	100
A0209204	Electrical Measurements &Instrumentation	2	1	0	3	30	70	100
A0210204	Network Theory	2	1	0	3	30	70	100
Skill Development Course								
A0019203	Aptitude Arithmetic Reasoning and Comprehension	1	2	0	2	30	70	100
Laboratories								
A0494204	IC and PDC Lab	0	0	3	1.5	25	50	75
A0293204	Electrical Machines-I Lab	0	0	3	1.5	25	50	75
A0294204	Electrical Measurements & Instrumentation Lab	0	0	3	1.5	25	50	75
	Total	**11**	**7**	**9**	**21.5**	**255**	**570**	**825**

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III B.TECH, I-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
Theory Subjects								
A0211205	Control Systems	2	1	0	3	30	70	100
A0212205	Electrical Machines-III	2	1	0	3	30	70	100
A0213205	Power Electronics	2	1	0	3	30	70	100
Professional Elective-I		2	1	0	3	30	70	100
A0214205	Transmission of Electric Power							
A0215205	Neural Networks & Fuzzy Systems							
A0216205	Programmable Logic Controllers							
Open Elective-I/JOE		2	1	0	3	30	70	100
A0512205	Core JAVA Programming							
A0506203	Computer Organization & Architecture							
A0513205	Web Programming							
Skill Development Course								
A0217205	Sensors & Actuators	1	2	0	2	30	70	100
Mandatory Learning Course								
A0014203	Indian Heritage & Culture	2	0	0	0	0	0	0
Laboratories								
A0296205	Electrical Machines-II Lab	0	0	3	1.5	25	50	75
A0297205	Control Systems & Simulations Lab	0	0	3	1.5	25	50	75
A0023205	Community Service Project/Summer Internship	0	0	3	1.5	0	100	100
	Total	**13**	**7**	**9**	**21.5**	**230**	**620**	**850**

III B.TECH, II-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
Theory Subjects								
A0219206	Basics of Signals & Systems	2	1	0	3	30	70	100
A0220206	Power System Analysis	2	1	0	3	30	70	100
A0221206	Power System Protection	2	1	0	3	30	70	100
Professional Elective-II		2	1	0	3	30	70	100
A0420206	Embedded Controllers							
A0222206	Power Electronics for Renewable Energy Systems							
A0421206	VLSI Design							
Open Elective-II / Job Oriented Elective/MOOCs		2	1	0	3	30	70	100
A0223206	High Voltage Direct Current Transmission							
A0224206	High Voltage Engineering							
A0507203	Database Management Systems							
Skill Development Course								
A0422206	Arduino Programming	1	2	0	2	30	70	100
Mandatory Learning Course								
A0022203	Constitution of India	2	0	0	0	0	0	0
Laboratories								
A0298206	Power Electronics Lab	0	0	3	1.5	25	50	75
A0499206	Embedded Controllers Lab	0	0	3	1.5	25	50	75
A0299206	Power Systems Lab	0	0	3	1.5	25	50	75
	Total	**13**	**7**	**9**	**21.5**	**255**	**570**	**825**

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IV B.TECH, I-SEMESTER COURSE STRUCTURE

Subject Code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
Professional Elective-III								
A0228207	Power Semiconductor Drives	2	1	0	3	30	70	100
A0229207	Power System Harmonics							
A0230207	Advanced Control System							
Professional Elective-IV								
A0225207	Distribution and Utilization of Electrical Energy	2	1	0	3	30	70	100
A0423206	Digital Signal Processing							
A0231207	Power Quality							
Professional Elective-V / MOOCs								
A0235207	Renewable Electrical Energy Sources	2	1	0	3	30	70	100
A0236207	Special Machines and Control							
A0237207	Facts Controllers and Applications							
Open Elective-III / Job Oriented Elective								
A0226207	Electrical Energy Resources	2	1	0	3	30	70	100
A0232207	Smart Grid Technologies							
A0233207	Energy Management & Audit							
Open Elective-IV / Job Oriented Elective								
A0227207	Fundamentals of Electric and Hybrid Electric Vehicles	2	1	0	3	30	70	100
A0446207	Microcontroller-based System Design							
A0240206	Soft Computing Techniques							
Skill Development Course								
A0541207	Structured Query Language	1	2	0	2	30	70	100
Humanities and Social Sciences								
A0017203	Managerial Economics and Financial Analysis	2	0	0	2	30	70	100
Laboratories								
A0094207	Comprehensive Viva	0	0	0	1	0	50	50
A0095207	Industrial/Research Internship	0	0	0	3	0	100	100
	Total	**13**	**7**	**0**	**23**	**210**	**640**	**850**

IV B.TECH, II-SEMESTER COURSE STRUCTURE

Course code	Name of the Subject	Hours/Week			Credits	Marks		
		Theory	Tutorial	Lab		Internal	External	Total
A0096208	Technical Seminar	0	0	0	1	50	0	50
A0097208	Internship in Industry	0	0	0	5	0	100	100
A0098208	Major Project	0	0	0	6	50	100	150
	Total	**0**	**0**	**0**	**12**	**100**	**200**	**300**

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I B.Tech, I-Sem (EEE)

L	T	C
2	1	3

(A0001201) LINEAR ALGEBRA AND ADVANCED CALCULUS
For branches: CE, EEE, ME, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:
- To familiarize the concepts of matrices and mean value theorems and their applications in engineering.
- To equip the students to solve various application problems in engineering through evaluation of Gamma, Beta functions and multiple integrals etc.,

COURSE OUTCOMES:
After completion of the course the student will be able to:
- Understand the use of matrices and linear system of equations in solving Network analysis, encoding and decoding in Cryptography and Quantum mechanics problems.
- Apply the concept of Gamma and Beta functions in digital signal processing, discrete Fourier transform, digital filters and Oscillatory theory in engineering.
- Analyze differential and integral calculus to solve improper integrals and its applications in many engineering disciplines.
- Determine the process to evaluate double and triple integrals and understand its usage to find surface area and volumes of various bodies in engineering.
- Identify the applications of advanced calculus & Linear algebra in electro-magnetic theory and in telecommunication engineering.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	-	-	-	-	-	-	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-

UNIT – I
Matrices: Elementary row transformations – Rank – Echelon form, Normal form – Solutions of Linear System of Homogenous and Non-Homogeneous equations.

UNIT – II
Eigen Values, Eigen vectors – Properties – Cayley – Hamilton Theorem – Inverse and Power of a matrix by Cayley – Hamilton theorem.

UNIT – III
Quadratic forms: Linear Transformation – Reduction of quadratic form to canonical form and their nature (Rank, Signature and Index).

UNIT – IV
Mean value theorems: Rolle's Theorem – Lagrange's Mean Value Theorem – (excluding proof). Simple examples of Taylor's and Maclaurin's Series.
Functions of several variables – Jacobian – Maxima and Minima of functions of two variables - Lagrange method of Multipliers with three variables only.

UNIT – V
Multiple integrals: – Evaluation of Double integrals (Cartesian and Polar) – Change of Variables – Change of order of Integration – Changing into Polar coordinates – Evaluation of triple integrals.

UNIT – VI

Special functions: Gamma function – Properties – Beta function – properties – Relation between Gamma and Beta functions – Evaluation of Integrals using Gamma & Beta functions.

TEXTBOOKS:

1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publications.
2) R. K. Jain, S. R .K. Iyengar, Advanced Engineering Mathematics, Alpha Science.
3) T.K.V. Iyengar, B. Krishna Gandhi, A Text Book of Engineering Mathematics, Vol – I, S. Chand & Company.

REFERENCES:

1) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2) Erwin kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons,2011.
3) Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4) Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
5) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

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I B.Tech, I-Sem (EEE)

L	T	C
2	1	3

(A0004201) APPLIED PHYSICS
For branches: EEE, ECE, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:
- To provide basic concepts of optics, quantum physics, semiconductors and their applications to the engineering students.

COURSE OUTCOMES:
After the completion of the course the students will be able to:
- Understand the concept of signals by studying the properties of light.
- Construct a quantum mechanical model to explain the behavior of a system at the microscopic level.
- Analyze the structures of materials.
- Identify the semiconducting materials for a particular application.
- Develop new optoelectronic devices for various applications.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	2	1	1	-	-	-	-	-	-	1
CO2	3	-	1	1	2	-	-	-	-	-	-	-
CO3	2	3	1	2	2	-	-	-	-	-	-	1
CO4	2	3	2	1	1	-	1	-	-	-	-	-
CO5	2	2	3	2	1	-	-	-	-	-	-	1

UNIT-I: WAVE –OPTICS
Interference: Introduction –Division of amplitude–Newton's rings and its applications.
Diffraction: Introduction – Fraunhofer diffraction at single slit– Diffraction Grating– Grating spectra –Determination of wavelength of light.

UNIT-II: QUANTUM MECHANICS
Introduction to quantum physics – Wave-Particle duality – de Broglie hypothesis – Verification of wave character of Matter waves (Davison–Germer experiment)– Uncertainty principle– Thought experiment (Electron diffraction) – Wave function (ψ) –Schrodinger's one-dimensional time-independent wave equation – Particle in 1D-potential box.

UNIT III: QUANTUM OPTICS & FIBER OPTICS
Lasers: Characteristics – Einstein's coefficients – Radiation processes – Population inversion – Pumping processes Lasing action –Nd-YAG and He-Ne lasers – Engineering applications
Fiber Optics: Structure –Principle – Acceptance angle, Numerical aperture – Propagation of light in Step-index and Graded-index fibers–Applications: Fibre optic communication system (Block diagram).

UNIT IV: THE CRYSTAL STRUCTURE OF SOLIDS
Introduction –Space lattice – Basis – Unit cell (primitive and Non-primitive) – Crystal systems – Bravais lattices –Atomic radius, Nearest neighbouring distance, Coordination numberand packing factor for SC, BCC, FCC lattices – Diamond structure – Crystal planes and directions– Miller Indices – calculation of interplanar distance.

UNIT V: FREE ELECTRON THEORY & BAND STRUCTURE OF SOLIDS
Introduction –Free electron theory–Sources of electrical resistivity – Fermi energy – Fermi level – Effect of temperature on Fermi distribution function –Kronig-Penny model (qualitative)–Energy bands– Effective mass – Classification of materials based on band theory.

UNIT VI: SEMICONDUCTOR PHYSICS & DEVICES

Introduction –Intrinsic and Extrinsic semiconductors–Fermi level (qualitative)– Carrier generation and recombination–Carriertransport: Diffusion and Drift–Hall Effect and its applications–Direct and indirect band gap semiconductors –p-n junction, Band diagram and Working principle –LED – Solar cell.

TEXT BOOKS

1) M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy" AText book of Engineering Physics"- S. Chand Publications, 11thEdition 2019.
2) R. K. Gaur and S.C. Gupta, "Engineering Physics",DhanpatRai Publications, New Delhi.

REFERENCES

1) "Concepts of Modern Physics",Arthus Beiser Tata Mc Graw Hill Publications, New Delhi.
2) "Physics Volume – II", Resnick, Halliday and Krane, Wiley, New Delhi.
3) "Elements of Solid State Physics", J.P. Srivastava, PHI, 4theds.New Delhi.
4) "Semiconductor Devices: Physics and Technology" S. M. Sze,2nd eds. Wiley.
5) "Solid State Electronic Devices" Ben G. Streetman, Sanjay Kumar Banerjee, 6th eds. PHI Learning.
6) "Electronic Devices and Circuits", 2ndeds. Reston Publishing Company, Inc., Reston, Virginia.
7) "Solid State Physics" R.K. Puri and V.K. Babber, S. Chand Publishing,

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I B.Tech, I-Sem (EEE) | L | T | C
2 | 1 | 3

(A0501201) PROBLEM SOLVING AND PROGRAMMING
For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:
- Introduce the internal parts of a computer, and peripherals.
- Introduce the Concept of Algorithm and use it to solve computational problems
- Identify the computational and non-computational problems
- Teach the syntax and semantics of a C Programming language
- Demonstrate the use of Control structures of C Programming language
- Illustrate the methodology for solving Computational problems

COURSE OUTCOMES:
- Construct his own computer using parts (L6).
- Recognize the importance of programming language independent constructs (L2)
- Solve computational problems (L3)
- Select the features of C language appropriate for solving a problem (L4)
- Design computer programs for real world problems (L6)
- Organize the data which is more appropriated for solving a problem (L6)

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	-	2	-	-	-	2	1	-	-
CO2	2	-	-	-	2	-	-	-	-	-	-	-
CO3	3	2	3	2	-	2	-	-	2	-	-	-
CO4	3	-	2	-	-	-	-	-	3	-	-	-
CO5	-	3	3	-	-	2	-	-	-	-	2	-
CO6	-	-	3	-	-	-	2	-	-	-	-	-

UNIT I

Computer Fundamentals: What is a Computer, Evolution of Computers, Generations of Computers, Classification of Computers, Anatomy of a Computer, Memory revisited, Introduction to Operating systems, Operational overview of a CPU.

Introduction to Programming, Algorithms and Flowcharts: Programs and Programming, Programming languages, Compiler, Interpreter, Loader, Linker, Program execution, Fourth generation languages, Fifth generation languages, Classification of Programming languages, Structured programming concept, Algorithms, Pseudo-code, Flowcharts, Strategy for designing algorithms, Tracing an algorithm to depict logic, Specification for converting algorithms into programs.

Learning Outcomes: Student should be able to
1. Identify the different peripherals, ports and connecting cables in a PC (L2)
2. Illustrate the working of a Computer (L3)
3. Select the components of a Computer in the market and assemble a computer (L4)
4. Solve complex problems using language independent notations (L3)

UNIT II

Introduction to computer problem solving: Introduction, the problem-solving aspect, top-down design, implementation of algorithms, the efficiency of algorithms, the analysis of algorithms.

Fundamental algorithms: Exchanging the values of two variables, counting, summation of a set of numbers, factorial computation, sine function computation, generation of the Fibonacci sequence, reversing the digits of an integer.

Learning Outcomes: Student should be able to

1. Solve Computational problems (L3)
2. Apply Algorithmic approach to solving problems (L3)
3. Analyze the algorithms (L4)

UNIT III

C Language Preliminaries: Keywords and Identifiers, Constants, Variables, Data Types, and Input Output Statements with suitable illustrative "C" Programs.

Operators: Assignment Operators, Relational and Logical Operators, Increment and Decrement Operators, Bitwise Operators, Ternary Operator, Type Conversion, Precedence and Associativity with suitable illustrative C Programs.

Learning Outcomes: Student should be able to

1. Understand keywords, data types in C (L2)
2. Use various operators in C program (L6)
3. Apply type conversions and also understand, analyse precedence and associativity (L2)

UNIT IV

Conditional/Decision Statements: if, if-else, Nested if-else, else-if ladder, Switch-Statement and goto statement with suitable illustrative C Programs.

Loop Control Statements: while, do-while and for with suitable illustrative "C" Programs, break, continue statements.

Learning Outcomes: Student should be able to

1. Select the control structures for solving the problem (L4)
2. Apply statements for solving the problem (L3)
3. Understand the statements in C language (L2)

UNIT V

Arrays: Definition, Importance of an array in C language, One-Dimensional Arrays, Two-Dimensional Arrays, Example programs on the topics mentioned above

Strings: Introduction to Strings, String I/O, String Operations and functions.

Functions: Introduction to Functions, benefits of functions, types of functions, Function calls, return vs. exit( ), Parameter Passing mechanisms, Call-by-Value, Recursion.

Learning Outcomes: Student should be able to

1. Design and develop C programs using functions and arrays. (L6)
2. Apply modular approach for solving the problem (L3)
3. Understand and apply various string handling functions (L2)

UNIT VI

Files : Input and Output – Concept of a file, streams, text files and binary files, Differences between text and binary files, State of a file, Opening and Closing files, file input / output functions(standard library input / output functions for files), file status functions (error handling),Positioning functions, command –line arguments, C program examples.

Storage Classes, pre-processor directives.

Learning Outcomes: Student should be able to

1. Describe the Files types and File operations. (L2)
2. Practice Command line arguments. (L3)
3. Perform Error handling in Filerelated programming in C.(L4)

TEXT BOOKS:

1. PradipDey, and Manas Ghosh, "Programming in C", 2018, Oxford University Press.
2. R.G. Dromey, "How to Solve it by Computer". 2014, Pearson.

3. Brian W. Kernighan, and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Pearson.

REFERENCE BOOKS:

1) P.Chenna Reddy, " Computer Fundamentals and C Programming" 2018, BS Publications
2) RS Bichkar "Programming with C", 2012, Universities Press.
3) PelinAksoy, and Laura Denardis, "Information Technology in Theory", 2017, Cengage Learning.

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I B.Tech, I-Sem (EEE)

L	T	C
2	1	3

(A0401201) FUNDAMENTALS OF ELECTRONIC DEVICES
For Branches: EEE Only

COURSE OBJECTIVES:
- To understand the basic materials used for fabrication of different semiconductor devices.
- To understand construction details, principle of operation and equivalent electrical model of each device.
- Evolution of different diodes based on doping levels.

COURSE OUTCOMES:
- Students are capable of identifying a particular device for different applications.
- Students are able to understand that all the devices are basically two state devices (Switches).
- Students are capable of using two junction devices as an amplifying device.
- Students are able to understand rectifiers, filters and regulators

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	1	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	2	-	3	-	-	-	-	-	-	-	-	-	2	-	-
CO4	-	2	3	-	-	-	-	-	-	-	-	-	2	-	-

UNIT I
FUNDAMENTALS OF SEMI CONDUCTOR: Semi-conductor, bonds in semi-conductor, commonly used semiconductors, energy band description of semi-conductors, types of semi-conductors, conductivity of a , charge densities in a semi-conductor, Diffusion current, Drift current, Carrier life time, continuity equation, Hall effect.

UNIT II
SEMICONDUCTOR DIODE CHARACTERISTICS: Review of PN Junction Diode - V-I characteristics of PN diode, Static and Dynamic resistances, Temperature dependence of parameters(Derivation not necessary)Diode equivalent circuits, Diode capacitances, Breakdown Mechanisms in Semiconductor Diodes, Zener diode characteristics, small signal equivalent circuit of PN diode

UNIT III
BIPOLAR JUNCTION TRANSISTORS (BJT): Study of operation of BJT, Detailed study of currents in a transistor, Input and Output characteristics of transistor in CB, CE, and CC configurations, Relation between Alpha, Beta and Gamma

UNIT IV
JUNCTION FIELD EFFECT TRANSISTORS (JFET): Construction, operation and transfer and output characteristics, Pinch-Off voltage, construction of MOSFET and its characteristics (Enhancement and depletion mode), Comparison of Transistors (BJT, FET, and MOSFET) - UJT

UNIT V
SPECIAL PURPOSE DEVICES: Principle and operation of Schottky Barrier Diode, SCR, DIAC, TRIAC, Avalanche photo diode, LED and Tunnel Diode with the help of energy band diagrams

UNIT VI

RECTIFIERS, FILTERS AND REGULATORS: PN Junction as a Rectifier, Half wave rectifier, ripple factor, Efficiency, regulation and Transformer utilization factor (TUF). Full wave rectifier, Bridge rectifier **Filters:** Harmonic components in a rectifier circuit, Inductor filter, Capacitor filter, L-Section filter, Π- Section filter, comparison of various filter circuits, Simple circuit of a regulator using Zener diode.

TEXT BOOKS:

1. Electronic Devices and Circuits – J.Millman, C.C.Halkias, Tata McGraw Hill, 2nd Ed., 2007.
2. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall, 9th Edition, 2006.
3. Electronic Devices and Circuits- David A. Bell, Oxford University Press, 5th Edition, 2008.

REFERENCES:

1. Electronic Devices and Circuits – T.F. Bogart Jr., J.S.Beasley and G.Rico, Pearson Education, 6th edition, 2004.
2. Principles of Electronic Circuits – S.G.Burns and P.R.Bond, Galgotia Publications, 2nd Edn.., 1998.
3. Microelectronics – Millman and Grabel, Tata McGraw Hill, 1988.
4. Electronic Devices and Circuits – Dr. K. Lal Kishore, B.S. Publications, 2nd Edition, 2005.
5. Electronic Devices and Circuits- Prof GS N Raju I K International Publishing House Pvt. Ltd 2006.

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I B.Tech, I-Sem (EEE)

L	P	C
1	4	3

(A0301201) ENGINEERING DRAWING

For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:

- Understand and appreciate the importance of basic concepts and principles of Engineering Drawing
- Realize and appreciate the importance of engineering drawing as a medium of communication to covey ideas in engineering field
- Enable the students to be aquatint with various basic engineering drawing formats
- Learn to take data and transform in to graphic drawings.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

- Understand the conventions and the methods adopted in engineering drawing.
- Understand the concepts of orthographic projection.
- Improve their visualization skills and to apply these skill in developing new products
- Improve technical communicative skills in the form of communicative drawings

MAPPING OF COs& POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	3	-	-	2	2	3	2	-	3	2	3	2
CO2	3	2	3	2	3	-	-	2	2	3	-	-	3	2	2	2
CO3	3	2	2	1	3	-	-	2	2	3	-	1	1	2	2	2
CO4	3	2	2	2	3	-	-	2	2	3	1	-	1	2	3	2

UNIT I

Geometrical Constructions: Polygons-Construction of Regular Polygons using given length of a side; Conic sections- Ellipse- Arcs of Circles and Oblong Methods, Construction of Parabola and Hyperbola by eccentricity method only.

UNIT II

Projection of Points and Lines: Introduction to Orthographic Projections- Projections of Points-Projections of Straight Lines parallel to both planes; Projections of Straight Lines-Parallel to one and inclined to other plane, inclined to both planes, determination of true lengths, angle of inclinations.

UNIT III

Projections of Planes: Regular Planes, Plane Perpendicular to one plane and Parallel to another Reference plane, Plane inclined to one Reference Plane.

UNIT IV

Projections of Solids: Prisms, Pyramids, Cones and Cylinders with the axis perpendicular to one plane and parallel to the reference plane, Plane inclined to one reference Plane only.

UNIT V

Section of solids: Sectioning of prism, pyramid, cone and cylinder– sectional view – true shape. Solids in simple position and cutting plane inclined to one reference plane only.

Development of surface of solids: Development of truncated prism, pyramid, cone and cylinder – frustum of cone and pyramid.

UNIT VI

Orthographic and Isometric Projections: Introduction to Isometric projections/ views, Construction of Isometric view/ projections of simple solids. Conversion of Isometric Views

to Orthographic Views/Projections-Conversion of Orthographic Views to Isometric Projection/ Views.

TEXT BOOK:

1) Engineering Drawing. K.L Narayana, P. Kannaiah, Scitech Publications, 2011
2) Engineering Drawing by N.D. Bhatt, Chariot Publications,2014

REFERENCE BOOKS:

1) Engineering Drawing, B.V.R Gupta, J.K. Publishers,2008
2) Engineering Drawing and Graphics, Venugopal /New age publications,2007
3) Engineering Drawing by M.B. Shah and B.C. Rana, Pearson Publishers,2009
4) Engineering Drawing, Johle, Tata Mc Graw – Hill, 2008
5) K.V. Natarajan, 'A text book of Engineering Graphics', Dhanalakshmi publishers, Chennai, 2006.

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I B.Tech, I-Sem (EEE)

L	P	C
0	3	1.5

(A0592201) ENGINEERING WORKSHOP & IT WORKSHOP
For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

ENGINEERING WORKSHOP

COURSE OBJECTIVES:

- To familiarize with the basic manufacturing processes and to study the various tools and equipment used, hands-on training is given in different sections. Essentially student should know the labour involved, machinery or equipment necessary, time required to fabricate and also should be able to estimate the cost of the product or job work.

COURSE OUTCOMES:

At the end of the Engineering Work Shop:

- A student should know the basic knowledge of various tools and their use in different sections of manufacturing such as fitting, carpentry, tin smithy, welding etc. and basic engineering practices such as plumbing, electrical wiring, electronic circuits, machine shop practice.
- Ability to design and model various basic prototypes in the trade of fitting such as Straight fit, V- fit.
- Ability to make various basic prototypes in the trade of Tin smithy such as rectangular tray, and open Cylinder.
- Ability to perform various basic House Wiring techniques such as connecting one lamp with one switch, connecting two lamps with one switch, connecting a fluorescent tube, Series wiring, Go down wiring.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	1	2	2	1	-	-	-	2	-	2	1	1	-	-
CO2	-	-	-	-	2	1	-	-	2	2	2	-	2	-	-
CO3	-	-	-	-	2	1	-	-	2	2	2	-	2	-	-
CO4	-	-	-	-	2	1	-	-	2	2	2	-	2	-	-

Note: At least two exercises should be done from each trade.

1. TRADES FOR EXERCISES:

A] Carpentry

1. T-Lap Joint
2. Cross Lap Joint
3. Dovetail Joint
4. Mortise and Tennon Joint

B] Fitting

1. Vee Fit
2. Square Fit
3. Half Round Fit
4. Dovetail Fit

C] House Wiring

1. Parallel / Series Connection of two/three bulbs
2. Stair Case wiring
3. Tube Light Wiring
4. Measurement of Earth Resistance/Go down Wiring

D] Tin Smithy

1. Rectangular Tray
2. Square Box without lid

3. Open Scoop
4. Funnel

E] Welding

1. Single V butt joint
2. Lap joint
3. Double V butt joint
4. T fillet joint.
5. Gas Welding

F] Soldering

1. Soldering & Desoldering Practice
2. Series Circuit
3. Parallel Circuit

2. TRADES FOR DEMONSTRATION:

a) Plumbing
b) Machine Shop
c) Bosch Power Tools

REFERENCE BOOKS:

1. Engineering Work shop practice for JNTU, V. Ramesh Babu, VRB Publishers Pvt. Ltd., 2009.
2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers, 2013
3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas, 2009
4. Dictionary of Mechanical Engineering, GHF Nayler, Jaico Publishing House, 1999.

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
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IT WORKSHOP

COURSE OBJECTIVES:

- The modules include training on PC Hardware, and Productivity tools including text processor, spread sheet, presentation tools. It enables the students to understand and fix the common hardware, software issues & makes the students to install either Windows or UNIX based Operating system in the machines.
- Enable students to understand how computers work, different types of computers, functions of applications, input and data storage devices, different operating systems,
- It makes the students to understand and use the common office suite tools like word, excel etc. effectively in their daily usage.

COURSE OUTCOMES:

By the end of module students will be expected to demonstrate

- PC Hardware- introduces the students to a personal computer and its basic peripherals, the process of assembling a personal computer. The students should work on working PC to disassemble and assemble to working condition.
- To do installation of system software like MS Widows and Linux and the required device drivers.
- Productivity tools- module would enable the students in crafting professional word documents; excel spread sheets and power point presentations using the Microsoft suite of office tools.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	2	-	-	-	-	-	-	-	-
CO2	2	2	-	2	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	3	-	-

PC HARDWARE

Exercise 1 - Identify the peripherals of a computer, components in a CPU and its functions.
Exercise 2 - Every student should disassemble and assemble the PC back to working condition.
Exercise 3 – Every student should individually install MS windows on the personal computer and also install Linux as dual boot with Windows.

OFFICE TOOLS

Exercise 4 - Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) office equivalent tool word: Importance of LaTeX and MS office tool Word as word Processors, Details of the four tasks and features that would be covered in each. Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.
Task 1-Task III: Using Word Processor to create project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in Word.

SPREAD SHEET

Exercise 5–Spread Sheet Orientation: The mentor needs to tell the importance of MS office 2007,2010/ equivalent tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.
Task 1-Task III: Features to be covered: - Gridlines, Format Cells, Summation, auto fill, Formatting Text, Formulas, Functions

PRESENTATION

Exercise 6 -Students will be working on basic presentation utilities and tools which help them create basic power point presentation. Topic covered during this Exercise includes :- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint. Students will be given model power point presentation which needs to be replicated (exactly how it's asked).

REFERENCES:

1) Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
2) LaTeX Companion – Leslie Lamport, PHI/Pearson.
3) Introduction to Computers, Peter Norton, 6/e Mc Graw Hill
4) Upgrading and Repairing, PC's 18th e, Scott Muller QUE, Pearson Education
5) Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dreamtech
6) IT Essentials PC Hardware and Software Companion Guide, Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education.

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I B.Tech, I-Sem (EEE)

L	P	C
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(A0093201) ENGINEERING PHYSICS LAB
For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:
- The laboratory should help the student to develop a broad array of basic skills and tools of experimental physics and data analysis.
- The laboratory should help students to understand the role of direct observation in physics and to distinguish inferences based on theory and the outcomes of experiments.
- To learn about the optical experiments in establishing the fundamentals in Interference and Diffraction phenomena which will be visualized with the light and laser experiments mentioned in the syllabus.
- To learn about the basic electronic experiments such as energy band gap determination, Hall Effect to know the type of extrinsic semiconductors, Stewart-Gee's experiment in field intensity determination and Solar I-V characteristics.

COURSE OUTCOMES:
After completion of the course the students will be able to
- Operate optical instruments like microscope and spectrometer
- Estimate the wavelength of different colors using diffraction grating
- Study the variation of intensity of the magnetic field due to circular coil carrying current with distance
- Identify the type of semiconductor (i.e., n-type or p-type) using Hall Effect

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	1	2	-	-	-	-	-	-	1
CO2	3	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	1	1	-	-	-	-	-	-	1
CO4	2	3	-	1	2	-	-	-	-	-	-	1

LIST OF EXPERIMENTS (Any10 Experiments)
1) Determination of radius of curvature of a given plano-convex lens using Newton's rings method.
2) Determination of thickness of a thin wire/filmby Wedge shape method.
3) Determination of wavelength of spectral lines using Transmission Grating and Spectrometer.
4) Determination of wavelength of a sodium light bynormal incidence method.
5) Determination of dispersive power of a prism using spectrometer.
6) Determination of wavelength of a laser using transmission grating.
7) Determination of particle size by laser diffraction.
8) Determination of numerical aperture of an optical fiber.
9) Study of variation of magnetic field along the axis of acircular coil carrying current using Stewart and Gee's method.
10) Determination of rigidity modulus of a given wire using Torsional Pendulum.
11) Determination of energy band gap of a Si or Ge semiconductor by Four probe method.
12) Study of B – H Curve of a ferromagnetic material.
13) Determination of carrier density and Hall coefficient or magnetic flux density of an extrinsic semiconductor using Hall effect.
14) Study current (I) and voltage (V) characteristics of a Solar Cell.
15) Measurement of Curie temperature of a given ferroelectric material by studying the temperature dependence of dielectric constant.

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I B.Tech, I-Sem (EEE) | L | P | C
0 | 3 | 1.5

(A0591201) PROBLEM SOLVING AND PROGRAMMING LAB
For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:
- To learn about different types of operators
- To learn how decision making is done during programming
- To learn about various simple constructs used for programming
- To learn to define functions and call them with appropriate parameters
- To understand the usage of string libraries to do common string operations
- To understand pointer referencing and pointer dereferencing

COURSE OUTCOMES:
At the end of this course, the student would be able to
- Apply the specification of syntax rules for numerical constants and variables, data types
- Know the Usage of various operators and other C constructs
- Design programs on decision and control constructs
- Develop programs on code reusability using functions
- Implement various concepts of arrays and strings

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	2	-	-	-	-	-	-	-
CO2	2	-	-	-	3	-	-	-	-	-	-	-
CO3	-	3	3	-	-	-	-	-	-	-	-	-
CO4	3	-	2	-	-	-	-	-	-	1	2	-
CO5	-	2	-	-	2	-	2	-	-	-	-	1

RECOMMENDED SYSTEMS /SOFTWARE REQUIREMENTS:
Intel based desktop PC with ANSI C Compiler and Supporting Editors

EXERCISE 1
Write a C program to demonstrate various operators used in C language.

EXERCISE 2
a) Write a C program to find the roots of a quadratic equation.
b) Write a C program to find both the largest and smallest number in a list of integers.

EXERCISE 3
a) Write a C program, which takes two integer operands and one operator from the user, performs the specified operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)
b) Write a C Program to find the reverse of a given number.

EXERCISE 4
a) Write a C program to find the sum of individual digits of a positive integer.
b) Write a C program to generate the first ‘n‘ terms of the Fibonacci sequence.
[**Note:** A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence.]
c) Write a C program to generate all the prime numbers between 1 and n, where ‘n‘ value is given by the user.
[**Note:** Develop each of the above programs by using different loop constructs supported by C language. (i.e., while, do while and for Loops)]

EXERCISE 5

a) Write a C Program to mask the most significant digit of the given number.
b) Write a program which Prints the following pattern

EXERCISE 6

a) Write a C program to find all the even numbers in the given one dimensional array.
b) Write a C program to print the elements of an array in reverse order.
c) Write a C program to construct a pyramid of numbers.

EXERCISE 7

Write a C program to perform the following operations:

a) Addition of Two Matrices
b) Multiplication of Two Matrices

[Note: Use functions to implement the above specified operations]

EXERCISE 8

Write C programs that use both recursive and non-recursive functions

a) To find the factorial of a given integer.
b) To find the GCD (greatest common divisor) of two given integers.

EXERCISE 9

a) Write a C Program to solve the Towers of Hanoi problem by using recursive function.
b) Write a C Program to demonstrate the various storage classes, which are supported by the C language. [i.e., automatic, external, static and register]

EXERCISE 10

a) Write a C Program to demonstrate that, how to pass an entire array as an argument to a function with a suitable example.
b) Write a C Program to perform various operations on given two strings using string handling functions.

EXERCISE 11

a) Write a C program that uses functions to perform the following operations:
   i) To insert a sub-string in to a given main string from the specified position.
   ii) To delete '**n**' Characters from a given position in a given string.
b) Write a C program to determine if the given string is a palindrome or not.

EXERCISE 12

a) Write a C program that displays the position or index in the string 'S' where the string 'T' begins, or – 1 if 'S' doesn't contain 'T'.
b) Write a C program to count the lines, words and characters in a given text.

EXERCISE 13

a) Write a C program to reverse the first 'n' characters in a file.
b) Write a C program to merge two files into a third file.

REFERENCE BOOKS

1) Programming in C, Pradeep Dey, Manas Ghosh, Oxford Heigher Education
2) The Spirit of C, an introduction to modern programming, M.Cooper, Jaico Publishing House.
3) Mastering C, K.R. Venugopal and S.R. Prasad, TMH Publications.
4) Computer Basics and C Programming, V. Raja Raman, PHI Publications

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I B.Tech, II-Sem (EEE)

L	T	C
2	1	3

(A0007202) DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

For branches: CE, EEE, ME, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:

- To familiarize the concepts of ordinary and partial differential equations.
- To equip the students to analyze vector differentiation and the evaluation of line, surface and volume integrals and their applications in electromagnetic theory, transmission lines etc.,

COURSE OUTCOMES:

After completion of the course the student will be able to:

- Obtain the knowledge of first and higher order differential equations and its use in solving Circuit analysis, heat transfer problems in engineering.
- Analyze solving higher order linear differential equations with variable coefficients and its applications.
- Understand about formation and solution of partial differential equations and importance in thermodynamics, continuum mechanics and fluid mechanics.
- Understand about vector differentiation and its applications in Electromagnetic theory.
- Apply the concept of vector integration to solve many problems in field theory, Electromagnetic theory and transmission lines.

MAPPING OF COS & POS:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	-	-	-	-	-	-	-
CO2	3	2	2	3	3	-	-	-	-	-	-	-
CO3	2	2	3	2	2	-	-	-	-	-	-	-
CO4	3	2	2	3	2	-	-	-	-	-	-	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-

UNIT-I

Differential equations of first order and first degree – Formation of ODEs – Solution of ODEs - Exact, Non – Exact, Linear and Bernoulli's equations – Applications of ODEs to L – R & C – R circuits.

UNIT – II

Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type, e^{ax}, $\sin ax, \cos ax$, Polynomials in x, $e^{ax}\,V(x), xV(x)$, Method of Variation of parameters.

UNIT – III

Higher Order linear Differential Equations with variable coefficients: Cauchy's and Legendre's linear Differential equations, simultaneous linear differential equations with constant coefficients.

UNIT – IV

Partial Differential Equations of First order:

First order partial differential equations, Formation of partial differential equations, solutions of first order linear and non – linear Partial differential equations. Method of separation of variables.

UNIT - V

Vector Differentiation: Introduction of Vector differentiation– Scalar and vector point functions – Gradient of scalar function– Directional derivatives – Divergence of a vector function – Curl of a vector function – Properties of Grad, Div and Curl.

UNIT – VI

Vector integration: Line integral - Potential function – Area, Surface and volume integrals. Vector integral theorems: Green's theorem – Stoke's and Gauss Divergence Theorem (excluding their proof), Verification of Green's, Stoke's and Gauss Theorems.

TEXTBOOKS:

1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publications.
2) R. K. Jain, S. R .K. Iyengar, Advanced Engineering Mathematics, Alpha Science.
3) T.K.V. Iyengar, B. Krishna Gandhi, A Text Book of Engineering Mathematics, Vol – 1, S. Chand & Company.

REFERENCES:

1) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2) (Erwin kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2011.
3) Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
4) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

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I B.Tech, II-Sem (EEE)

L	T	C
2	1	3

(A0005201) MODERN ENGINEERING CHEMISTRY
For branches: EEE, ECE, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:
- To understand the concepts of molecular structures and bonding.
- To explain the students on the principles and applications of electrochemistry.
- To demonstrate about the preparation and applications of polymers.
- To introduce the advanced concepts about nanomaterials.
- To introduce the basic principles of UV and IR spectroscopy.
- To familiarize about Surface chemistry and its applications.

COURSE OUTCOMES:
At the end of the course, the students will be able to
- Concept of Molecular Orbital Theory and Crystal Field Theory(L2)
- Explain about the conductance and role of electrodes in electrochemistry(L1)
- Explain the preparation, properties, and applications of thermoplastics & elastomers (L2)
- Explain the preparation, properties, and applications of Nano materials.
- Understanding the principles of UV-Visible & IR Spectroscopes(L2)
- Summarize the applications of adsorption in Industries (L2)

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	1	-	-	-	1	1	-	-	1
CO2	-	1	2	1	-	1	1	-	-	-	-	-
CO3	1	-	-	2	-	-	1	1	-	-	-	-
CO4	1	3	-	1	2	1	-	1	-	-	-	1
CO5	1	1	-	1	2	-	-	1	1	-	-	1
Course	1	-	1	-	1	-	-	-	1	-	-	-

UNIT-I: Molecular Structure and Bonding
Molecular orbital theory – bonding in homo and heteronuclear diatomic molecules – Energy level diagrams of O_2 and NO–Crystal field theory and its salient features – splitting in octahedral and tetrahedral geometry - Band theory of solids – band diagrams for conductors, semiconductors and insulators.

UNIT-II: Electrochemistry and Applications
Introduction – Conductance, Specific conductance, Equivalent Conductance and molar conductance –Determination of equivalent conductance by Wheatstone bridge method – Conductometric titrations (acid-base titrations) – Numerical Problems on conductance - Electrodes –Reference electrode (Standard hydrogen electrode) – Daniel cell.

UNIT-III: Polymer Technology
Classification of polymers – Functionality – Chain growth, step growth polymerization and Copolymerization with specific examples– Mechanisms of additional polymerization.
Plastics**:** Preparation, properties and applications of PVC, Teflon and Bakelite.
Elastomers: Buna-S and Buna-Npreparation, properties and applications.

UNIT-IV Advanced Engineering Materials
Nanoparticles: Introduction, preparation methods – Sol-gel method, Chemical reduction method – properties and applications in Graphene and CNT.
Super capacitors: Definition, Classification – Engineering Applications.

UNIT-V: Instrumental Methods and Applications

Electromagnetic spectrum, Absorption of radiation: Beer-Lambert's law, UV-Visible Spectroscopy: Types of electronic transitions, Absorption and Intensity Shifts, Principle, Instrumentation and its applications. IR Spectroscopy: Types of Molecular vibrations, Principle, Instrumentation and its applications.

UNIT-VI: Surface Chemistry and Applications

Introduction to surface chemistry, Adsorption- Types of adsorption, Adsorption of gases on solids and its applications, Adsorption isotherm-Langmuir adsorption isotherm theory and postulates.

Colloids: Definition, micelle formation, synthesis of colloids (Chemical and BrediNgs method with examples).

TEXT BOOKS:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

REFERENCE BOOKS:

1. K N Jayaveera, G V Subba Reddy and C Rama Chandraiah, Engineering Chemistry 1/e Mc Graw Hill Education (India) Pvt Ltd, New Delhi 2016
2. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
3. K Sesha Maheswaramma and Mridula Chugh, Engineering Chemistry Pearson India Education Services Pvt. Ltd

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I B.Tech, II-Sem (EEE)

L	T	C
2	1	3

(A0502202) DATA STRUCTURES

For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:

- To make students aware about structures and unions in C language.
- To provide exposure on various searching and sorting techniques.
- To provide exposure on various data structures like stacks, queues, circular queues and linked lists etc.,
- To develop solutions for various problems by using C Programming.

COURSE OUTCOMES:

At the end of this course, the student would be able to

- Develop programs with user defined data types.
- Apply various file handling techniques for better data management
- Apply stacks in various applications
- Apply queues in various applications and distinguish between stacks and queues.
- Analyse various dynamic data structures.
- Implement various searching and sorting techniques

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	3	-	2	-	-	-	2	-	-	2
CO2	3	-	3	-	-	2	-	-	-	-	2	-
CO3	3	2	-	-	-	-	3	-	-	-	-	-
CO4	-	3	-	-	-	-	2	-	-	-	-	-
CO5	3	3	2	-	-	2	3	-	-	-	-	-
CO6	3	-	-	2	3	3	-	-	-	-	-	-

UNIT I

Pointers: Pointer variable and its importance, Pointer variable declaration, initialization of pointer variables, how to access a value from a memory location through it‘s pointer variable. Arithmetic operations on pointer variables, Scale factor length. Pointers and functions - pointers as function arguments (i.e., call-by-reference), Pointers and Arrays, Pointers and Strings, Generic Pointers.

Learning Outcomes: Student should be able to

1) Explain different types of pointers and their usage. (L2)
2) Understand, solving of arithmetic operations on pointer variables (L2)
3) Apply pointers on functions, arrays and strings (L4)

UNIT II

Structure and Unions In C Language: Structures – Introduction, Features of Structures. Declaration and Initialization of Structures, Accessing structure members, structure initialization. Nested Structures, Array of Structures, Arrays within structures and Pointers to Structures, Structures and Functions, Unions, typedef. Example Programs on the topics mentioned above.

Learning Outcomes: Student should be able to

1) Use Structures and Unions in applications using C programming. (L3)
2) Apply the structures and union concepts to solve real world problems. (L2)

UNIT III

Introduction to Data Structures: Classification of data structures, dynamic memory allocation functions in C language. **Stacks:** Definition, Various representation methods, operations on stacks and their implementation in C language, applications of stacks.

Learning Outcomes: Student should be able to

1) Apply the concepts of Data structures to solve the real world problems (L4)
2) Understand the concepts of Stacks and also its applications (L2)
3) Describe the operations of Stacks. (L2)

UNIT IV

Queues: Definition, Various representation methods, operations on queues and their implementation in C language, applications of queues. Circular queues- operations on circular queues and their implementation in C language.

Learning Outcomes: Student should be able to

1) Understand the concepts of Queues and also its applications (L2)
2) Describe the operations of Queues. (L2)

UNIT V

Linked Lists: Definition, Various representation methods, operations on linked lists and their implementation in C language.

Learning Outcomes: Student should be able to

1) Understand the concepts of Linked list (L2)
2) Use the linked lists in various operations. (L3)

UNIT VI

Searching and Sorting Techniques: Searching Techniques - Linear search and Binary Search Techniques. Sorting techniques - Bubble Sort, Selection Sort, Insertion Sort. Implementation of all the above mentioned techniques in C language and trace them by giving different test data.

Learning Outcomes: Student should be able to

1) Design the different sorting techniques (L6)
2) Use Linear search and Binary search methods. (L3)

TEXT BOOKS:

1) PradipDey and ManasGhosh, Programming in C, Oxford University Press, 2nd Edition 2011.
2) B.A.Forouzon and R.F. Gilberg, “COMPUTER SCIENCE: A Structured Programming Approach Using C”, Third edition, CENGAGE Learning, 2016

REFERENCE BOOKS:

1) Byron Gottfried, “Programming with C”, Schaum’s Outlines, 2nd Edition, TATA McGraw-Hill.
2) M.T.Somashekara, “Problem Solving Using C”, PHI, 2nd Edition 2009.
3) A.K.Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press
4) Rajaraman V., "The Fundamentals of Computers", 4th Edition, Prentice Hall of India, 2006.
5) R S Bichker, "Programming in C", University Press, 2012.

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I B.Tech, II-Sem (EEE)

L	T	C
2	1	3

(A0302202) FLUID MECHANICS & HYDRAULIC MACHINERY

For branches: EEE & ME

COURSE OBJECTIVES:

At the end of this course,

- The object is to impart fundamental aspects of fluid motion, including important fluid properties, regions of flow, and pressure variations in fluids at rest and in motion, fluid kinetics.
- To discuss about the laws and equations related to the fluid mechanics.
- Emphasis is placed on understanding how flow phenomena are described mathematically. The effects of fluid friction on pressure and velocity distributions are also considered in some detail.
- The similitude, dimensional analysis and flow measurement should be able to apply to the analysis and of hydraulic machines.
- The student should able to apply the knowledge to solve more complicated problems and study the effect of problem parameters and able to describe the construction and working of different types of hydraulic machines and also plot the performance curves of hydraulic machines.
- The student should be prepared to continue the study and analyze the fluid flows and hydraulic machines to solve the complicated practical problems.

COURSE OUTCOMES:

- Knowledge and understanding
- Extending the student's knowledge of hydraulic machines and learning the design of such systems. Cognitive skills (thinking and analysis)
- The students should link the scientific concepts they are learning with real applications by giving live examples
- Where the subject concepts are applied.
- Students gain a lot of information by searching through the internet and references and from local industrial
- Companies in order to design and solve the problems associated with this subject.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	2	-	-	-	-	2	2	-
CO2	3	2	-	2	2	-	-	-	-	2	-	-
CO3	3	3	-	-	2	1	-	-	-	2	2	-
CO4	2	2	-	2	-	-	-	-	-	3	-	1
CO5	3	3	-	2	2	2	2	-	-	-	-	-

UNIT I

FLUID STATICS: DIMENSIONS AND UNITS: Physical properties of fluids-specific gravity, viscosity, vapor pressure and their influence on fluid motion- atmospheric gauge and vacuum pressure –measurement of pressure- Piezometer, U-tube and differential manometers. Hydrostatic force on a plane area, Buoyancy, centre of Buoyancy, meta-centre, meta-centre height, conditions of equilibrium of a floating and submerged bodies.

UNIT II

FLUID KINEMATICS: Stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform, non-uniform, laminar, turbulent, rotational, and irrotational flows-equation of continuity for one dimensional flow

Fluid dynamics: Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

UNIT III

CLOSED CONDUIT FLOW: Laminar and turbulent flow through pipes: Reynolds experiment significance of Reynold's number, formulae for laminar flow through circular pipes, Turbulent flow-Darcy Weisbach equation, friction factor and Mody's diagram - Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line. Measurement of flow: pilot tube, venturimeter, and orifice meter.

UNIT IV

BOUNDARY LAYER FLOW: Introduction, Definitions, Drag force on a flat plate due to Boundary layer, Turbulent Boundary layer on a flat plate, Analysis of Turbulent Boundary layer, Separation of Boundary layer

UNIT V

BASICS OF TURBO MACHINERY: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

UNIT VI

HYDRAULIC TURBINES: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube theory-functions and efficiency, Unit and specific quantities, characteristic curves.

Hydraulic Pumps: Working principle of Centrifugal and Reciprocating pump. (No-derivations and No-problems)

TEXT BOOKS

1. Fluid Mechanics and Hydraulic Machinery MODI and SETH, S.Chand & co, New Delhi
2. Fluid Mechanics and Hydraulic Machines by R. K. Rajput, Lakshmi Publications.
3. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Standard Book House, New Delhi.

REFERENCES:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
3. Hydraulic Machines by Banga & Sharma, Khanna Publishers.
4. Instrumentation for Engineering Measurements by James W. Dally, William E. Riley, John Wiley & Sons Inc. (Chapter 12 – Fluid Flow Measurements).

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

I B.Tech, II-Sem (EEE)

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(A0003201) ENGLISH FOR ENGINEERS

For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES

- English for Engineers is prescribed to make students communicate their thoughts, opinions and ideas freely in real life situations.
- To improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
- To equip students with professional skills & soft skills
- Develop Communication skills in formal and informal situations.

COURSE OUTCOMES

- Students will be able to use creativity in writing such as E-mails, Reports, Resume writing and Info- Graphics to enhance engineering abilities
- Students will analyze the concepts of critical and analytical Reading skills to understand needs of engineering in society by using modern tools
- Students will be able to develop flair for any kind of writing with rich vocabulary to enhance communicative skills
- Students will understand the basic Grammar techniques and utilize it for language development
- Students will apply the strategies of Soft skills & Ethical components

MAPPING OF COS & POS:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	2	-	-	-	1	1	3	3	-	2
CO2	-	-	-	-	2	2	-	2	-	2	-	3
CO3	-	-	-	-	-	-	-	1	2	2	-	3
CO4	-	-	-	-	-	-	-	-	-	2	-	3
CO5	-	-	-	-	-	-	-	3	3	2	-	2

UNIT- I

a) Reading: Skimming the text for theme
   Reading Text: Engineering in Society by Sarah Bell
b) Grammar: Types of Sentences - Demonstratives- Articles- Prepositions
c) Writing: Paragraph Writing & Practice
d) Vocabulary: Root words - Word lists from Word power Made Easy by Norman Lewis
   Method of Teaching: Analyzing the theme of Reading Prescribed Text, Worksheets on Articles & Prepositions, Assignment on Short paragraphs, Vocabulary activities through worksheets.

UNIT- II

a) Reading: Scanning the text for specific details
   Reading Text: Sultana's Dream by Begum Rokeya
b) Grammar: Tenses & Usage
c) Writing: Formal Letters and E-mail writing – Tips & Practice
d) Vocabulary: Homonyms - Word lists & Practice
   Method of Teaching: Classroom discussion &critical appreciation of the Reading Lesson, Worksheets on Tenses, Practice of Formal Letters, Vocabulary Quizzes- Assignment.

UNIT- III

a) Reading: Note-making (identifying the main ideas and making notes)

Reading text: Satya Nadella: When Empathy is Good for Business
https://www.morningfuture.com

b) Grammar: Framing questions –Wh Qs - Yes/No questions - Question Tags
c) Writing: Resume & Cover letter Writing- Tips &Practice
d) Vocabulary: Synonyms & Antonyms
Method of teaching: Class room Discussions, Student Activity on Questions,E-mail writing, Vocabulary activities through games- Practice- Assignment.

UNIT – IV

a) Reading: Summarizing
Reading Text: Life is a Pizza by Richard Templar from Rules of Life
b) Grammar: If Clauses – Usage & Practice
c) Writing: Writing Definitions – Process of Writing - Tips & Practice
d) Vocabulary: Idioms & Phrases- Practice
Method of Teaching: Discussion & Assignment, If Clauses from Newspapers, Preparing profiles for Resume, Vocabulary activities through worksheets

UNIT – V

a) Reading: Intensive reading (reading for every detail)
Reading text: What is a Drone: Main Features & Applications of Today's Drones by Jack Brown
b) Grammar: Active Voice –Passive Voice- Usage
c) Writing: Report Writing- Types - Practice
d) Vocabulary: Technical Terms- Word Lists- Practice
Method of Teaching: Assignment on Drones, Worksheets on Active/ Passive voice**,** Watch a Documentary on social issues and draft a Report, Technical Terms- Quiz.

UNIT- VI

a) Reading: Appreciating a poem (focus on genre)
Reading text: Where the mind is without fear by Rabindranath Tagore
b) Grammar: Direct & Indirect Speech - Common Errors- Practice
c) Writing: Info-Graphics- Types- Practice
d) Vocabulary: Foreign Derived Words- Word Lists from Norman Lewis Word Power Made Easy
Method of teaching: Learner's interaction on the poem, Practicing Grammar through on line tests, practice reading and understanding graphs, Quiz & worksheets.

REFERENCE TEXTS:

1) English Language & Communication Skills for Engineers (AICTE Syllabus) by Sanjay Kumar & Pushpa Latha, Oxford University Press, 2018
2) Practical English Usage by Michael Swan, Oxford University Press.
3) Technical Communication, Principles and Practice by Meenakshi Raman & Sangeetha Sharama, Oxford University Press, 2016
4) Word Power Made Easy by Norman Lewis, Goyal Publications.
5) 4000 Essential English Words 3 by Paul Nation, Compass Publishing, 2009.
6) GRE/TOEFL Sources to teach vocabulary

ONLINE SOURCES FOR PRESCRIBED READING TEXTS:

https://www.morningfuture.com
https://www.raeng.org.uk/publications/reports/engineering-in-society
https://digital.library.upenn.edu/women/sultana/dream/dream.html,
https://www.mydronelab.com/blog/what-is-a-drone.html

https://www. Freealbaab.free.fr › The Rules of Life PDF
https://www.poetryfoundation.org ›Gitanjali 35 by Rabindranath Tagore | Poetry Foundation

ONLINE SOURCES FOR PRESCRIBED LISTENING SKILLS:

https://learnenglish.britishcouncil.org/skills/listening
https://agendaweb.org/listening/comprehension-exercises.html
https://www.123listening.com/
https://www.linguahouse.com/learning-english/skill-4-learners/listening
https://www.talkenglish.com/listening/listen.aspx
https://ed.ted.com/

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I B.Tech, II-Sem (EEE)

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(A0010202) ENVIRONMENTAL SCIENCE

(Mandatory Learning Course)

For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:

- Creating the awareness about environmental problems among people.
- Imparting basic knowledge about the environment and its allied problems.
- Developing an attitude of concern for the environment.
- Motivating public to participate in environment protection and environment improvement.
- Acquiring skills to help the concerned individuals in identifying and solving environmental problems.
- Environmental education should have an interdisciplinary approach by including physical, chemical, biological as well as socio-cultural aspects of the environment. It should build a bridge between biology and technology.

COURSE OUTCOMES:

- Understand environmental problems arising due to developmental activities.
- Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
- Identify the natural resources and suitable methods for conservation of environment.
- Identify the environmental pollutants and abatement devices.
- Adopt practices that help in promoting balance in nature by making judicious utilization of recourses.

UNIT I MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL SCIENCE

Environment -Definition, Scope, Importance and Need for public awareness. Segments of Environment (Atmosphere, Lithosphere, Hydrosphere and Biosphere).

UNIT II RESOURCES AND UTILIZATION

Renewable and Non-renewable resources.

a) Natural Resources: Soil &Water sources (conflicts of over utilization of water Resources - Hydro power project-problems), forest & mineral resources – Utilization-problems.
b) Non-conventional resources of energy(Solar Energy, wind energy and their applications)

UNIT III

a) **CONCEPTS OF ECO-SYSTEM**
   Structure and functions of an ecosystem: Producers, Consumers and Decomposers-Interaction between biotic and abiotic factors in an ecosystem- Trophic levels- Food chain- Food web –Ecological Pyramid.
b) **TYPES OF ECOSYSTEM**
   Understanding the types of ecosystem: (i) Terrestrial (forest)(ii) Aquatic – (Marine)

UNIT IV BIODIVERSITY

Introduction – Definition – Value of biodiversity- Biodiversity at global, National and Local levels-India as a mega diversity nation-Hot-spots of biodiversity-Threats to biodiversity-IUCN Red data book - Conservation of bio diversity (Insitu and Exsitu conservation methods).

UNIT V ENVIRONMENTAL POLLUTION

Introduction- Causes, effects and control measures of

a) Air pollution
b) Water pollution
c) Soil pollution
d) Noise pollution
e) Plastic pollution

Disaster management: Floods, Earthquake.

UNIT-VI

HUMAN POPULATION ISSUES

a) Demography-problems related to Population explosion- Age structure-Family welfare and family planning programme
b) Diseases- AIDS, Malaria, COVID, Cancer.
c) Human rights, Fundamental duties and Value of education.

ENVIRONMENTAL ISSUES

a) Climatic changes
b) Greenhouse effect and global warming.
c) Ozone layer depletion.
d) Acid rain.

TEXT BOOKS:

1) Deswal, S and Deswal A., (2004), A Basic Course in Environmental Studies, DhanpatRai & Co. Delhi.
2) Anubha Kousik and C P Kousik., New age international publishers.

REFERENCES:

1) Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2) Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,
3) Ahmedabad –380 013, India, Email:mapin@icenet.net (R)
4) Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5) Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)

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I B.Tech, II-Sem (EEE)

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(A0091201) DIGITAL ENGLISH LANGUAGE LAB

For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

The Digital English Language Lab focuses on the production and practice of sounds of language and equips students with the use of English and vocabulary in everyday situations and contexts.

COURSE OBJECTIVES:

- To facilitate the students to use language effectively in everyday social conversations
- To expose the students to the blend of self-instructional and modes of language learning teacher assisted through digital lab
- To improve the fluency and intelligibility of student in spoken English and neutralize their mother tongue influences
- To help the students to participate in group discussions, to face interviews and shape the individual language learning

COURSE OUTCOMES:

- Social interactions, greetings, self-introductions and group talk
- Improving standard pronunciation patterns and neutralize the mother tongue impact
- Developing communication through listening, reading, speaking and writing activities
- Enhancing vocabulary and grammar to develop professional language
- Improving life skills through GD and role plays practices

MAPPING OF COs& POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	1	1	2	2	3	-	2
CO2	1	-	-	-	-	2	1	2	2	3	-	2
CO3	1	-	-	-	-	2	1	2	2	3	-	2
CO4	1	-	-	-	-	2	1	2	2	3	-	2
CO5	1	-	-	-	-	2	1	2	2	3	-	2

Digital English Language Lab consists of two parts:

1) CALL (Lab): Computer Assisted Language Learning
2) ICS (Lab): Interactivity Communication Skills

EXERCISE-I

a) Introduction to Phonetics - Speech Sounds - Vowels - Phonetic Transcription **-**CALL Lab
b) Ice Breaking Activity - Self Introductions (SWOT) –Social Interactions -Pair work - ICS Lab

EXERCISE-II

a) Diphthongs - Consonants - Phonetic Transcription **-** CALL Lab
b) Just A Minute (JAM) **-** ICS Lab

EXERCISE-III

a) Listening Comprehension (audio) - IELTS Testing Exercises -CALL Lab
b) Speaking Activity - Group talk - ICS Lab

EXERCISE-IV

a) Vocabulary Building - Synonyms & Antonyms - Analogy - Testing Exercises -CALL Lab
b) Narration of a Story/Event/ Describing an Object - ICS Lab

EXERCISE-V

a) Situational Dialogues - CALL Lab
b) Role Play - ICS Lab

EXERCISE-VI

a) Pronunciation Evaluation Testing Exercises through EPD - CALL Lab
b) Group Discussion - ICS Lab
   - Any student-based activities

PRESCRIBED SOFTWARE:

K-VAN Solutions (licensed software)

1) Advance Communication Skills Lab
2) English Language Communication Skills Lab
3) Cambridge Advanced Learners' English Dictionary with CD
4) IELTS Academic Preparation and Practice with CD

BOOKS SUGGESTED FOR DELL: (CENTRAL LIBRARY)

1) Skill Pro – A Course in Communication Skills and Soft Skills by Prof. K. Sumakiran et.al, EMESCO.
2) Skill Pro-I Foundation Course - 4 - by Dr. G. Gulam Tariq et.al, Maruthi Publications.
3) Strengthen YourSteps – A Multimodal Course in Communication skills by Dr. M. Hari
4) Prasad et.al
5) English Pronouncing Dictionary Daniel Jones Current Edition with CD
6) English Dictionary for Advanced Learners, (with CD) International edn.Macmillan 2009.

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I B.Tech, II-Sem (EEE)

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(A0092201) ENGINEERING CHEMISTRY LAB
For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:
- Verify the fundamental concepts with experiments

COURSE OUTCOMES:
At the end of the course, the students will be able to
- Learning the analytical skills while doing the experiments (L3)
- prepare simple and advanced polymer materials (L2)
- Measure the concentration of the solutions by conductometric titrations (L3)
- Analyze the IR and UV-Visible Spectra of some organic compounds (L3)

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	1	-	-	-	-	1	-	-	1
CO2	-	2	1	-	2	1	1	1	-	-	1	-
CO3	-	1	-	-	1	-	1	-	1	-	-	1
CO4	1	3	2	1	2	-	1	-	-	-	1	1
Course	1	2	1	-	2	1	-	-	1	1	-	1

LIST OF EXPERIMENTS:

1) Preparation of standard $K_2Cr_2O_7$ solution
2) Estimation of Hardness of Water by using Standard EDTA solution
3) Estimation of Copper by using Standard EDTA solution
4) Estimation of Magnesium by using Standard EDTA solution
5) Estimation of Ferrous Ion by Dichrometry.
6) Determination of Strength of given Hydrochloric Acid against standard sodium hydroxide solution by Conductometric titrations
7) Determination of Strength of given Acetic Acid against standard sodium hydroxide solution by Conductometric titrations
8) Determination of strength of mixture of acids against standard sodium hydroxide solution by conductometric method.
9) Verification of Beer-Lambert's law
10) Determine the strength of Cu(II) ion by colorimeter
11) Preparation of a simple polymer (PVC)
12) Preparation of Bakelite
13) Thin layer chromatography
14) Identification of simple organic compounds by IR and UV-Visible Spectroscopy graphs.
15) HPLC method in separation of liquid mixtures.

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(A0593202) DATA STRUCTURES LAB
For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:
- To understand how to use structures and unions as a compound data types
- To understand various basic file operations
- To understand various stack and queue operations
- To understand various linked list operations
- To understand basic searching and sorting techniques

COURSE OUTCOMES:
At the end of this course, the student would be able to
- Develop applications on user defined data types
- Apply dynamic memory allocation through pointers
- Use different data structures for create/update basic data files
- Implement linear data structures through stacks and queues
- Implement various searching and sorting techniques, Linked lists.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	3	-	2	-	-	-	2	-	-	2
CO2	3	-	3	-	-	2	-	-	-	-	2	-
CO3	3	2	-	-	-	-	3	-	-	-	-	-
CO4	-	3	-	-	-	-	2	-	-	-	-	-
CO5	3	3	2	-	-	2	3	-	-	-	-	-

RECOMMENDED SYSTEMS /SOFTWARE REQUIREMENTS:
Intel based desktop PC with ANSI C Compiler and Supporting Editors

EXERCISE 1
a) Write a C Program to perform various arithmetic operations on pointer variables.
b) Write a C Program to demonstrate the following parameter passing mechanisms:
   i) Call-by-value
   ii) Call-by-reference

EXERCISE 2
a) Write a C Program to copy the contents of one structure variable to another structure variable.
b) Write a C program to implement nested structure to store and display the student information. The structure student contains the field‘s S.no, name, and date. Date is the nested structure and it contains the fields day, month and year.

EXERCISE 3
a) Write a C program to add two distances which is in feet and inches
b) Write a C program to illustrate passing the whole structure as argument to a function.

EXERCISE 4
Write a C program that uses functions to perform the following operations:
a) Reading a complex number
b) Writing a complex number
c) Addition of two complex numbers
d) Multiplication of two complex numbers (Note: represent complex number using a structure.)

EXERCISE 5

a) Write a C program to implement Union Concept.
b) Write a C program which copies last ‘n‘ characters from one file to another.

EXERCISE 6

Write a C program to implement the following operations on Stack using array representation

a) Push
b) Pop
c) Display

EXERCISE 7

Write a C program to implement the following operations on Queue using array representation

a) Insert
b) Delete
c) Display

EXERCISE 8

Write a C program to implement the following operations on Singly Linked list using linked representation

a) Insert
b) Delete
c) Display
d) Search

EXERCISE 9

Write a C program that implements the following sorting methods to sort a given list of integers in ascending order.

a) Bubble sort
b) Selection sort
c) Insertion sort

EXERCISE 10

Write C program to implement the following searching methods to search an element in a given list of integers

a) Linear Search
b) Binary Search

REFERENCE BOOKS:

1) Programming in C, Pradeep Dey, Manas Ghosh, Oxford Heigher Education
2) Computer programming and Data Structures, E.Balaguruswamy, Tata Mc GrawHill. 2009 revised edition.
3) Mastering C, K.R. Venugopal and S.R. Prasad, TMH Publications.

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II B.Tech., I-Sem (EEE)

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(A0013203) TRANSFORMATION TECHNIQUES AND COMPLEX VARIABLES

COURSE OBJECTIVES:

- To familiarize the transformation techniques and complex variables.
- To equip the students to solve various application problems in Signals and Systems, Control systems, Network analysis and Digital signal processing etc.,

COURSE OUTCOMES:

After completion of the course the student will be able to:

- Understand the concept of Laplace and Inverse Laplace transformation and solving ODEs using Laplace transformation technique. Analyze applications of Laplace transforms in control system engineering and Signals and system engineering
- Determine the process of expanding periodic functions into Fourier series and non-periodic functions into Fourier transform its use in Electrical circuit analysis and signal processing
- Obtain the knowledge of Z – Transforms and its applications in digital electronics, control systems, signal processing & discrete systems
- To familiarize the complex variables and to analyze the importance of Caychy – Riemann equations in engineering
- Identify Residue theorem to solve many improper integrals and its use in control theory and electro-magnetic engineering.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	-	-	-	-	-	-	-			
CO2	3	2	2	3	2	-	-	-	-	-	-	-			
CO3	2	2	3	3	2	-	-	-	-	-	-	-			
CO4	3	2	2	2	2	-	-	-	-	-	-	-			
CO5	2	3	2	3	2	-	-	-	-	-	-	-			

UNIT-I

Laplace transform of standard functions – Inverse Transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta (Unit Impulse) function – Convolution theorem (without proof).

Laplace transform of Periodic function- Application of Laplace transforms to solve ODEs of first and second order.

UNIT-II

Fourier series: Determination of Fourier coefficients – Fourier series in $[C, C + 2\pi]$ – Fourier series of Even and odd functions – Fourier series expansion in arbitrary intervals. Half - range Fourier sine and cosine series expansions

UNIT-III

Fourier integral theorem (statement only) – Fourier sine and cosine integrals - Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – Parseval's identity for Fourier transforms.

UNIT-IV

Complex Variables: Continuity – Differentiability – Analyticity of Complex functions – Cauchy – Riemann equations in Cartesian and polar coordinates. Milne – Thompson method. Elementary functions of a complex variable.

UNIT-V

Complex Integration: –Line integral – Evaluation along a path by indefinite integration- Cauchy's Integral Theorem – Cauchy's Integral Formula.

Complex Power Series: Expansions in Taylors series – Maclaurin's series and Laurent series expansions.

UNIT-VI

Singular point – Isolated singular point – pole of order m – Removable – Essential singularity. Residue – Evaluation of residue – Cauchy's Residue theorem – Evaluations of real definite integrals of the type (i) $\int_0^{2\pi} F(\sin\theta, \cos\theta)d\theta$ (ii) $\int_{-\infty}^{\infty} f(x)dx$. Conformal Mapping – Bi-linear (Mobius) transformation.

TEXT BOOKS:

1) T.K.V. Iyengar, B. Krishna Gandhi and Others, A Text Book of Engineering Mathematics –Vol- I, S. Chand & Company.
2) T.K.V. Iyengar, B. Krishna Gandhi and Others, A Text Book of Mathematical Methods, S. Chand & Company.
3) T.K.V. Iyengar, B. Krishna Gandhi and Others, A Text Book of Engineering Mathematics –Vol- III, S. Chand & Company.
4) R.K.Jain and S.R.K. Iyngar, Advanced Engineering Mathematics, Alpha science International limited, 2016

REFERENCES:

1) Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2011.
2) J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.
3) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.

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II B.Tech., I-Sem (EEE)

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(A0402203) ANALOG ELECTRONICS AND OP-AMP CIRCUITS

COURSE OBJECTIVES:

- To study the analysis and design of single stage amplifiers at low and high frequencies.
- Study of small signal and large signal amplifiers and their area of applications.
- To understand the concepts of feedback and their applications (Voltage feedback amplifiers and oscillators)

COURSE OUTCOMES:

- Know the characteristics, utilization of various components.
- Understand the biasing techniques
- Design and analyze various large signal amplifier circuits.
- Design sinusoidal and non-sinusoidal oscillators.
- A thorough understanding, functioning of OP-AMP, design OP-AMP based circuits
- Applications of various electronic amplifiers and Op-AMP.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	-			
CO2	3	3	-	-	-	-	-	-	-	-	-	-			
CO3	2	1	1	1	-	-	-	-	-	-	-	-			
CO4	1	2	-	1	-	-	-	-	-	-	-	-			
CO5	2	2	-	-	-	-	-	-	-	-	-	1			
CO6	1	3	1	-	-	-	-	-	-	-	-	1			

UNIT I DIODE CLIPPING AND CLAMPING CIRCUITS

Introduction, Semiconductor Diode as a Switch, Clipping Circuits- Series, Shunt, Two-level Clippers, Clamping Circuits- Types, Design of a Clamping Circuit, Clamping Circuit Theorem.

UNIT II SINGLE STAGE AMPLIFIERS

Transistor as a Switch, Importance of Biasing, Operating Point, Load line (DC and AC), types of Biasing: Fixed bias, Collector to Base, Voltage Divider bias, Transistor as an amplifying device.

Classification of Amplifiers, Small signal equivalent model of BJT, Analysis of single stage common emitter transistor amplifier using h-parameters- Deriving equations for Input Impedance, Output Impedance, Voltage Gain and Current Gain.

UNIT III POWER AMPLIFIERS

Introduction, Classification of Power Amplifiers, Class A Amplifiers (Directly Coupled and Transformer Coupled), Second - Harmonic Distortion, Higher - Order Harmonic Generations, Class B Amplifier (Push Pull), Elimination of Cross over distortion.

UNIT IV FEEDBACK AMPLIFIERS & OSCILLATORS

FEEDBACK AMPLIFIERS Concepts of Feedback, Classification of Feedback Amplifiers, Transfer Gain with Feedback, General Characteristics of Negative-Feedback Amplifiers, Effect of Feedback on Amplifier characteristics.

OSCILLATORS Conditions for oscillations, Phase - shift Oscillator, Wien Bridge Oscillator, L-C Oscillators (Hartley and Colpitts).

UNIT V OPERATIONAL AMPLIFIER

Basic information of Op-amp, ideal and practical Op-amp, internal circuits, Op-amp characteristics, DC and AC characteristics, modes of operation-inverting, non-inverting, differential, Comparator, Schmitt trigger, Astable and Monostable Multi vibrators

UNIT VI SPECIAL PURPOSE INTEGRATED CIRCUITS

Introduction to 555 timer, functional diagram, Monostable and Astable operations, Schmitt Trigger and applications.

TEXT BOOKS:

1) Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, 9th edition, Pearson/Prentice Hall, 2009.
2) Millman, Halkias and Jit, "Electronic Devices and Circuits", 4th Edition, McGraw Hill Education (India) Private Ltd., 2015.
3) Ramakanth A. Gayakwad, "Op-Amps & Linear ICs", 4th Edition, Pearson, 2017.

REFERENCE BOOKS:

1) D. Roy Choudhury, "Linear Integrated Circuits", 2 nd Edition, New Age International (p) Ltd, 2003.
2) Pulse, Digital and Switching Waveforms. India: McGraw-Hill Education (India) Pvt Limited, 4th edition, 2011.
3) David A. Bell, "Electronic Devices and Circuits", 5th edition, Oxford, 2008.
4) https://nptel.ac.in/courses/108/102/108102095/
5) https://nptel.ac.in/courses/108/108/108108114/

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(A0205203) CIRCUIT THEORY

COURSE OBJECTIVES:

- This course introduces the basic concepts of circuit analysis which is the foundation for all subjects of the Electrical Engineering& Electronics Engineering discipline.
- The emphasis of this course if laid on the basic analysis of circuits which include single phase circuits, magnetic circuits, theorems, transient analysis and network topology.

COURSE OUTCOMES:

- To learn a number of powerful engineering circuit analysis techniques such as nodal analysis, mesh analysis, theorems, source transformation and several methods of simplifying networks.
- Analyze & Design AC Circuits and DC Circuits
- Find performance of series and parallel RL, RC & RLC Circuits with the help of Locus diagrams.
- To understand frequency response in electrical circuits
- Analyses & design a circuit with the help of theorems.
- To develop a clear understanding of the important parameters of a magnetic circuit.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	2	-	-	-	-	-	3	3	-	-
CO2	2	3	2	2	-	3	-	-	-	--	-	2	3	-	-
CO3	3	3	2	2	-	1	-	-	-	-	-	2	3	-	-
CO4	1	2	1	2	-	2	-	-	-	-	-	2	3	-	-
CO5	2	2	2	3	-	2	-	-	-	-	-	2	3	-	-
CO6	1	3	1	2	-	1	-	-	-	-	-	2	3	-	-

UNIT I DC CIRCUITS

Introduction of Circuit Concept – R-L-C parameters – Types of Voltage and Current sources – Source transformation – Voltage-Current relationship for passive elements – Kirchhoff's laws – Network Reduction Techniques – Series, Parallel, Series-Parallel, Star-to-Delta or Delta-to-Star transformation, Nodal Analysis, Mesh Analysis, Super Node and Super Mesh Analysis

UNIT II AC CIRCUITS

R.M.S. and Average values and form factor of different periodic wave forms, Steady state analysis of R, L and C (in series, parallel and series parallel combinations) with sinusoidal excitation – Concept of Reactance, Impedance, Susceptance and Admittance – Phase and Phase difference - Concept of Power factor, Real and Reactive Powers - j-notation, Complex and Polar forms of representation, Complex Power

UNIT III LOCUS DIAGRAMS

Locus diagrams - Series R-L, R-C, R-L-C and parallel combinations with variation of source, R, L and C.

UNIT IV RESONANCE

Resonance – Condition for resonance-Series resonance and Parallel resonance-Behavior of impedance and current characteristics, Derivation of Bandwidth, lower cutoff frequency and Higher cut off frequency, Resonant frequency, Q-factor, magnification factors-Numerical Problems.

UNIT V NETWORK THEOREMS

Network theorems: (Without proof) : Thevenin's, Norton's, Maximum Power Transfer, Superposition, Reciprocity, Millman's, Tellegen's and Compensation theorems for dc and ac excitations

UNIT VI MAGNETIC CIRCUITS

Magnetic Circuits – Faraday's Laws of electromagnetic induction – Concept of self and mutual inductances – dot convention – coefficient of coupling – Composite Magnetic Circuits – Analysis of Series and Parallel Magnetic Circuits

TEXT BOOKS:

1) Circuits and Networks Analysis and Synthesis – A Sudhakar and Shymmohan S Palli, Tata McGraw-Hill Publishing Company Ltd, Fifth Edition, 2017.
2) Circuit Theory (Analysis & Synthesis) – A.Chakrabarthi, DhanpatRai & Co
3) Engineering Circuit Analysis - by William Hayt and Jack E. Kemmerly, Tata McGraw-Hill Publishing Company Ltd, Ninth Edition, 2020.
4) Electric Circuits – Charles K. Alexander & Matthew N. O. Sadiku , Tata McGraw-Hill Publishing Company Ltd, Sixth Edition, 2016.

REFERENCE BOOKS:

1) Electric Circuits - J. Edminister& M. Nahvi, - Schaum's Outlines, Tata McGraw-Hill Publishing Company Ltd, Fifth Edition, 2017.
2) Network Analysis –M.E Van Valkenberg. Pearson Publishing Company Ltd, Revised Third Edition, 2015.
3) Electrical and Electronic Technology – Hughes , Pearson Publishing Company Ltd, Tenth Edition, 2010
4) Electrical Circuit Theory and Technology – John Bird - Newnes Publisher; Fourth edition – 2010.
5) https://nptel.ac.in/courses/108/106/108106172/
6) https://nptel.ac.in/courses/108/104/108104139/

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(A0504203) PYTHON PROGRAMMING
For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:
- Learn Syntax and Semantics of various Operators used in Python.
- Understand about Various Input, Output and Control flow statements of Python.
- Understand Strings, List, Tuple, Set and Dictionary in Python.
- Implement Object Oriented Programming concepts in Python.
- Understand Exception handling and File I/O in Python.
- Understand Functions, Modules and Regular Expressions in Python.

COURSE OUTCOMES:
- Examine Python syntax and semantics and be fluent in the use of various Operators of Python.
- Make use of Flow Control statements, Input / Output functions and Strings of Python.
- Demonstrate proficiency in handling of data structures like List, Tuple, Set and Dictionary.
- Demonstrate the use of Functions, Modules and File I/O operations in in Python.
- Interpret the Concepts of Object-Oriented Programming in Python.
- Interpret the various issues of Exception handling mechanisms and Regular Expressions in Python.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	-	2	-	-	-	1	1	-	1	1	1	-
CO2	3	2	1	-	2	-	-	-	1	1	-	1	1	1	-
CO3	3	3	2	1	2	-	-	-	1	1	-	2	1	2	2
CO4	3	2	1	1	2	-	-	-	1	1	-	1	1	1	1
CO5	3	3	2	1	2	1	-	-	1	1	-	2	2	2	2
CO6	3	3	2	1	2	2	-	-	1	1	-	2	2	2	2

UNIT – I

Introduction: History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation. Overview on Fundamental data types of Python.

Operators in Python: Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Shift Operators, Ternary operator, Membership Operators, Identity Operators, Expressions and order of evaluations. Illustrative examples on all the above operators.

UNIT – II

Input and Output statements: input () function, reading multiple values from the keyboard in a single line, print () function, 'sep' and 'end' attributes, Printing formatted string, replacement operator ({}). Control flow statements: Conditional statements. Iterative statements. Transfer statements.

Strings: Operations on string, String slicing, important methods used on string.

UNIT – III

Lists: Operations on List, important methods used on list. List comprehensions

Tuples: Operations on tuples, important methods used on tuple.

Sets: Operations on sets, important methods used on set.

Dictionaries: Operations on Dictionaries, important methods used on dictionaries.

UNIT – IV

Functions - Defining Functions, Calling Functions, Types of Arguments - Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful functions, Scope of the Variables in a Function. Recursive functions.

Modules: Creating modules, import statement, from Import statement.

File I/O: Need of files concept, Types of file Opening and Closing a Text file, Reading & Writing operations on files, Setting offsets in a file, Traversing a Text file.

UNIT – V

Object Oriented Programming (OOP) in Python: Classes and Objects, 'self-variable', Types of Variables and Methods used in Classes, Constructor Method, Inheritance, Overriding Methods, Abstract Classes, Data hiding.

UNIT – VI

Error and Exceptions: Difference between an Error and Exception, Types of Exceptions, Handling Exceptions, try, except, else and finally blocks, control flow in try-except-else-finally blocks, Raising Exceptions, Customized Exceptions.

Regular Expressions: Character matching in regular expressions, Extracting data using regular expressions.

TEXT BOOKS

1) Allen B. Downey, “Think Python”, 2nd edition, SPD/O’Reilly, 2016.
2) Martin C.Brown, “The Complete Reference: Python”, McGraw-Hill, 2018.

REFERENCE BOOKS

1) R. Nageswara Rao, “Core Python Programming”, 2nd edition, Dreamtech Press, 2019Core Python Programming, 2016 W.Chun, Pearson.
2) Introduction to Python, 2015 Kenneth A. Lambert, Cengages
3) https://www.w3schools.com/python/python_reference.asp
4) https://www.python.org/doc/

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(A0206203) ELECTRICAL MACHINES-I

COURSE OBJECTIVES: The course will introduce the students:
- To learn the basic concepts of DC machines.
- To gain knowledge on construction and operation of DC machines.
- To analyse the behaviour of DC machines through different loads.
- To study the different speed control techniques adopted for DC machines
- To examine the performance of DC machines by different testing methods.

COURSE OUTCOMES:
After successful completion of the course the students will be able to
- Apply basic magnetic field theory to DC machines.
- Understand the construction and working of DC machines.
- Evaluate the performance of DC machine and its improvement methods.
- Acquire the knowledge of speed control techniques.
- Analyse the behaviour of DC machines by testing.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	1	-	-	2	-	-	3	3	-	-
CO2	3	-	2	-	-	2	-	-	-	-	-	3	3	2	-
CO3	3	2	2	2	-	1	-	-	1	-	-	2	2	3	-
CO4	3	2	2	1	1	2	-	2	2	-	1	2	1	3	-
CO5	3	2	2	2	-	1	-	-	1	-	-	2	2	3	-

UNIT I D.C. GENERATORS – CONSTRUCTION & OPERATION
D.C. Generators – Principle of operation – Action of commutator – constructional features – armature windings – lap and wave windings – simplex and multiplex windings –use of laminated armature – E. M.F Equation – Problems

UNIT II TYPES OF DC GENERATORS & LOAD CHARACTERISTICS
Methods of Excitation – separately excited and self-excited generators – build-up of E.M.F - critical field resistance and critical speed - causes for failure to self-excite and remedial measures.
Load characteristics of shunt, series and compound generators – parallel operation of d.c generators – use of equalizer bar– load sharing.

UNIT III ARMATURE REACTION IN D.C. GENERATOR
Armature reaction – Cross magnetizing and de-magnetizing AT/pole — commutation – reactance voltage – methods of improving commutation.

UNIT IV D.C. MOTORS
D.C Motors – Principle of operation – Back E.M.F. - Torque equation – characteristics and application of shunt, series and compound motors

UNIT V SPEED CONTROL OF D.C. MOTORS
Speed control of D.C. Motors: Armature voltage and field flux control methods- Ward-Leonard system-Principle of 3 point and 4 point starters – protective devices

UNIT VI TESTING OF D.C. MACHINES
Testing of D.C. machines: Losses – Constant & Variable losses – calculation of efficiency – condition for maximum efficiency Methods of Testing – direct, indirect and regenerative testing – brake test – Swinburne's test – Hopkinson's test – Field's test – Retardation test – separation of stray losses in a D.C. motor test.

TEXT BOOKS:

1) Electric Machines, Dr. P. S. Bimbra, Publisher: Khanna Books, ISBN: 9789386173294, 9386173298, Edition: 2, 2021.
2) A Textbook of Electrical Technology, B L Theraja, ISBN- 9788121924375, Publisher: S. Chand, Edition: Vol 2 Ac and Dc Machines, 23/e.
3) Electric Machines, Ashfaq Husain and Harroon Ashfaq, Publisher: Dhanpat Rai & Co. (P) Limited; ISBN-10: 8177001663, ISBN-13: 978-8177001662, Third edition (1 January 2016).
4) Electric Machines, D.P. Kothari and I.J. Nagrath, Publisher: Tata Mc Graw – Hill Publishers, ISBN-10: 935260640X, Edition: 5th.

REFERENCE BOOKS:

1) Electric Machinery, A Fitzgerald, Charles Kingsley, Stephen Umans , ISBN-10: 0070530394, Publisher: Tata Mc Graw – Hill,
2) Theory and Performance Electrical Machines, J. B. Guptha, Publisher: Katson Books, Edition 2014.
3) Principles of Electrical Machines, P.C.Sen, Publisher: Wiley, ISBN: 9789390395057, Edition: Third, 2020
4) https://nptel.ac.in/courses/108/105/108105155/

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(A0012203) DESIGN THINKING AND INNOVATIONS
(Skill Development Course)
For branches: CE, EEE, ME, ECE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:
- To create awareness of design thinking among students of engineering
- To teach a systematic approach to identifying and defining a problem before brainstorming for a solution
- To instill a sense of significance towards applying creativity to product and service design
- To motivate students to apply design thinking while implementing a project focusing on local or global societal problems

COURSE OUTCOMES:
- Identify design principles from an engineering perspective
- Cultivate sensitivity towards design aspects of Activities, Environments, Interactions, Objects, and Users (A-E-I-O-U) in daily life
- Validate problem statements through user empathisation with societal and environmental consciousness
- Devise visual design and documentation to communicate more effectively
- CO-5: Develop project management skills in a multidisciplinary environment

STUDENTS' RESPONSIBILITIES:
- Forming diverse teams of 3–5 members each to work collaboratively throughout the semester.
- Proactively engaging to observe the objects and interactions in their daily life and society from a design perspective.
- Identifying general societal and social problems that may be effectively addressed using design thinking principles
- Presenting and reporting the tasks to the concerned faculty members using their creative communication and people skills.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	1	-	-	-	-	1	1	2	-	1
CO2	2	1	-	-	-	1	-	-	-	-	-	1	2	-	2
CO3	2	2	1	1	1	-	-	-	1	1	1	1	2	1	2
CO4	2	2	2	1	1	1	1	1	2	-	1	1	2	-	1
CO5	1	2	2	1	2	1	1	1	2	1	1	1	1	1	1

UNIT – I
Introduction, what is design thinking, the traditional model of innovation, The model of design thinking, Design thinking is not old, Design thinking is to innovation, The sweet spot of design thinking.
Why design thinking now? Products & Services, Multifaceted problems, fast becoming B2C, wide spread digitization, Customer knowledgeable, Clash of business models, Challenging markets.

UNIT – II
Key tenets of Design thinking, Human centric, Focus on subject not object, Problem solving with the customer not for the customer, Thinking beyond products, Striking balance, Think

Broad, Solution Generation, validation, root causes, What else, visualize your thinking, Fail often.
Inspire: Create a stretch, Get the design brief right, Adopt the power of metaphors, Widen the aperture, Bring on diversity, The learning personas, the organizing personas, the building personas,.

UNIT - III

Empathize and Define: The traditional market research is broken, Create new channels to listen to customers, Be the customer you wish to serve, Leverage technology, Get to the customers, Do not limit empathy to customers, Engineering empathy, Mind mapping, Stake holder map, Customer journey map, Empathy map, Picking problem worth solving, Framing problem sharply, Innovating in absence of customer.

UNIT - IV

Ideate: Ideas are like Lego blocks, Hybrid brain storming, Intersection of disciplines, Imitate with grace, Braking the pattern, Challenging assumptions, Value chain, Looking beyond current users, Designing for extreme, Analogous design, Triggering ideation.
Prototype and Test: The high cost of just doing it, seeking clarity, Be quick and dirty, Manageable hypotheses, Doing last experiment first, Visualize through storyboarding and scenarios, Engaging through stories, Is dogfooding enough?, Solicit feedback, Inventory prototypes.

UNIT - V

Scale: Keep the main thing as the main thing, cut some slack, Leaders must show up, Provide ‘air cover’, cultivate innovation evangelists, Measure for impact, Don’t confuse empathy with good business sense.
Design Thinking in action: A two day Design thinking workshop, session objectives, Ground rules, workshop flow, mentoring program, Build your own version of design thinking program, offer avenues to practice design thinking, think beyond, Juggad, pay attention to the physical space, trust the process

UNIT - VI

How to be a Design Thinker Live curious, Listen with intent, observe with purpose, Defer your judgement, Hone multiple affiliations, Be a T-shaped person, develop failure tolerance.
Case studies of Design thinking like Chota Cool, Indian post box, Big Bazar, Reliance, royal Enfield etc. (Any other case studies may also be considered).

TEXT BOOKS:

1) Pavan Soni, Design your thinking, Penguin Random house India, 2020.
2) Vijay Kumar, “101 Design Methods: A Structured Approach for Driving Innovation in Your Organization”, John Wiley & Sons (2012) (ISBN: 978-1118083468)
3) Jeanne Liedtka and Tim Ogilvie, Designing for Growth: A Design Thinking Tool Kit for Managers, Columbia Business School Publishing, E-ISBN 978-0-231-52796-5
4) B. K. Chakravarthy, Janaki Krishna moorthi, Innovation By Design: Lessons from Post Box Design & Development, Springer India, 2013
5) Donald A. Norman, “The Design of Everyday Things”, MIT Press, 2013 (ISBN: 978-0262525671)
6) Tom Kelly, Jonathan Littman, “The Art of Innovation”, HarperCollins Business, 2002 (ISBN: 978-0007102938)

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(A0015203) UNIVERSAL HUMAN VALUES
(Mandatory Learning Course-I)
For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:
- This course is developed to design a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- The main objective of this course is to help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

COURSE OUTCOMES:
- To create a holistic perspective based on self-exploration
- The students are able to see that their practice in living is not in harmony with their natural acceptance most of the time, and all they need to do is to refer to their natural acceptance to remove this disharmony.
- The students are able to see that they can enlist their desires and the desires are not vague.
- To strengthen the self-reflection.
- To develop the commitment and courage to act.
- The students become aware of their activities of 'I' and start finding their focus of attention at different moments. Also they are able to see that most of their desires are coming from outside (through preconditioning or sensation) and are not based on their natural acceptance.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	1	1	-	2	-	2	-	-	-	1	3	-	-
CO2	2	3	2	3	-	3	-	1	-	--	-	3	3	-	-
CO3	2	2	3	1	-	1	-	3	-	-	-	2	3	-	-
CO4	3	2	3	2	-	2	-	2	-	-	-	2	3	-	-
CO5	2	2	2	1	-	2	-	1	-	-	-	3	3	-	-
CO6	1	1	1	2	-	1	-	3	-	-	-	2	3	-	-

UNIT I Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Purpose and motivation for the course, recapitulation from Universal Human Values-I, Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfil the above human aspirations

UNIT II Understanding Harmony in the Human Being - Harmony in Myself!

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - happiness and physical facility, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs,

meaning of Prosperity in detail, Programs to ensure Sanyam and Health (Practice Exercises and Case Studies will be taken up in Practice Sessions)

UNIT III Understanding Harmony in the Family and Society-Harmony in Human-Human Relationship (Part-I)

Understanding Harmony in the family–the basic unit of human interaction , Understanding values in human-human relationship; meaning of Justice (Nyaya) (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness (Ubhay-tripti); Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention and competence,

UNIT IV Understanding Harmony in the Family and Society-Harmony in Human-Human Relationship (Part-II)

Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals (Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals), Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha), Practice Exercises and Case Studies will be taken up in Practice Sessions

UNIT V Understanding Harmony in the Nature and Existence – Whole existence as Coexistence

Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all- pervasive space, Holistic perception of harmony at all levels of existence, Practice Exercises and Case Studies will be taken up in Practice Sessions

UNIT VI Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order

b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

TEXT BOOK

1) R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034-47-1
2) R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

REFERENCE BOOKS

1) Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2) A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3) The Story of Stuff (Book).
4) Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
5) E. F Schumacher. "Small is Beautiful"
6) Slow is Beautiful –Cecile Andrews
7) J C Kumarappa "Economy of Permanence"
8) Pandit Sunderlal "Bharat Mein Angreji Raj"
9) Dharampal, "Rediscovering India"
10) Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"
11) India Wins Freedom - Maulana Abdul Kalam Azad
12) Vivekananda - Romain Rolland(English)
13) Gandhi - Romain Rolland (English)

In addition, the following reference books may be found useful for supplementary reading in connection with different parts of the course:

1) B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
2) PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
3) Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4) Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
5) Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, Universe Books.
6) Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
7) A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
8) E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
9) A.N. Tripathy, 2003, Human Values, New Age International Publishers.

RELEVANT WEBSITES, MOVIES AND DOCUMENTARIES

1) Story of Stuff, http://www.storyofstuff.com
2) Al Gore, An Inconvenient Truth, Paramount Classics, USA
3) Charlie Chaplin, Modern Times, United Artists, USA
4) IIT Delhi, Modern Technology – the Untold Story
5) Gandhi A., Right Here Right Now, Cyclewala Productions

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
AUTONOMOUS
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

II B.Tech., I-Sem (EEE)

T	P	C
0	3	1.5

(A0491203) ELECTRONIC DEVICES & CIRCUITS LAB
For branches: EEE & ECE

COURSE OBJECTIVES:
- This Lab provides the students to get an electrical model for various semiconductor devices. Students can find and plot VI characteristics of all semiconductor devices. Student learns the practical applications of the devices. They can learn and implement the concept of the feedback and frequency response of the small signal amplifier
- Linear and nonlinear wave shaping circuits

COURSE OUTCOMES:
- Students able to learn electrical model for various semiconductor devices.
- Students able to learn electrical model for FET devices.
- Realize simple Rectifier without filters and with filters.
- Analyze and design the RC circuits.
- Design the circuits for generating desired wave shapes (Clippers and Clampers)

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	-	-	-	-	-	3	-	-	-			
CO2	1	-	3	-	-	-	-	-	3	-	-	-			
CO3	2	-	-	-	-	-	-	-	3	-	-	-			
CO4	-	2	1	-	-	-	-	-	3	-	-	-			
CO5	-	2	-	-	-	-	-	-	3	-	-	-			

LIST OF EXPERIMENTS:

1) PN Junction diode characteristics
2) Zener diode characteristics and Zener as a Regulator
3) Transistor CB characteristics (Input and Output)
4) Transistor CE characteristics (Input and Output)
5) Rectifier without filters (Full wave & Half wave)
6) Rectifier with filters (Full wave & Half wave)
7) FET characteristics
8) MOSFET characteristics
9) SCR characteristics
10) UJT characteristics
11) Linear wave shaping
12) Non-Linear Wave Shaping – Clippers
13) Non-Linear Wave Shaping – Clampers

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(A0291203) ELECTRICAL CIRCUIT THEORY & SIMULATION LAB

COURSE OBJECTIVES:
- To understand the basic concepts of electric circuits (AC & DC) clearly.
- To understand the various techniques which are required to analyse the electric circuits.
- To understand the various techniques that can be used to analyse electric circuits using MATLAB or PSPICE software.
- To understand series and parallel resonance for AC circuits.
- To know about various theorems which are necessary for solving electrical circuits.

COURSE OUTCOMES:
- To check the effect of parameter variation on electrical current and voltage.
- Measurement of three phase power by using two single phase watt meters.
- Evaluate steady state behaviour of single port networks for DC and AC excitations.
- Analyse response of series and parallel resonant circuits.
- To find the magnetic circuits parameters in terms of coefficient of coupling, self and mutual inductances etc.
- To analyse and verify important network theorems.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	3	-	-	-	-	2	2	2	3	3	-	-
CO2	3	2	2	2	-	-	-	-	3	2	2	2	3	-	-
CO3	3	3	1	2	-	-	-	-	2	3	2	3	3	-	-
CO4	3	3	2	3	-	-	-	-	3	2	2	2	3	-	-
CO5	3	2	2	3	-	-	-	-	2	2	3	3	3	-	-
CO6	2	3	3	2	-	-	-	-	3	2	2	3	3	-	-

HARDWARE BASED EXPERIMENTS
1) Experimental verification of KVL & KCL laws for given circuit.
2) Experimental verification of Star-Delta and Delta-Star Transformation.
3) Experimental verification of Measurement of Active & Reactive Power for Star Connected Balanced load.
4) Experimental verification of Thevenin's and Norton's Theorem.
5) Experimental verification of Maximum Power Transfer and Reciprocity Theorems.
6) Experimental Verification of Superposition & Millman's Theorem.

SIMULATION OF EXPERIMENTS USING MATLAB OR PSPICE
1) Verification of KVL & KCL laws for given circuit.
2) Verification of Star-Delta and Delta-Star Transformation.
3) Verification of Thevenin's and Norton's Theorem.
4) Verification of Maximum Power Transfer and Reciprocity Theorem.
5) Verification of Superposition & Millman's Theorem.

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(A0571203) PYTHON PROGRAMMING LAB
For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:
- To be able to introduce core programming basics and various Operators and flow control statements of Python programming language through proper practice.
- To demonstrate about various Python fundamental data structures such as int, float, complex, bool and strings.
- To demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries.
- To demonstrate about Functions, Modules and File Input - Output operations in Python programming language.
- To demonstrate about Object Oriented Programming in Python Programming.
- To understand about and Exception handling mechanisms and Regular Expressions in Python Programming.

COURSE OUTCOMES:
- Student should be able to understand the basic concepts of scripting and the contributions of scripting language.
- Student should be able to explore Fundamental data structures in Python.
- Student should be able to explore python data structures like Lists, Tuples ,Sets and dictionaries.
- Student should be able to explore Functions, Modules and File input – Output Operations in Python programming language.
- Student should be able to explore Object Oriented Programming in Python Programming.
- Student should be able to create practical and contemporary applications using Exception handling mechanisms and Regular Expressions.

MAPPING OF COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	1			1				1	1		1	2	1	1
CO 2	3	3	2		2				1	1		1	1	1	1
CO 3	3	2	2	1	2				1	1		2	1	2	1
CO 4	3	2	1		2				1	1		1	1	2	
CO 5	3	3	1	1	1				1	1		2	2	2	2
CO 6	3	3	1	1	1				1	1		2	2	2	2

S.No	Name of the Experiment
1	a) Demonstrate about Basics of Python Programming.
	b) Demonstrate about fundamental Data types in Python Programming. (i.e., int, float, complex, bool and string types)
	c) Demonstrate the working of following functions in Python. i) id( ) ii) type( ) iii) range( )
	d) Write a Python program to demonstrate various base conversion functions.
	e) Write a Python program to demonstrate various type conversion functions.
2	a) Demonstrate the following Operators in Python with suitable examples. i) Arithmetic Operators ii) Relational Operators iii) Assignment Operator iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators

3	a) Write Python programs to demonstrate the following: i) input( ) ii) print( ) iii) 'sep' attribute iv) 'end' attribute v) replacement Operator ({ })
	b) Demonstrate the following Conditional statements in Python with suitable examples. i) if statement ii) if else statement iii) if – elif – else statement
	c) Demonstrate the following Iterative statements in Python with suitable examples. i) while loop ii) for loop
	d) Demonstrate the following control transfer statements in Python with suitable examples. i) break ii) continue iii) pass
4	Write Python programs to print the following Patterns:
	i) A A B A B C A B C D A B C D E ii) * * * * * * * * * * * * * * *
	iii) E E E E E E E E E D D D D D D D C C C C C B B B A iv) 4 4 3 4 3 2 4 3 2 1 4 3 2 1 0 4 3 2 1 4 3 2 4 3 4
	v) 4 3 4 2 3 4 1 2 3 4 0 1 2 3 4 1 2 3 4 2 3 4 3 4 4 vi) * * ** ** *** *** **** **** **********
	vii) ** ** **** **** ****** ****** ******** ******** ********** ********** viii) E D E C D E B C D E A B C D E B C D E C D E D E E
5	a) Write a Python program to demonstrate various ways of accessing the string. i) By using Indexing (Both Positive and Negative) ii) By using Slice Operator

	b) Demonstrate the following functions/methods which operates on strings in Python with suitable examples: i) len( ) ii) strip( ) iii) rstrip( ) iv) lstrip( ) v) find( ) vi) rfind( ) vii) index( ) viii) rindex() ix) count( ) x) replace( ) xi) split( ) xii) join( ) xiii) upper( ) xiv) lower( ) xv) swapcase( ) xvi) title( ) xvii) capitalize( ) xviii) startswith() xix) endswith()
6	a) Demonstrate the different ways of creating list objects with suitable example programs.
	b) Demonstrate the following functions/methods which operates on lists in Python with suitable examples: i) list( ) ii) split( ) iii) len( ) iv) count( ) v) index ( ) vi) append( ) vii) insert( ) viii) extend() ix) remove( ) x) pop( ) xi) reverse( ) xii) sort( ) xiii) copy( ) xiv) clear( )
	c) Demonstrate the following with suitable example programs: i) List slicing ii) List Comprehensions
7	a) Demonstrate the different ways of creating tuple objects with suitable example programs.
	b) Demonstrate the following functions/methods which operates on tuples in Python with suitable examples: i) len( ) ii) count( ) iii) index( ) iv) sorted( ) v) min ( ) vi)max( ) vii) cmp( ) viii) extend() ix) remove( ) x) pop( ) xi) reverse( ) xii) sort( ) xiii) copy( ) xiv) clear( )
8	a) Demonstrate the different ways of creating set objects with suitable example programs.
	b) Demonstrate the following functions/methods which operates on sets in Python with suitable examples: i) add( ) ii) update( ) iii) copy( ) iv) pop( ) v) remove( ) vi)discard( ) vii) clear( ) viii) union() ix) intersection( ) x) difference( )
9	a) Demonstrate the different ways of creating dictionary objects with suitable example programs.
	b) Demonstrate the following functions/methods which operates on dictionary in Python with suitable examples: i) dict( ) ii) len( ) iii) clear( ) iv) get( ) v) pop( ) vi)popitem( ) vii) keys( ) viii) values() ix) items( ) x) copy( ) xi) update( )
10	a) Demonstrate the following kinds of Parameters used while writing functions in Python. i) Positional Parameters ii) Default Parameters iii)Keyword Parameters iv) Variable length Parameters
	b) Write a Python program to return multiple values at a time using a return statement.
	c) Write a Python program to demonstrate Local and Global variables.
	d) Demonstrate lambda functions in Python with suitable example programs.
11	a) Python program to perform read and write operations on a file.
	b) Python program to copy the contents of a file to another file.
	c) Python program to count frequency of characters in a given file.
	d) Python program to print each line of a file in reverse order.

	e) Python program to compute the number of characters, words and lines in a file.
12	Demonstrate various Object Oriented Programming Concepts in Python Programming with illustrative examples.
13	Demonstrate about Exception Handling in Python Programming with illustrative examples.
14	a) Demonstrate the following in-built functions to use Regular Expressions very easily in our applications. i) compile( ) ii) finditer( ) iii) match( ) iv) fullmatch( ) v) search( ) vi) findall( ) vii) sub( ) viii) subn( ) ix) split( )
	b) Write a Regular Expression to represent all RGM language (Your own language) identifiers. **Rules**: 1. The allowed characters are a-z,A-Z,0-9,#. 2. The first character should be a lower case alphabet symbol from a to k. 3. The second character should be a digit divisible by 3. 4. The length of identifier should be at least 2. Write a python program to check whether the given string is RGM language identifier or not?
	c) Write a Regular Expression to represent all 10 digit mobile numbers. **Rules:** 1. Every number should contains exactly 10 digits. 2. The first digit should be 7 or 8 or 9 Write a Python Program to check whether the given number is valid mobile number or not?

TEXT BOOKS

1. Learning Python, Mark Lutz, Orielly, 3 Edition 2007.
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson, 2017.

REFERENCE BOOKS

1) Think Python, 2 Edition, 2017 Allen Downey, Green Tea Press
2) Core Python Programming, 2016 W.Chun, Pearson.
3) Introduction to Python, 2015 Kenneth A. Lambert, Cengages
4) https://www.w3schools.com/python/python_reference.asp
5) https://www.python.org/doc/

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II B.Tech., II-Sem (EEE)

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(A0207204) FIELD THEORY

COURSE OBJECTIVES:

- The objective of this course is to introduce the concepts of electric field
- To introduce magnetic fields concepts which will be utilized in the development of the theory for power transmission lines and electrical machines

COURSE OUTCOMES:

- To apply knowledge of basic mathematics and physics for the determination of electric and magnetic quantities.
- Application of electrostatic and magneto static theorems to determine electric field intensity and magnetic field intensity
- To determine the self and mutual inductance of simple practical current carrying systems
- To solve the problems related to electromagnetic field using dealt theorems
- To understand time varying electromagnetic fields as governed by the Maxwell's equations
- To analyze the behavior of the conductors using ohms law, inductors using Faraday's law and capacitors using dielectric principles.

MAPPINGOF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	-	-	-	2	1	-	2	3	-	-
CO2	3	3	-	2	-	-	-	-	2	1	-	2	3	-	-
CO3	3	3	-	2	-	-	-	-	2	1	-	2	3	-	-
CO4	1	2	-	2	-	-	-	-	2	1	-	2	3	-	-
CO5	2	2	-	2	-	2	-	-	2	1	-	2	3	-	-
CO6	1	3	-	2	-	-	-	-	2	1	-	2	3	-	-

UNIT I ELECTROSTATICS-I

Coulomb's law and electrical field intensity: Coulomb's law, Field due to different charge distributions.

Electric flux density, Gauss's law and divergence: Concept of electric flux density, Gauss's law and its applications, Maxwell's first eqn. and divergence theorem for electric flux density.

Electrical potential & Dipole: Energy expanded in moving a point charge in electrical field, Line integral, Definition of potential difference and potential, Potential field of a point charge and system of charges, Potential gradient, Electric Dipole, potential and EFI due to an electric dipole, Torque on an Electric dipole in an electric field.

UNIT II ELECTROSTATICS-II

Conductors, dielectrics and capacitance: Definition of currents and current density, Continuity equation, Behavior of conductors inside an electric field, Dielectric materials, Characteristics, Dielectric polarization, Boundary conditions, Energy density in electrostatic field, Capacitance of a parallel plate capacitor, Coaxial cable and spherical capacitors. Poisson's and Laplace equation, Examples of solution of Laplace and Poisson's equations

UNIT III MAGNETO STATICS

Biot–savart Law and its applications: Magnetic field intensity – Biot–savart Law -Magnetic field due to straight conductors, circular loop and solenoid current Carrying wire –Magnetic flux density (B) – B in free space, Maxwell's second Equation.

Ampere's circuital law and its applications: Ampere's circuital law and its applications viz. MFI due to an infinite sheet of current and a long current carrying filament, Point form of

Ampere's circuital law, Maxwell's third equation, Curl (H)=Jc, Field due to a circular loop, rectangular and square loops.

UNIT IV MAGNETIC FORCES

Lorentz Law of force ,Force on a moving charge, Force on a differential current element, Force on a straight and a long current carrying conductor in a magnetic field, Force between two straight long and parallel current carrying conductors ,Force and torque on a close circuit.

UNIT V MAGNETIC POTENTIAL AND INDUCTANCE

Scalar Magnetic potential and its limitations, vector magnetic potential and its properties, vector magnetic potential due to simple configurations, vector Poisson's equations. Self and Mutual inductance, Neuman's formulae, Determination of self-inductance of a solenoid and toroid and mutual inductance between a straight long wire and a square loop wire in the same plane, energy stored and density in a magnetic field.

UNIT VI ELECTRO DYNAMIC FIELDS

Faraday's laws and its integral and point forms, induced emf – Transformer and motional EMF –Maxwell's equations (differential and integral forms) – Displacement current – Relation between field theory and circuit theory - Modification of Maxwell's equations for time varying fields, Poynting Theorem and poynting vector

TEXT BOOKS:

1) Principles of Electromagnetic Fields- Matthew N.O. sadiku and S.V. Kulkarni, 6th Ed., Oxford University Press, Aisan Edition, 2015.
2) Schaums Outline of Theory and Problems of Electromagnetics- EDMINISTER JOSEPH. A. 5th edition, McGrawHill, 2019.
3) Engineering Electromagnetics- William H. Hayt Jr. and John A. Buck, 8th Ed., McGrawHill, 2014.

REFERENCE BOOKS:

1) Electromagnetic Field theory -U.A. Bakshi, Technical Publications, 2007.
2) Electromagnetic Field Theory-K.A Gangadhar, KHANNA PUBLISHERS, 2009.
3) Electromagnetic Field Theory-S.P.Ghose, McGraw Hill Education 2017.

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(A0208204) ELECTRICAL MACHINES-II

COURSE OBJECTIVES:

- To learn the basic concepts of AC machines.
- To gain knowledge on construction and operation of AC machines.
- To analyze the behavior of single and poly phase AC machines.
- To study the different speed control techniques adopted.
- To examine the performance characteristics of AC machines.

COURSE OUTCOMES:

- To remember about fundamentals of AC machines.
- To understand the construction and working of AC machines.
- To evaluate the performance of AC machine.
- To apply the knowledge of AC machines to solve numerical problems.
- To test the behavior of AC machines with relevant techniques.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	1	-	-	2	-	-	3	3	-	-
CO2	3	-	2	-	-	2	-	-	-	-	-	3	3	2	-
CO3	3	2	2	2	-	1	-	-	1	-	-	2	2	3	-
CO4	3	2	2	1	1	2	-	2	2	-	1	2	1	3	-
CO5	3	2	-	1	-	2	-	1	2	-	-	1	2	2	-

UNIT I SINGLE PHASE TRANSFORMERS – CONSTRUCTION & OPERATION

Single phase transformers-types - constructional details-minimization of hysteresis and eddy current losses-emf equation - operation on no load and on load - phasor diagrams - Equivalent circuit - losses and efficiency-regulation- All day efficiency - effect of variations of frequency & supply voltage on iron losses.

UNIT II TESTING OF SINGLE-PHASE TRANSFORMER

OC and SC tests - Sumpner's test - predetermination of efficiency and regulation-separation of losses test-parallel operation with equal and unequal voltage ratios - auto transformers-equivalent circuit - comparison with two winding transformers

UNIT III THREE PHASE TRANSFORMERS

Poly-phase transformers – Poly-phase connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ, Third harmonics in phase voltages-three winding transformers-tertiary windings- off load and on load tap changing; Scott connection.

UNIT IV THREE PHASE INDUCTION MOTORS

Poly-phase induction motors-construction details of cage and wound rotor machines-production of a rotating magnetic field - principle of operation - rotor emf and rotor frequency - rotor reactance, rotor current and pf at standstill and during operation- Rotor power input, rotor copper loss and mechanical power developed and their inter relation- crawling and cogging.

UNIT V CHARACTERISTICS OF INDUCTION MOTORS

Torque equation-derivation of torque equation - expressions for maximum torque and starting torque - torque slip characteristic- Circle diagram-no load and blocked rotor tests-predetermination of performance-methods of starting and starting current and torque calculations

UNIT VI SPEED CONTROL METHODS

Speed control-change of frequency; change of poles and methods of consequent poles; cascade connection- induction generator-principle of operation.

TEXT BOOKS:

1) Electric Machines, Dr. P. S. Bimbra, Publisher: Khanna Books, ISBN: 9789386173294, 9386173298, Edition: 2, 2021.
2) A Textbook of Electrical Technology, B L Theraja, ISBN- 9788121924375, Publiser: S. Chand, Edition: Vol 2 Ac And Dc Machines, 23/e.
3) Electric Machines, Ashfaq Husain and Harroon Ashfaq, Publisher: Dhanpat Rai & Co. (P) Limited; ISBN-10: 8177001663, ISBN-13: 978-8177001662, Third edition (1 January 2016).
4) Electric Machines, D.P. Kothari and I.J. Nagrath, Publisher: Tata Mc Graw – Hill Publishers, ISBN-10: 935260640X, Edition: 5th.

REFERENCE BOOKS:

1) Electric Machinery, A Fitzgerald, Charles Kingsley, Stephen Umans , ISBN-10: 0070530394, Publisher: Tata Mc Graw – Hill,
2) Theory and Performance Electrical Machines, J. B. Guptha, Publisher: Katson Books, Edition 2014.
3) Principles of Electrical Machines, P.C.Sen, Publisher: Wiley, ISBN: 9789390395057, Edition: Third, 2020
4) https://nptel.ac.in/courses/108/105/108105155/

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(A0407204) DIGITAL ELECTRONICS

COURSE OBJECTIVES:

- To understand the different number system, its conversions and binary arithmetic.
- To understand the concepts of PLD's (ROM/PROM, PAL & PLA).
- To optimize combinational and sequential logic circuits.
- This course introduces all varieties of linear and digital IC's. It also deals with Timers, PLL's, D-A and A-D converters.

COURSE OUTCOMES:

- Illustrate the given logical function by using Boolean algebra, k-map and tabular methods.
- Classifications of binary-coded decimal codes.
- Transfer one number system to other number system.
- Analyze combinational and sequential logic circuits.
- Develop the concepts of D-A and A-D converters.
- Design the concepts of PLD's (ROM/PROM, PAL & PLA).

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	-	-	-	-	-	-	-			
CO2	-	3	3	-	-	-	-	-	-	-	-	-			
CO3	-	2	3	-	-	-	-	-	-	-	-	1			
CO4	2	3	2	-	-	-	-	-	-	-	-	1			
CO5	2	3		-	-	-	-	-	-	-	-	1			
CO6	1	2	2	-	-	-	-	-	-	-	-	1			

UNIT I NUMBER SYSTEMS, CODES AND BOOLEAN ALGEBRA

Philosophy of number systems – complement representation of Negative numbers, Binary arithmetic, Binary codes, Error Detecting &Error Correcting codes, Hamming codes. Fundamental postulates of Boolean algebra, Basic theorems and properties

UNIT II SWITCHING FUNCTIONS AND IT'S MINIMIZATION

Switching functions, Canonical and standard forms, Algebraic simplification Digital Logic Gates, properties of XOR gates, Universal Gates, Multilevel NAND/NOR realizations. K-map method, Prime Implicants, Don't care combinations, Minimal SOP and POS forms.

UNIT III COMBINATIONAL LOGIC DESIGN

Half adder, Full adder, Ripple carry adder, Carry look ahead generator, BCD adder, Half subtractor, Full subtractor, Encoder, Decoder, Multiplexer, De-Multiplexer, MUX realization of Switching functions, Parity bit generator, Code-converters, multiplier.

UNIT IV PROGRAMMABLE LOGIC DEVICES, THRESHOLD LOGIC

Basic PLD's- ROM, PROM, PLA, PAL Realization of switching function using PLD's.

UNIT V SEQUENTIAL CIRCUITS

Classification of sequential circuits, Basic Flip-Flops, Excitation and Characteristic Tables. Steps in Synchronous Sequential circuit design. Design of modulo-N counters, Ring and Johnson counters, Universal shift register, Serial Binary adder, Sequence Detector. FSM-capabilities and Limitations, Mealy and Moore models, Minimization of completely specified Sequential Machines using partition method.

UNIT VI D-A & A- D CONVERTERS

Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, Different types of ADCs - parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC. DAC and ADC specifications – Numerical problems.

TEXTBOOKS:

1) Morries Mano, "Digital Design" 4th edition, PHI.
2) Anand Kumar, "Switching Theory and Logic design", 3rd edition, PHI learning Pvt Ltd., 2016.
3) D. Roy Chowdhury, "Linear Integrated Circuits", 2nd edition, New Age International (p) Ltd, 2003.

REFERENCE BOOKS:

1) Fletcher, "An Engineering Approach to Digital Design", Prentice-Hall, 2007.
2) Charles H. Roth, "Fundamentals of Logic Design", 7th edition, Cengage learning, 2013.
3) John M. Yarbrough, "Digital Logic Applications and Design", West Publishing Company, 1998.
4) Zvi Kohavi, "Switching & Finite Automata theory", 2nd edition, Tata McGraw-Hill, 1978.
5) Floyd, "Digital Fundamentals", 11th Edition, Pearson, 2015.
6) https://nptel.ac.in/courses/108/105/108105132/

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(A0209204) ELECTRICAL MEASUREMENTS & INSTRUMENTATION

COURSE OBJECTIVES:

- Electrical measurements course introduces the basic principles of all measuring instruments.
- It also deals with the measurement of voltage, current Power factor, power, energy.
- Instrumentation is essential in monitoring and analysis of any Physical system and its control.
- This course deals with different types of transducers, digital voltmeters, and measurement of non-electrical quantities.

COURSE OUTCOMES:

- To acquire the basic knowledge of measuring instruments and their characteristics.
- To understand the working of Digital Meters, Signal Analyzers and various transducers.
- To analyze different kind of measuring meters with their relevant equations analysis and solutions to numerical problems.
- To calibrate of DC, AC bridges and Potentiometers.
- To apply the acquired knowledge in measuring of electrical parameters such as voltage, frequency, Total Harmonic Distortion and the advantages of the above said instruments.
- To design the Q-meter for calculation of unknown parameters of radio frequency coils.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	-	-	-	-	-	2	2	3	-	-
CO2	3	3	2	2	2	-	-	-	-	-	2	1	3	-	-
CO3	2	3	1	2	1	-	-	-	2	-	2	-	3	-	-
CO4	2	2	1	2	2	-	-	-	2	-	2	1	3	-	-
CO5	2	2	1	2	2	2	-	-	2	-	2	-	3	-	-
CO6	2	3	2	2	2	-	-	-	2	-	3	-	3	-	-

UNIT I MEASURING INSTRUMENTS - CHARACTERISTICS & ERRORS

Measuring Systems - Performance Characteristics - Static characteristics - Dynamic Characteristics; Errors in Measurement – Gross Errors, Systematic Errors, and Statistical Analysis of Random Errors

Deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, Dynamometer, moving iron type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunts and series resistance

UNIT II INSTRUMENT TRANSFORMERS AND D.C POTENTIOMETERS

CT and PT – Ratio and phase angle errors.

Principle and operation of D.C. Crompton's potentiometer – standardization – Measurement of unknown resistance, current, voltage

UNIT III MEASUREMENT OF POWER, POWER FACTOR & ENERGY

Single phase dynamometer wattmeter, LPF and UPF, Double element dynamometer wattmeter, expression for deflecting and control torques.

Types of P.F. Meters – dynamometer and moving iron type – 1-ph and 3-ph meters

Single phase induction type energy meter – driving and braking torques – errors and compensations-Adjustments.

UNIT IV D.C & A.C BRIDGES

Method of measuring low, medium and high resistance – sensitivity of Wheatstone's bridge – Kelvin's double bridge for measuring low resistance, measurement of high resistance – loss of

charge method & Meggar - Measurement of inductance - Maxwell's bridge, Hay's bridge, Anderson's bridge - Measurement of capacitance and loss angle - Desauty bridge, Wien's bridge – Schering Bridge.

UNIT V ELECTRONIC MEASUREMENTS

Digital voltmeters - Successive approximation, ramp, dual-Slope integration, continuous balance type - Microprocessor based ramp type DVM, Digital Frequency meter-Digital Phase angle meter - Vector impedance meter, Q meter - Peak reading and RMS voltmeters

UNIT VI TRANSDUCERS

Definition of transducers, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of Resistive transducer, inductive transducer, LVDT and capacitor transducers; LVDT Applications. Strain gauge and its principle of operation, Gauge factor, Thermistors, Thermocouples, Synchros, Piezo Electric transducers, Photovoltaic, Photo Conductive cells, Photo Diodes.

TEXT BOOKS:

1) Electrical & Electronic Measurement & Instruments by A.K.Sawhney, 19th edition Dhanpat Rai & Co. Publications, 2011.
2) Electronic Instrumentation by H. S. Kalsi, 4th edition Tata Mc Graw-Hill, 2019.
3) Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, 3rd Edition Reem Publications, 2011.
4) Transducers and Instrumentation by D. V. S Murthy, 2nd edition Prentice Hall of India, 2008.

REFERENCE BOOKS:

1) Measurements Systems, Applications and Design, by D O Doeblin, 4th edition McGraw Hill Higher Education, 1990.
2) Principles of Electrical Measurements by Buckingham and Price, 1st edition Hodder and Stoughton Ltd., 1966.
3) Measurement and Instrumentation Principles by A.S Morris, 3rd edition, Butterworth-Heinemann, 2001.
4) Modern Electronic Instrumentation and Measurement techniques by A.D Helfrick and W.D. Cooper, 1st edition, Pearson/Prentice Hall of India, 2015.
5) Electrical & Electronic Measurement & Instrumentation by R. K. Rajput, 1st Edition, S.Chand (G/L) & Company Ltd, 2008.
6) https://www.digimat.in/nptel/courses/video/108105153/L01.html

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(A0210204) NETWORK THEORY

COURSE OBJECTIVES:

- To impart strong foundation in network analysis and synthesis
- To introduce three phase circuit and analysis
- To give strong foundation in all electrical core subjects

COURSE OUTCOMES:

- To understand the concept of graphical solution to electrical network.
- To Analyse & Design Three Phase Circuits.
- Focus on Concept of DC transient Analysis.
- Learn concept of AC transient Analysis.
- Different types of two-port network analysis using network parameters, with different types of connections.
- To analyze various types of filters

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	2	-	-	-	-	-	3	3	-	-
CO2	2	3	2	2	-	3	-	-	-	--	-	2	3	-	-
CO3	3	3	3	2	-	1	-	-	-	-	-	2	3	-	-
CO4	1	2	2	2	-	2	-	-	-	-	-	2	3	-	-
CO5	2	2	3	3	-	2	-	-	-	-	-	2	3	-	-
CO6	1	3	1	2	-	1	-	-	-	-	-	2	3	-	-

UNIT I GRAPH THEORY

Network topology - Definitions – Graph – Tree, Basic cutset and Basic Tie set matrices for planar network – Loop and Nodal methods of analysis of Networks with dependent and independent voltage and current sources - Duality & Dual networks.

UNIT II THREE PHASE CIRCUITS

Three phase circuits : Phase sequence – Star and delta connection – Relation between line and phase voltages and currents in balanced systems – Analysis of balanced and Unbalanced 3 phase circuits – Application of Millman's theorem to unbalanced circuits - Measurement of 3 phase power, active power and reactive power.

UNIT III DC TRANSIENT ANALYSIS

Transient response of RL, RC, RLC circuits (Series and Parallel combinations) for D.C excitation - Initial conditions –Classical method and Laplace transform methods of solutions – Response of RL, RC, RLC for step, ramp, pulse and impulse excitations using Laplace transform methods.

UNIT IV AC TRANSIENT ANALYSIS

Transient response of RL, RC, RLC circuits (Series and Parallel combinations) for sinusoidal excitations - Initial conditions –Classical method and Laplace transform methods of solutions.

UNIT V TWO PORT NETWORKS-I

Two Port network parameters – Z, Y, (ABCD) Transmission and Hybrid parameters for Resistive Networks and their relations

UNIT VI TWO PORT NETWORKS-II

Concept of Transformed Network – 2 port network parameters using transformed variables-cascaded networks - Filters – Low pass- High pass and Band pass filters – Constant K and M-derived filters and composite filter design.

TEXT BOOKS:

1) Circuits and Networks Analysis and Synthesis – A Sudhakar and Shymmohan S Palli, Tata McGraw-Hill Publishing Company Ltd, Fifth Edition, 2017.
2) Circuit Theory (Analysis & Synthesis) – A.Chakrabarthi, DhanpatRai & Co
3) Engineering Circuit Analysis - by William Hayt and Jack E. Kemmerly, Tata McGraw-Hill Publishing Company Ltd, Ninth Edition, 2020.
4) Electric Circuits – Charles K. Alexander & Matthew N. O. Sadiku , Tata McGraw-Hill Publishing Company Ltd, Sixth Edition, 2016.

REFERENCE BOOKS:

1) Electric Circuits - J. Edminister& M. Nahvi, - Schaum's Outlines, Tata McGraw-Hill Publishing Company Ltd, Fifth Edition, 2017.
2) Network Analysis –M.E Van Valkenberg. Pearson Publishing Company Ltd, Revised Third Edition, 2015.
3) Electrical and Electronic Technology – Hughes , Pearson Publishing Company Ltd, Tenth Edition, 2010
4) Electrical Circuit Theory and Technology – John Bird - Newnes Publisher; Fourth edition – 2010.
5) https://nptel.ac.in/courses/108/106/108106172/
6) https://nptel.ac.in/courses/108/104/108104139/

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(A0019203) APTITUDE ARITHMETIC REASONING AND COMPREHENSION
(Skill Development Course)
For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:
- To familiarize the students about the concepts of aptitude, arithmetic and reasoning
- To cope up the students to improve their employable skills

COURSE OUTCOMES:
- Understand number system which helps to become well trained for recruitment drives.
- Analyze permutations and combinations concept.
- Obtain the knowledge of coding and decoding concept.
- Understand the topics related to clock and probability.
- Identify the topics related to Venn diagrams, reasoning and Non-verbal reasoning.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	-			
CO2	3	3	2	-	-	-	-	-	-	-	-	-			
CO3	3	2	2	-	-	-	-	-	-	-	-	-			
CO4	3	2	3	-	-	-	-	-	-	-	-	-			
CO5	3	3	2	-	-	-	-	-	-	-	-	-			

UNIT-1
Numbers, Number Systems Simple Equations, Ratio, Proportion, Variation Quadratic Equations, Progressions Percentages.

UNIT-2
Profit, Loss, Partnerships Averages, Mixtures & Allegations, Simple Interest, Compound Interest, Time and Work-Pipes, indices, surds, inequalities , Cisterns Time and Distance Geometry and Menstruation.

UNIT-3
Permutations & Combinations and Probability Data Interpretation & Data Sufficiency.

UNIT-4
Number & Letter Series, Analogies, Coding Decoding, Odd Man Out Blood Relations.

UNIT-5
Direction Sense, Symbols and Notations Deductions & Connectives Clocks, Calendars Analytical

UNIT-6
Reasoning (Verbal and Non-Verbal) , Venn Diagrams, Analytical Puzzles and Octal number system.

REFERENCES:
1) R.S. Agarwal. Quantitative Techniques. S.Chand Series.
2) Shankuntala Devi. Techniques of Reasoning. S.Chand Series.
3) https://www.fresherslive.com/online-test/verbal-ability-test/questions-and answers
4) https://www.fresherslive.com/online-questions/verbal-ability-test/arithmetic Reasoning

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(A0494204) IC AND PDC LAB

COURSE OBJECTIVES:

- Astable and mono stable multi vibrators.
- IC 741 OP-AMP applications.

COURSE OUTCOMES:

- Study the working principle of various Multivibrators (Bi-stable, Mono-stable, and Astable Multivibrators).
- Realize simple logic gates using diodes and transistors
- Realize Adder, integrator & differentiator using OP-Amp
- Realize different oscillator circuits and Function generator using IC741.
- Realize different multivibrators using IC555 timer
- Realize 4-bit DAC using OP-Amp.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	-	-	-	-	-	3	-	-	-			
CO2	1	-	3	-	-	-	-	-	3	-	-	-			
CO3	2	-	-	-	-	-	-	-	3	-	-	-			
CO4	-	2	1	-	-	-	-	-	3	-	-	-			
CO5	-	2	-	-	-	-	-	-	3	-	-	-			
CO6	-	2	-	-	-	-	-	-	3	-	-	-			

LIST OF EXPERIMENTS:

1) Study of Logic Gates & Some Applications
2) Transistor as a switch
3) Finding of operating point in CE configuration
4) Common Emitter amplifier
5) Common Collector amplifier
6) IC 741 OP AMP Applications –Integrator Circuits
7) IC 741 OP AMP Applications- Differentiator Circuits
8) IC 555 Timer – Monostable Operation Circuits
9) IC 555 Timer – Astable Operation Circuits
10) Function Generator using 741 OP AMP
11) Schmitt Trigger Circuits – Using IC 741 and IC 555
12) 4 bit DAC using 741 OP AMP

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(A0293204) ELECTRICAL MACHINES–I LAB

COURSE OBJECTIVES:

- To understand the practical connections of the machines.
- To draw the characteristics of different types of generators.
- To test the DC machines under different loading conditions to understand their performance.

COURSE OUTCOMES:

- Make the connections for DC machines.
- Selecting the meter ratings for various applications.
- Control the speed of the DC motor by different methods.
- Determine the efficiency of the given DC machine.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	1	-	-	-	-	-	3	-	-	3	-	-	2
CO2	3	2	2	2	1	-	-	3	3	-	-	2	-	-	-
CO3	3	2	1	2	1	1	-	2	3	-	-	2	-	-	1
CO4	3	3	2	2	2	-	-	2	3	-	-	2	-	1	2

LIST OF EXPERIMENTS:

1) Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed.
2) Load test on DC compound generator. Determination of characteristics.
3) Swinburne's test. Predetermination of efficiencies.
4) Brake test on DC compound motor. Determination of performance curves.
5) Hopkinson's test on DC shunt machines. Predetermination of efficiency.
6) Separation of losses in a DC shunt motor.
7) Load test on DC shunt generator. Determination of characteristics.
8) Brake test on DC shunt motor. Determination of performance curves.
9) Field's test on DC series machines. Determination of efficiency.
10) Speed control of DC shunt motor.
11) Study of Starters (2-point, 3-point, 4-point).
12) Experimental Verification of Critical Speed and Critical Field Resistance.

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(A0294204) ELECTRICAL MEASUREMENTS & INSTRUMENTATION LAB

COURSE OBJECTIVES:

- Electrical measurements lab introduces calibration of various meters like energy meter, power factor meter and measuring of energy, active and reactive power and testing of current transformers in measurement of unknown voltages and currents through potentiometers.
- Instrumentation has introduced the measurement of various physical quantities like strain, temperature, displacement, pressure, vibration and speed.
- Change of dielectric in terms of electrical quantities measuring quality factor for R,L,C circuits and measuring of R,L,C using different bridges.

COURSE OUTCOMES:

- To provide basic laboratory exposure to all electrical measuring instruments, their principles and applications.
- To determine ratio error and phase errors in CTs and PTs.
- To measure Resistance, Inductance and capacitance using AC and DC bridges.
- To understand the behaviour and characteristics of different equipment's.
- To improve measuring capabilities using LVDT and thermistor.
- To measure passive electrical parameter R, L, C and Quality factor using Q meter.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	-	-	-	1	1	-	-	3	-	-
CO2	3	3	1	-	2	-	-	-	1	1	-	-	3	-	-
CO3	3	3	2	1	1	1	-	-	1	1	-	-	3	-	-
CO4	2	3	2	1	1	-	-	1	1	1	-	-	3	-	-
CO5	2	2	1	2	1	1	-	1	1	2	-	1	3	-	-
CO6	3	2	1	1	2	1	-	-	2	1	-	-	3	-	-

The following experiments are required to be conducted as compulsory experiments:

1) Calibration and Testing of single-phase energy Meter
2) Calibration LPF wattmeter & Power Factor meter
3) Crompton D.C. Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter
4) Kelvin's double Bridge – Measurement of resistance – Determination of Tolerance.
5) Schering bridge & Anderson bridge
6) Measurement of 3-Phase reactive power with single-phase wattmeter
7) Measurement of 3-Phase active power using 2-CTs and 1-Phase wattmeter
8) Dielectric oil testing using H.T. testing Kit
9) Measurement of strain using strain gauge. (Change in strain into resistance)
10) Measurement of temperature using RTD & Thermistor.
11) (Change in temperature into Resistance)
12) Measurement of physical variable based on induced emf using Linear Variable Differential Transformer. (Change in displacement into Induced Voltage)
13) Measurement of pressure using bourdon tube. (Change in pressure into displacement)
14) Measurement of speed using digital stroboscope

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(A0211205) CONTROL SYSTEMS

COURSE OBJECTIVES:

- Be prepared to apply mathematics, established scientific and engineering knowledge, for the development and implementation of a broad range of electronic systems
- Be knowledgeable about current technologies and be prepared to adapt to technology advances and ensure professional growth through an appreciation for lifelong learning.
- Basic skill in methods of design and analysis across a broad range of electrical and computer engineering areas

COURSE OUTCOMES:

- Analyze electromechanical systems by mathematical modeling.
- Determine Transient and Steady State behavior of systems using standard test signals.
- Analyze linear and non-linear systems for steady state errors, absolute stability and relative stability.
- Determine stability analysis in s-domain using RH criterion and Root Locus Techniques.
- Able to observe stability using the analysis of polar, nyquist and bode plots.
- Using state space analysis state models can be obtained.

MAPPING OF COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	-	-	-	2	-	1	2			
CO2	3	3	3	2	-	-	-	-	2	-	1	2			
CO3	3	3	2	2	-	-	-	-	1	-	2	1			
CO4	3	3	2	2	-	-	-	-	2	-	2	2			
CO5	3	3	3	2	-	-	-	-	1	-	2	2			
CO6	3	3	3	2	-	-	-	-	2	-	1	1			

UNIT-I INTRODUCTION: Concepts of control systems – Open loop and closed loop control systems and their differences, examples – Types of feedback control systems. Mathematical modeling of Electrical & Mechanical(translational & rotational) systems, differential equations- Electrical analogous (F-V,F-I) of mechanical system- use of Laplace transforms in control systems-Transfer function: concepts, features-Transfer functions of above systems

UNIT-II BLOCK DIAGRAM REDUCTION & SIGNAL FLOW GRAPH REPRESENTATION: Block diagram representation of electrical systems and reduction techniques - Signal flow graphs and reduction using mason‟s gain formula- Transfer function of DC servomotor, AC servomotor Control system components-DC Servo motor-AC Servo motor

UNIT-III TIME RESPONSE ANALYSIS: Definition & classification of time response- Standard test signals – Type & order of a system- Transient response of fist order and 2^{nd} order systems for step input- Transient response specifications- Steady state response- Steady sate errors and error constants- Effects of PD, PI & PID controllers.

UNIT-IV STABILITY ANALYSIS IN S-DOMAIN: The concept of stability - Routh stability criterion, special cases, advantages and limitations Root locus technique: The root locus concept, construction of root loci- Effects of adding poles and zero‟s to G(s) H(s) on the root loci.

UNIT-V FREQUENCY RESPONSE ANALYSIS: Introduction – Steady state response to sinusoidal input (frequency response) - Bode diagrams- Phase margin and gain

margin- Stability analysis from Bode plots- Determination of transfer function from Bode diagram.

UNIT-VI **POLAR AND NYQUIST PLOTS:** Polar plots - Nyquist plots- Stability analysis

TEXT BOOKS:

1. J. Nagarath and M. Gopal, "Control System Engineering", New age international (P) limited, 2006.
2. B.C. Kuo, "Automatic control systems", 9th edition, John Wiley and son"s, 2010.
3. Katsuhiko Ogata, "Modern control engineering", PHI, 2010.

REFERENCE BOOKS:

1. M. Gopal, "Control systems: Principles and Design", Tata McGraw-Hill Education Pvt Limited, 2002.
2. S. Palani, "Control Systems Engineering", 2nd edition, Tata McGraw-Hill Education Pvt Limited, 2010.
3. Norman S. Nise, "Control Systems Engineering", John Wiley, 2017.
4. https://nptel.ac.in/courses/107/106/107106081/

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(A0212205) ELECTRICAL MACHINES - III

COURSE OBJECTIVES:
- To gain knowledge on construction and operation of Synchronous machines.
- To analyze the behavior of Synchronous machines.
- To apply mathematical skills to understand the performance of synchronous machines.
- To gain idea on double filed revolving theory.

COURSE OUTCOMES:
- Classify Synchronous Machines based on constructional and operational features.
- Evaluate the behavior of Synchronous machines.
- Acquire the knowledge of applying mathematical skills to analyze the performance.
- Sketch and analyze the Characteristics of Synchronous machines based on application.
- Analyze the behavior of single and poly phase AC machines by testing.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	1	1	2	1	-	1	-	2	2	1	1	3
CO2	3	2	-	1	1	-	-	-	-	-	1	2	1	2	3
CO3	3	3	1	3	1	-	-	2	-	-	1	3	1	3	3
CO4	3	2	1	1	-	-	-	-	-	-	-	2	1	3	3
CO5	3	3	2	2	1	1	-	1	-	-	-	2	1	3	3

UNIT I SYNCHRONOUS GENERATOR – CHARACTERISTICS

Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation-Harmonics in generated e.m.f. – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – experimental determination - phasor diagram – load characteristics.

UNIT II REGULATION OF SYNCHRONOUS GENERATOR

Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – salient pole alternators – two reaction analysis – experimental determination of X_d and Xq (Slip test) Phasor diagrams – Regulation of salient pole alternators.

UNIT III PARALLEL OPERATION OF SYNCHRONOUS GENERATOR

Synchronizing alternators with infinite bus bars – synchronizing power torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input. Analysis of short circuit current wave form – determination of sub-transient, transient and steady state reactance's

UNIT IV SYNCHRONOUS MOTORS – PRINCIPLE OF OPERATION

Theory of operation – phasor diagram – Variation of current and power factor with excitation – synchronous condenser – Mathematical analysis for power developed.

UNIT V POWER CIRCLE DIAGRAM

Excitation and power circles – hunting and its suppression – Methods of starting – synchronous induction motor.

UNIT VI SINGLE PHASE MOTORS

Single phase Motors: Single phase induction motor – Constructional features-Double revolving field theory – Elementary idea of cross-field theory – split-phase motors – shaded pole motor.

TEXT BOOKS:

1. Electric Machines, Dr. P. S. Bimbra, Publisher: Khanna Books, ISBN: 9789386173294, 9386173298, Edition: 2, 2021.
2. A Textbook Of Electrical Technology, B L Theraja, ISBN- 9788121924375, Publiser: S. Chand, Edition: Vol 2 Ac And Dc Machines,23/e.
3. Electric Machines, Ashfaq Husain and Harroon Ashfaq, Publisher: Dhanpat Rai & Co. (P) Limited; ISBN-10: 8177001663, ISBN-13 : 978-8177001662, Third edition (1 January 2016).
4. Electric Machines, D.P. Kothari and I.J. Nagrath, Publisher: Tata Mc Graw – Hill Publishers, ISBN-10: 935260640X, Edition: 5th.

REFERENCE BOOKS:

1. Electric Machinery, A Fitzgerald, Charles Kingsley, Stephen Umans , ISBN-10: 0070530394, Publisher: Tata Mc Graw – Hill,
2. Theory and Performance Electrical Machines, J. B. Guptha, Publisher: Katson Books, Edition 2014.
3. Principles of Electrical Machines, P.C.Sen, Publisher: Wiley, ISBN: 9789390395057, Edition: Third, 2020
4. https://nptel.ac.in/courses/108/105/108105155/

RGM COLLEGE OF ENGINEERING AND TECHNOLOGY
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(A0213205) POWER ELECTRONICS

COURSE OBJECTIVES:

- To prepare the students thorough in basic concepts of semiconductor devices used in Power Electronic converters.
- To Analyze and design different power electronic converter circuits. Like AC-DC, AC-AC, DC-DC, and DC-AC converters.

COURSE OUTCOMES:

- Understand fundamental concepts and techniques used in power electronic conversion.
- Ability to analyze operating principle of various single phase and three phase power converters.
- Understand the practical applications of power electronic converters in the various fields.
- Learn how to design the components in the various converters for different types of loads.
- Understand various control methods used in the power electronic converters to control power flow from source to load.
- Acquire knowledge about how to design an application oriented power supply system.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	-	-	-	-	-	2	2	3	-	-
CO2	3	3	2	2	2	-	-	-	-	-	2	1	3	-	-
CO3	2	3	1	2	1	-	-	-	2	-	2	-	3	-	-
CO4	2	2	1	2	2	-	-	-	2	-	2	1	3	-	-
CO5	2	2	1	2	2	2	-	-	2	-	2	-	3	-	-
CO6	2	3	2	2	2	-	-	-	2	-	3	-	3	-	-

UNIT I SINGLE PHASE AC-DC CONVERTERS Introduction-Principle of phase control technique-Single phase full wave Midpoint, fully controlled, half controlled converters with R load, RL load & RLE load-Continuous and discontinuous current conduction mode of operations- Derivation of average and RMS load voltage and currents-Effect of freewheeling Diode-Effect of source inductance-performance factors of fully controlled and half controlled converters-Numerical problems.

UNIT II THREE PHASE AC-DC CONVERTERS

THREE PHASE AC-DC CONVERTERS: Introduction-Three phase half wave Converter-Three phase full wave fully controlled and half controlled converters with R load and RL load-Continuous and discontinuous current conduction mode of operations-Derivation of average load voltage-Numerical problems.

DUAL CONVERTERS: Principle of dual converter-practical dual converter with RL Load- circulating current mode of operation-Non-circulating current mode of operation (Only Operation and Waveforms).

UNIT III SINGLE PHASE AC-AC CONVERTERS:

AC VOLTAGE CONTROLLERS: Introduction-half wave and full wave ac voltage controllers with R Load and RL load-Derivation of RMS output voltage and power factor-principle of integral cycle or ON/OFF control method in the AC voltage controller-Numerical problems.

CYCLOCONVERTERS: Introduction-Single phase step down and step up cycloconverters-Midpoint and bridge type configurations with R load and RL load (Only operation and Waveforms).

UNIT IV DC-DC CONVERTERS

Introduction-principle of Step-down and Step-up Chopper-Derivation of load voltage and current-Time ratio control and Current limit control strategies–first quadrant chopper- second quadrant chopper- Steady state time domain analysis of first and second quadrant choppers with RLE load -Two quadrant choppers-Four quadrant choppers (principle of operation only).

UNIT V DC-AC CONVERTERS, SINGLE PHASE INVERTERS:

Introduction-Single phase voltage source bridge inverters (VSI)–Half and full bridge inverters-Fourier analysis for output voltage waveforms-RMS voltage- Performance parameters of inverters-Voltage control techniques for inverters-Single Pulse Width Modulation (PWM)-Multiple PWM-Sinusoidal PWM-Current Source inverter- Numerical problems.

THREE PHASE INVERTERS: Introduction-Three phase voltage source bridge inverter-1800 conduction mode and 1200 conduction mode of operations-Fourier analysis for output voltage waveforms-Derivation of output RMS voltage-Voltage control techniques for inverters-Single Pulse Width Modulation (PWM)-Multiple PWM-Sinusoidal PWM-Numerical problems.

UNIT VI SWITCHED MODE POWER SUPPLIES

Introduction-Linear Power Supply-Switch Mode Power Supply (SMPS)-comparison between linear power supply and SMPS-Switch mode DC power supply block diagram-isolated DC to DC converters-Fly back converter-Forward converter-push pull converter.
Introduction of UPS–On line UPS and its specifications–off line UPS and its specifications.

TEXT BOOKS:

1. Power Electronics - P.S. Bimbhra, Khanna Publications, 2018.
2. Power Electronics –M. D. Singh & K. B. Kanchandhani, Tata Mc Graw – Hill Publishing Company, 2008.

REFERENCE BOOKS:

1. Power Electronics Handbook: Circuits, Devices and Applications – M. H. Rashid, Prentice Hall of India, 2004.
2. Power Electronics - V.R Murthy, OXFORD University Press, 2005.
3. Power Electronics - Essentials & Applications by L. Umanand, Wiley India Pvt. Ltd, 2009.
4. Power Electronics by V Ramanarayanan, 2006.
5. Power Electronics converters, applications and design-Ned Mohan, Wiley india,2006.
6. https://nptel.ac.in/courses/108/102/108102145/

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(A0214205) TRANSMISSION OF ELECTRICAL POWER
(Professional Elective-I)

COURSE OBJECTIVES:
- This course is an extension of Generation & Distribution of Electric Power course.
- It deals with basic theory of transmission lines modeling and their performance analysis.
- This course gives emphasis on mechanical design of transmission lines, cables and insulators.

COURSE OUTCOMES:
- To classify the different types of conductors, along with its virtual parameters in transmission system.
- To calculate the parameters (R, L, C) of transmission lines.
- The evaluation of performance of different Types of transmission lines.
- Describes travelling waves and various transients in transmission system.
- To analyze the mechanical design & aspects of transmission system.
- To know the importance of underground cables for transmission system and their applications.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	2	2	1	-	-	1	-	-	1	2	-	-	3
CO2	3	3	2	2	1	-	-	-	1	-	1	2	-	-	3
CO3	3	3	2	2	1	-	-	-	1	-	1	2	-	-	3
CO4	3	3	3	2	2	-	-	-	1	1	-	2	-	-	3
CO5	1	3	3	1	1	-	-	-	-	1	-	2	-	-	3
CO6	3	3	3	2	-	1	1	-	2	-	1	2	-	-	3

UNIT I TRANSMISSION LINE PARAMETERS
Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition, Numerical Problems. Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

UNIT II PERFORMANCE OF TRANSMISSION LINES
Classification of Transmission Lines - Short, medium and long line and their model - representations - Nominal-T, Nominal-Pie and A, B, C, D Constants. Numerical Problems. Mathematical Solutions to estimate regulation and efficiency of all types of lines - Numerical Problems. Long Transmission Line-Rigorous Solution, evaluation of A, B, C, D Constants, Interpretation of the Long Line Equations – Representation of Long lines – Equivalent T and Equivalent – π – surge Impedance and surge Impedance loading - wavelengths and Velocity of propagation – Skin Effect, Ferranti effect , Proximity effect.

UNIT III POWER SYSTEM TRANSIENTS
Types of System Transients - Travelling or Propagation of Surges - Attenuation, Distortion, Reflection and Refraction Coefficients - Termination of lines with different types of conditions - Open Circuited Line, Short Circuited Line, T-Junction, Lumped Reactive
Junctions (Numerical Problems) - Bewley's Lattice Diagrams (for all the cases mentioned with numerical examples).

UNIT IV CORONA

Corona - Description of the phenomenon, factors affecting corona, critical disruptive voltages, visual critical voltage and power loss due to corona, Radio Interference.

UNIT V DESIGN OF INSULATORS AND SAG ON OVERHEAD LINES

Types of Insulators, String efficiency and Methods for improvement, Numerical Problems - voltage distribution, calculation of string efficiency, Capacitance grading and Static Shielding, Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor, Numerical Problems - Stringing chart and sag template and its applications.

UNIT VI UNDERGROUND CABLES

Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation resistance and stress in insulation, Numerical Problems. Capacitance of Single and 3-Core belted cables, Numerical Problems. Grading of Cables. Numerical problems.

TEXT BOOKS:

1) Principles of Power Systems- V. K. Mehta & Rohith Mehta. S. Chand, 2005.
2) Power System Analysis and Design- B.R Gupta, S. Chand & Co, 2005.
3) Electrical power systems -C. L Wadhwa, New Age International (P) Limited, Publishers, 2006.

REFERENCE BOOKS:

1) A Text Book on Power System Engineering -M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A Chakrabarthy, Dhanpat Rai & Co Pvt. Ltd, 2008.
2) Modern Power System Analysis - I.J.Nagarath and D.P.Kothari, Tata McGraw Hill, 2007.
3) Power System Engineering - R. K. Rajput, Laxmi Publications, 2006.
4) https://nptel.ac.in/courses/108/102/108102047

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(A0215205) NEURAL NETWORKS & FUZZY SYSTEMS

(Professional Elective-I)

For branches: EEE & ECE

COURSE OBJECTIVE:

- This course introduces the basics of neural networks, single &multi-layer feed forward networks, fuzzy sets & fuzzy logic components.

COURSE OUTCOMES:

- To differentiate Biological system, intelligent systems and the concepts of crisp and fuzzy set theory
- To analyze the learning strategies of Artificial Neural networks and learning rules
- To understand training algorithms and are able to provide adequate knowledge about feed forward and feedback neural networks.
- To design training algorithms for associative memory network for pattern recognition problems
- To demonstrate knowledge and understanding of fuzzy system as they apply in real time systems
- To apply different methodologies to solve the problems related to defuzzification.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	-	-	-	-	-	-	-	1	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-	-	1	-	-
CO3	3	3	3	3	2	-	-	-	-	-	-	1	1	-	-
CO4	3	3	3	2	3	-	2	-	-	-	-	2	1	-	-
CO5	3	3	3	2	1	-	-	-	-	-	-	-	1	-	-
CO6	3	3	3	3	2	-	-	-	-	-	-	2	1	-	-

UNIT I

ARTIFICIAL NEURAL NETWORKS: Introduction, Biological Neuron, Artificial Neuron, Basic concepts of Neural Networks, Basic Models of ANN Connections, McCulloch-Pitts Model, Characteristics of ANN, Applications of ANN.

UNIT II

ESSENTIALS OF ARTIFICIAL NEURAL NETWORKS: Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN ¬– Connectivity, Learning Strategies (Supervised, Unsupervised, Reinforcement), Learning Rules, Numerical problems, Types of Application

UNIT III

SUPERVISED LEARNING NETWORKS: Perceptron Network, Perceptron Learning Rule, Architecture, Perceptron Training Algorithm, ADALINE, MADALINE, Back Propagation Network, BP Learning Rule, Input Layer Computation, Hidden Layer Computation, Output Layer Computation, Radial Basis Function Demonstration through MATLAB

UNIT IV

ASSOCIATIVE MEMORY NETWORK: Training Algorithms for Pattern Association, Auto Associative Memory Network, Hetero Associative Memory Network, BAM, Hopfield Networks, Applications

UNIT V

CLASSICAL & FUZZY SETS: Introduction to classical sets - properties, Operations and

relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

UNIT VI

FUZZY LOGIC SYSTEM COMPONENTS: Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods, Applications

TEXT BOOKS:

1) Neural Networks and Fuzzy Logic System by Bart Kosko, PHI Publications.
2) Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Pai – PHI Publications.
3) Fundamental of Artificial Neural Network and Fuzzy Logic-by Rajesh Kumar, Lakshmi publications

REFERENCE BOOKS:

1) Neural Networks – James A Freeman and Davis Skapura, Pearson Education.
2) Neural Networks – Simon Hakins, Pearson Education.

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(A0216205) PROGRAMMABLE LOGIC CONTROLLERS
(Professional Elective-I)

COURSE OBJECTIVE:
- This course is essential in monitoring and analyzing the PLC In this course Theory and implementation about PLC is discussed in detail.

COURSE OUTCOMES:
- To provide knowledge levels needed for PLC programming and operating.
- To make the students how devices to which PLC input and output modules are connected
- To train the students to create ladder diagrams from process control descriptions.
- To make the students understand various types of PLC registers
- Apply PLC Timers and Counters for the control of industrial processes
- To make the students understand PLC functions, Data Handling Function

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	-	-	3	3	3	1	-	-	-	-	-	3
CO2	1	-	2	1	2	3	3	-	2	-	-	1	-	-	3
CO3	1	2	2	1	2	1	2	-	2	-	-	2	-	-	3
CO4	1	2	2	2	2	-	1	2	2	-	-	2	-	-	3
CO5	2	2	3	2	2	1	1	-	-	-	-	2	-	-	3
CO6	1	2	3	-	2	3	3	3	-	-	-	3	-	-	3

UNIT I
PLC Basics: PLC system, I/O modules and interfacing, CPU processor, programming Equipment, programming formats, construction of PLC ladder diagrams, Devices connected to I/O modules.

UNIT II
PLC Programming: Input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill press operation

UNIT III
Digital logic gates, programming in the Boolean algebra system, conversion examples Ladder Diagrams for process control: Ladder diagrams & sequence listings, ladder diagram construction and flowchart for spray process system.

UNIT IV
PLC Registers: Characteristics of Registers, module addressing, holding registers, Input Registers, Output Registers.

UNIT V
PLC Functions: Timer functions & Industrial applications, counter function & industrial applications, Arithmetic functions, Number comparison functions, number conversion functions

UNIT VI
Data Handling functions: SKIP, Master control Relay, Jump, Move, FIFO, FAL, ONS, CLR & Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two-axis & three axis Robots with PLC, Matrix functions.

TEXT BOOKS:

1) Programmable Logic Controllers- Principles and Applications by John W. Webb & Ronald A. Reiss, Fifth Edition, PHI
2) Programmable Logic Controllers by W. Bolton, Elsevier.

REFERENCE BOOKS:

1) Programmable Logic Controllers- Programming Method and Applications –JR. Hackworth & F.D Hackworth Jr. –Pearson.
2) Programmable controllers, Theory and Implementation –Second edition, E.A. Bryan, An industrial text company publication, USA.

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(A512205) CORE JAVA PROGRAMMING
(Open Elective-I)
For branches: EEE & ECE

COURSE OBJECTIVES:
After taking this course, the student should be able to:
- Describe the Windows event-driven programming model
- Build simple JAVA applications according to the model
- Write fluent JAVA code for creating classes
- Use JAVA variables, data, expressions and arrays
- Design and create forms, menus and controls
- Write clear, elementary Java programs (applets and applications)
- Use a Java-enabled browser and/or the applet viewer to execute Java applets
- Use the Java interpreter to run Java applications
- Design and construct effective graphic user interfaces for application software.
- Use Java Beans, RMI to build complex business applications

COURSE OUTCOMES:
- Understand the syntax and concepts of JAVA
- Write JAVA programs to implementing Object Oriented Concepts
- Able to build directories and manage applications with interfaces
- Write JAVA programs that use data from flat files and databases
- Develop programs with error free and Multi-tasking.
- Program assignment utilizing Java GUI components, event listeners and event-handlers.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3	1	2				1		2	2	2	2	
CO2	2	1	3	2	2			1				3	1	2	1
CO3	1	2	2	1	1							2		1	
CO4	1	1	2	1	2			1			2	2		2	1
CO5	2	2	2		2			1			1	2	2	2	
CO6		1	1		2							1		1	1

UNIT-I
Introduction To Java – Introduction to OOP, OOP Concepts, History of Java, Java buzzwords, How Java differs from C , Structure of Java Program, data types, variables, constants, type conversion and casting, enumerated types, scope and life time of variables, operators, expressions , control flow- conditional statements, break and continue, simple java program, arrays, parameter passing, static fields and methods, access control, this, overloading methods and constructors, recursion, garbage collection.

UNIT-II
Inheritance –Inheritance concept, Super and Sub classes, Member access rules, types of Inheritance, super uses, final classes and methods, casting, polymorphism- dynamic binding, method overriding, abstract classes and methods, the Object class and its methods.

UNIT-III
Interfaces – Interfaces vs. Abstract classes, defining an interface, implementing interfaces, accessing implementations through interface references, extending interface.

Packages- Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.

UNIT-IV

Files – streams, text Input/output, binary input/output, random access file operations, File management using File class, Using java.io.
Strings: Strings, string functions.

UNIT-V

Exception handling – benefits of exception handling, exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, rethrowing exceptions, built in exceptions, creating own exceptions.
Multithreading - Differences between multiple processes and multiple threads, thread states, creating threads, interrupting threads, thread priorities, synchronizing threads, interthread communication, thread groups, daemon threads, thread deadlock.

UNIT-VI

Event Handling - Events, Event sources, Event classes, Event Listeners, Relationship between Event sources and Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes.

TEXT BOOKS:

1) Java; the complete reference, 7th editon, Herbert schildt, TMH.
2) Understanding OOP with Java, updated edition, T. Budd, pearson eduction.

REFERENCES:

1) An Introduction to programming and OO design using Java, J.Nino and F.A. Hosch, John wiley & sons.
2) Programming in Java, Sachin Malhotra, Saurabh Choudhary, Second Edition.
3) An Introduction to OOP, second edition, T. Budd, pearson education.
4) Introduction to Java programming 6th edition, Y. Daniel Liang, pearson education.
5) An introduction to Java programming and object oriented application development, R.A. Johnson- Thomson.
6) Core Java 2, Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell, seventh Edition, Pearson Education.
7) Core Java 2, Vol 2, Advanced Features, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education.

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(A0506203) COMPUTER ORGANISATION & ARCHITECTURE
(Open Elective-I)
For branches: EEE, ECE & CSE

COURSE OBJECTIVES:
- To understand the structure, function, characteristics and performance issues of computer systems.
- To understand the design of the various functional Units of digital computers

COURSE OUTCOMES:
- Explain the organization of basic computer, its design & the design of control unit and trade-offs between hardware and software.
- Students will formulate and solve problems, understand the performance requirement of the systems and the operations & languages of the register transfer, micro operations and input output organization.
- Students can understand how computer stores positive and negative numbers.
- Understand the organization of memory and memory management hardware.
- Elaborate advanced concepts of computer architecture, Parallel Processing, inter processor communication and synchronization.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	1	3	-	-	-	-	-	2	-	-	-	-	-	-
CO2	-	-	2	3	1	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	2	-	-	-	-	-	-	-	1	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	2	1	-	-	-

UNIT I BASIC STRUCTURE OF COMPUTERS

Computer Types, Functional Unit, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers

DATA REPRESENTATION: Fixed Point Representation, Floating Point Representation - Error Detection codes

UNIT II REGISTER TRANSFER LANGUAGE AND MICRO OPERATIONS

Register transfer language, Register Transfer, Bus and memory transfers, Arithmetic Micro operations, logic micro operations, shift micro operations

BASIC COMPUTER ORGANIZATION AND DESIGN: Instruction codes, Computer Registres, Computer instructions, Instruction cycle, Memory- reference instructions, Input – Output and Interrupt

UNIT III CENTRAL PROCESSING UNIT

Stack organization, Instruction formats, Addressing modes, Data transfer and manipulation, Program control

COMPUTER ARITHMETIC: Fixed point operations - Addition and subtraction, multiplication, Division Algorithms

UNIT IV THE MEMORY SYSTEM

Basic concepts, semiconductor RAM memories, Read-only memories, Cache memories, performance considerations, Virtual memories, secondary storage, Introduction to RAID.

UNIT V PIPELINE AND VECTOR PROCESSING

Parallel processing, Arithmetic pipeline, Instruction Pipeline, RISC Pipeline, Vector processing, Array Processors

UNIT VI MULTI PROCESSORS

Characteristicsof Multi Processors, Inter Connection Structures, Inter Processor Arbitration; Inter Processor Communication & Synchronization, Cache Coherence

TEXT BOOKS:

1) Computer Systems Architecture – M. Moris Mano, Pearson/PHI

REFERENCE BOOKS:

1) Computer Organization – Carl Hamacher, Zvonks Vranesic, SafeaZaky, McGraw Hill.

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(A0513205) WEB PROGRAMMING

(Open Elective-I)

For branches: EEE, ECE, CSE & CSE(DS)

COURSE OBJECTIVES:

- This course demonstrates an in-depth understanding of the tools and Web technologies necessary for business application design and development.
- The course covers client side scripting like HTML, JavaScript and server side scripting like servlets, JSPs. And also XML and web servers and database interfacing.

COURSE OUTCOMES:

- Student can able to demonstrate the HTML important tags and for designing static web pages and separate design from content using CSS.
- Able to design a webpage with more user interactivity using JavaScript.
- Students can able to understand the need of XML in the developing of Web applications.
- Students able to understand the need of Server side scripting using Servlets and JSP.
- Able to develop the web applications with MVC architecture design using Struts.
- Students can able to apply the java programming to develop interactive of databases and develop the scalable web applications.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	3	1	2	2	1	-	2	-	-	2	-	-	-
CO2	1	-	1	-	2	1	-	1	2	-	-	2	-	-	-
CO3	1	-	-	-	2	1	-	-	1	-	-	2	-	-	-
CO4	1	2	1	1	2	2	-	-	2	1	-	2	-	-	-
CO5	1	1	1	2	3	-	-	-	2	-	-	-	-	-	-
CO6	1	1	1	-	2	-	-	-	2	-	-	1	-	-	-

UNIT I INTRODUCTION TO HTML

HTML common tags, HTML program structure, Attributes, List, Tables, images, image maps, forms, Frames; Cascading Style sheets

UNIT II JAVASCRIPT

Introduction to Java Scripts, Objects in Java Script, Dynamic HTML with Java Script, Data Validation using Java Script.

UNIT III XML

Document type definition, XML Schemas, Document Object model, Presenting XML, Using XML Processors: DOM and SAX

UNIT IV MORE ON SERVLETS

Reading Initialization parameters, the javax. Servlet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking

JSP Application Development

Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing – Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods Sharing Data between JSP pages, Sharing Session and Application Data.

UNIT V STRUTS

Tomcat &Struts Installation, Struts Request life cycle, Struts Configuration file, Form Validation with Struts, Simple Struts application.

UNIT VI DATABASE ACCESS

Database Programming using JDBC, Types of JDBC Drivers, Studying Javax.sql.* package, Accessing a Database from a JSP Page, Application – Specific Database Actions

AJAX: Introduction, Background, How AJAX works, Common steps AJAX will follow.

TEXT BOOKS:

1. HTML Black Book – Steve Holzner.
2. Web Programming, building internet applications, Chris Bates, WILEYD reamtech
3. The complete Reference Java 2 by Patrick Naughton and Herbert Schildt. TMH
4. Java Server Pages –Hans Bergsten, SPD O'Reilly

REFERENCE BOOKS:

1. Programming world wide web-Sebesta, Pearson.
2. Core Servlets and Java Server Pages, Volume:1 Core Technologies by Marty Hall and Larry Brown Pearson.
3. Internet and World Wide Web – How to program by Dietel and Nieto PHI/Pearson Education Asia.
4. Jakarta Struts Cookbook , Bill Siggelkow, S P D O'Reilly
5. Murach's beginning JAVA JDK 5, Murach, SPD.
6. An Introduction to web Design and Programming –Wang-Thomson.

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(A0217205) SENSORS & ACTUATORS
(Skill Development Course)

COURSE OBJECTIVES:
- To understand basics of sensors, actuators and their operating principle.
- To explain about sensors and its importance in the real world and also how to fabricate some of those sensors.
- To provide in-depth understanding on characteristic parameters to evaluate sensor performance.
- To explain working of various types of thermal, radiation, smart sensors and actuators.
- To provide information about interfacing and characterization of different sensors.

COURSE OUTCOMES:
- Able to choose electrical drives and actuators for various applications.
- Understand the operation of commonly employed sensors and actuators.
- Explain the characteristics and working principles of various types of sensors.
- Analyze the architecture of most commonly used actuators.
- Evaluate different sensors and apply them to the real time applications.
- Design and construct the appropriate interface circuits for the sensors and actuators.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	-	-	-	2	-	1	2	-	-	-
CO2	3	3	1	2	-	-	-	-	2	-	1	2	-	-	-
CO3	3	1	2	3	-	-	-	-	1	-	2	1	-	-	-
CO4	3	3	2	2	-	-	-	-	2	-	2	2	-	-	-
CO5	3	3	1	2	-	-	-	-	1	-	2	2	-	-	-
CO6	3	3	2	2	-	-	-	-	2	-	2	2	-	-	-

UNIT – I Sensors / Transducers

Principles - Classification - Parameters - Characteristics - Environmental Parameters (EP) - Characterization Mechanical and Electromechanical Sensors: Introduction - Resistive Potentiometer - Strain Gauge - Resistance Strain Gauge - Semiconductor Strain Gauges - Inductive Sensors: Sensitivity and Linearity of the Sensor –Types-Capacitive Sensors - Ultrasonic Sensors.

UNIT – II Thermal Sensors

Introduction - Gas thermometric Sensors - Thermal Expansion Type Thermometric Sensors - Acoustic Temperature Sensor - Dielectric Constant and Refractive Index thermo sensors - Resistance Change Type Thermometric Sensors - Thermo emf Sensors - Junction Semiconductor Types - Thermal Radiation Sensors - Quartz Crystal Thermoelectric Sensors - Heat Flux Sensors- Magnetic sensors – Magneto resistive Sensors.

UNIT – III Radiation Sensors

Introduction – Basic Characteristics – Types of Photosensistors/Photo detectors– X-ray and Nuclear Radiation Sensors– Fiber Optic Sensors Electro analytical Sensors- Sensor Electrodes.

UNIT – IV Smart Sensors

Introduction – Primary Sensors – Excitation – Amplification – Filters – Converters – Compensation– Information Coding/Processing - Data Communication – Standards for Smart Sensor Interface – The Automation Sensors –Home Appliance Sensors – Aerospace Sensors – Sensors for Manufacturing –Sensors for environmental Monitoring.

UNIT – V Actuators

Working principles of Actuators - Piezoelectric and Piezoresistive actuators, Pneumatic and Hydraulic Actuation Systems - Directional Control valves –Pressure control valves – Cylinders - Servo and proportional control valves – Process control valves

UNIT - VI Mechanical Actuators

Rotary actuators Mechanical Actuation Systems- Types of motion – Kinematic chains – Cams – Gears – Ratchet and pawl – Belt and chain drives – Bearings – Mechanical aspects of motor selection Electrical Actuation Systems-Electrical systems -Mechanical switches – Solid-state switches Solenoids – D.C. Motors – A.C. motors – Stepper motors.

TEXT BOOKS:

1) D. Patranabis, “Sensors and Transducers”, PHI Learning Private Limited.
2) W. Bolton, “Mechatronics”, Pearson Education Limited.

REFERENCE BOOKS:

1) Patranabis, “Sensors and Actuators”, 2nd Edition, PHI, 2013.
2) https://nptel.ac.in/courses/108/108/108108147/

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(A0014203) INDIAN HERITAGE & CULTURE

(Mandatory Learning Course)

For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

INTRODUCTION:

- Indian Heritage is an ancient facet pertaining to bygone ages. It reflects strong ethical culture and embodiment of nature in life style. It had its deep roots in great Indian epics and Upanishads. It has been transformed and strengthened by many kings and queens. It is received by erudite writers. The glory of Indian Heritage & culture have been ignored or distorted in wake of western culture. The present generation ought to know their indigenous culture and heritage.

COURSE OBJECTIVES:

- To enable the students to have an insight into and understanding of the great heritage and culture of India.
- To sensitize them towards preservation and progression of the same.

COURSE OUTCOMES:

- Equip themselves with knowledge about the heritage and culture of India.
- Apply the ancient wisdom to become successful professionals.

UNIT-1

Origin of Indian Culture - Indus valley & Vedic Culture Evolution - Political unification of India under Mauryas and Guptas - Cultural achievements - Cultural conditions under the Sathavahanas - Contribution of Pallavas and Cholas to art and letters.

UNIT-2

Influence of Islam on Indian Culture - The Sufi, Bhakti and Vishnavite Movements - Cultural achievements of Vijayanagara rulers - Contribution of Shershah and Akbar to the evolution of administrative system in India - Cultural Developments under Mughals - Great Indian Monuments.

UNIT-3

Great Indian Epics - Ramayana and Mahabharata - Upanishads - Vedas - Pathanjali - Yoga - Principles of Jainism and Buddhism

UNIT-4

Indian Literature - Rabindranath Tagore - Arundhathi Roy - RK.Narayan - Sri Sri - Gurajada - Jashuva - Western Impact on India - Introduction of Western Education - End of the Gurukulas educational system.

UNIT-5

Social and Cultural awakening and social reform movements - Raja Rama Mohan Roy - Dayananda Saraswathi

-Theosophical Society - Ramakrishna Paramahamsa and Vivekananda - Iswara Chandra Vidyasagar and Kandukuri Veeresalingam - Emancipation of women and struggle against Caste.

UNIT-6

Mahatma Gandhi - Non-violence and Satyagraha - Great leaders of Freedom struggle - Post Independent Era.

TEXT BOOK

1. Madanlal Malpani & Shamsunder Malpani (2016), *Indian Heritage and Culture,* New Delhi: Kalyani Publishers.

REFERENCE BOOKS

1. Romila Thapar (2018) , Indian Cultures as Heritage: Contemporary Pasts, India.
2. Anurag Mathur (2017), Indian Culture & Heritage, Create space independent publishing Platform, 2017.
3. P.R.Rao & P. Raghavendra , Indian Heritage and culture, Sterling Publication Pvt. Ltd.
4. Madhukar kumar Bhagat, Indian Heritage and culture, Access Publications.
5. Dhirendra Singh, Indian Heritage and culture , APH Publications.
6. http://www.indiaculture.nic.in/
7. http://www.indiaculture.nic.in/world-heritage

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(A0296205) ELECTRICAL MACHINES-II LAB

COURSE OBJECTIVES:

- To understand the practical connections of AC machines.
- To calculate the various parameters of induction motor and synchronous machine.
- To analyze the performance of the induction motor and synchronous machine by conducting suitable experiments.

COURSE OUTCOMES:

After the completion of this course, students will be able to:

- Analyze the performance of Induction and synchronous machines for their applications.
- Estimate the voltage regulation of AC Machines by various regulation methods.
- Determine the performance characteristics of AC machines by conducting suitable tests.
- Illustrate the synchronization of alternator to bus bar.
- Analyze the conversion principle employed in Scott connection of transformer.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	1	-	2	3	-	-	2	-	2	2
CO2	3	3	2	1	1	1	-	2	3	-	-	2	-	1	2
CO3	3	2	2	1	-	-	-	-	3	-	-	2	-	1	1
CO4	3	-	-	-	2	-	-	3	3	1	-	2	-	1	1
CO5	3	2	2	2	1	1	-	2	3	-	-	2	-	1	2

The following experiments are required to be conducted compulsorily

1. OC & SC tests on single phase transformer (equivalent circuit, efficiency & regulation)
2. Scott connection of transformers.
3. Parallel operation of single phase transformers.
4. Separation of core losses in a single phase transformer.
5. No-load & Blocked rotor tests on three phase Induction motor.
6. Brake test on three phase Induction Motor.
7. Regulation of three-phase alternator by
   a) Synchronous Impedance Method and
   b) MMF method.
8. V and Inverted V curves of a 3 phase synchronous motor.
9. Equivalent Circuit of a single phase induction motor.

In addition to the above eight experiments, at least any two of the following experiments are required to be conducted from the following list:

1. Determination of Xd and Xq of a salient pole synchronous machine.
2. Regulation of three-phase alternator by Z.P.F. method.
3. Load test on three phase induction generator.
4. Synchronization of three phase alternator by using Dark Lamp Method.
5. Sumpners test on two identical transformers.

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(A0297205) CONTROL SYSTEMS & SIMULATION LAB

COURSE OBJECTIVES:

- To help the students understand and practice the modeling, simulation and to implementation of a physical dynamical system by a linear time invariant ordinary differential equation.
- To highlight the electrical modeling of a second order system and analyze the under damped, over damped and critically damped cases.
- To experimentally determine the transfer function of servo motor skills and techniques.

COURSE OUTCOMES:

- Understand the behaviour of second order control systems and DC motors
- Analyze the DC and AC servo motor and its characteristics. Also to set up a closed loop position control system and study the system performance.
- Set up a system for closed loop voltage regulation for a dc shunt generator its characteristics.
- Obtain the characteristics of the synchro systems and set up a synchro link position.
- Analyze the stability of a control system in time and frequency domain using MATLAB Programming.
- Understand the steady state errors and maximum peak over shoot of Second order control system using PID controller.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	2	-	-	1	1	-	-	3	-	-
CO2	3	3	1	-	2	2	-	-	1	1	-	-	3	-	-
CO3	3	3	2	1	1	1	-	-	1	1	-	-	3	-	-
CO4	2	3	2	1	1	-	-	1	1	1	-	-	3	-	-
CO5	2	2	1	2	1	-	-	1	1	2	-	1	3	-	-
CO6	3	2	1	1	2	-	-	-	2	1	-	-	3	-	-

Note:

The minimum of 10 experiments are to be performed from the following, out of which at least two should be software based.

1. Time response of Second order system
2. Characteristics of Synchro
3. Speed-torque characteristics of DC servo motor
4. DC motor position controller
5. Lead-lag compensation
6. Transfer function of DC shunt generator
7. PID controller trainer
8. Stepper motor control system
9. AC servo motor speed control trainer
10. Dc motor speed control trainer

Software based experiments

11. To plot root locus diagram of an open loop transfer function and determine range of gain ‘k’ for stability
12. To plot a Bode diagram of an open loop transfer functions and examines the stability of the system.
13. To draw a Nyquist plot of an open loop transfer functions and examines the stability of the closed loop system.
14. To determine response of first order and second order systems for step input and compare theoretical and practical results.
15. State space to transfer function using MATLAB

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(A0219206) BASICS OF SIGNALS & SYSTEMS

COURSE OBJECTIVES:

- Study of signals and systems.
- Analysis of signals & systems and frequency transform methods.
- To understand the concepts of convolution and correlation.

COURSE OUTCOMES:

- Classification of continuous and discrete time signals and concept of orthogonality.
- Analyze the periodic and a periodic signals using Fourier analysis.
- Classify the systems based on their properties and determine the response of LTI system.
- Apply the Laplace transform and z-transform to analyze the continuous and discrete time signals.
- Concept of convolution, correlation and sampling theorem are useful for analysis in the areas of linear systems and communication theory.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	1	-	-	-	-	-	-	1	-	-	-
CO2	3	2	-	2	1	-	-	-	-	-	-	1	-	1	-
CO3	2	1	-	-	-	-	-	-	-	-	-	1	-	1	-
CO4	3	3	-	2	1	-	-	-	2	-	-	2	-	3	-
CO5	2	1	-	2	1	-	-	-	1	-	-	1	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

UNIT-I INTRODUCTION TO SIGNALS

Definition of signals, Different types of signals, classification of signals, operations on signals, concepts of impulse function, Unit step function, Signum function, exponential and sinusoidal signals, Analogy between vectors and signals. Approximation of one signal to another signal.

UNIT-II REPRESENTATION OF SIGNALS USING FOURIER SERIES AND FOURIER TRANSFORMS

Representation of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Complex Fourier spectrum, Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, properties of Fourier transforms.

UNIT-III SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS

Classification of Systems, Transfer function of a LTI system. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and physical realization-The poly-wiener criterion.

UNIT-IV CONVOLUTION AND CORRELATION OF SIGNALS

Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Convolution properties of Fourier transforms. Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Properties of convolution, Relation between convolution and correlation.

UNIT-V LAPLACE TRANSFORMS

Review of Laplace transforms, Partial fraction expansion, Inverse Laplace transform, Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's relation between L.T. and F.T. of a signal.

UNIT-VI SAMPLING THEOREM AND Z-TRANSFORM

Fundamental difference between continuous and discrete time signals, discrete time signal representation using complex exponential and sinusoidal components, Concept of Z-Transform of a discrete sequence. Distinction between Laplace, Fourier and Z transforms. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z-transform, properties of Z-transforms.

TEXT BOOKS:

1. Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003.
2. Signals and Systems - *A V Oppenheim A S Willsky* With S Hamid *Nawab,* Publisher: Prentice Hall; *2nd*Edition, 2011

REFERENCE BOOKS:

1. Signals & Systems - Simon Haykin, Barry Van Veen, Signals and Systems, 2nd edition,
2. John iley & Sons, 2003.
3. Network Analysis - M.E. Van Valkenburg, PHI Publications, 3rd Edn., 2000.
4. Fundamentals of Signals and Systems Michel J. Robert, MGH International Edition, 2008.
5. Signals, Systems and Transforms - C. L. Philips, J.M.Parr and Eve A.Riskin, Pearson education.3rd Edition, 2004.

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(A0220206) POWER SYSTEM ANALYSIS

COURSE OBJECTIVE:

- To introduces formation of Y bus & Z bus of a transmission line.
- To give basic idea regarding power flow analysis by various power flow methods.
- To obtain the knowledge on power system network for various faults by short circuit analysis

COURSE OUTCOMES:

- To analyze the power flow study.
- To develop the power system network matrices.
- To summarize the load flow analysis for an electrical power system network and interpret the results of the analysis.
- To evaluate the both balanced and unbalanced fault currents.
- To understand the various types of various short circuit faults.
- To design power systems modals using MATLAB/Simulink.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	-	-	-	2	1	-	1	-	-	3
CO2	3	3	2	2	-	-	-	-	2	1	-	2	-	-	3
CO3	3	3	2	2	1	-	-	-	2	1	3	2	-	-	3
CO4	1	2	1	2	2	1	-	-	2	1	2	2	-	-	3
CO5	2	2	3	2	2	1	-	-	2	1	2	2	-	-	3
CO6	1	3	1	2	3	1	-	-	2	1	3	2	-	-	3

UNIT I SHORT CIRCUIT ANALYSIS-I

Per-Unit System of Representation - Per-Unit equivalent reactance network of a three phase Power System, Numerical Problems. Symmetrical Component Transformation, Positive, Negative and Zero sequence components. Symmetrical Component Theory: Sequence Networks: Positive, Negative and Zero sequence Networks, Numerical Problems.

UNIT II POWER SYSTEM NETWORK MATRICES-I

Graph Theory: Definitions, Bus Incidence Matrix, Ybus formation by Direct and Singular Transformation Methods, Numerical Problems on Ybus with mutual coupling (max size 3x3) and without mutual coupling.

UNIT III POWER SYSTEM NETWORK MATRICES-II

Formation of ZBus: Partial network, Algorithm for the Modification of ZBus Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses (Derivations and Numerical Problems).

UNIT IV POWER FLOW STUDIES-I

Necessity of Power Flow Studies – Derivation of Static load flow equations – Load flow solutions using Gauss Seidel Method: Acceleration Factor, Algorithm and Flowchart. Numerical Load flow Solution for Simple Power Systems (Max. 3-Buses): Determination of Bus Voltages, Injected Active and Reactive Powers (Sample One Iteration only) and finding Line Flows/Losses for the given Bus Voltages.

UNIT V POWER FLOW STUDIES-II

Newton Raphson Method in Rectangular & Polar Co-Ordinate Form: Load Flow Solution with and without PV Busses- Algorithm and Flowchart. Comparison of Different Methods

UNIT VI SHORT CIRCUIT ANALYSIS-II

Symmetrical fault Analysis: Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors, Numerical Problems. Unsymmetrical Fault Analysis: LG, LL, LLG faults with and without fault impedance, Numerical Problems.

TEXT BOOKS:

1. Modern Power system Analysis – by I.J.Nagrath & D.P.Kothari: Tata McGraw-Hill Publishing Company, 3rd edition, 2007.
2. Power System Analysis by Nagsarkar and Sukhija, OXFORD University Press, 2nd edition, 2014.
3. Power Systems Analysis (Si) by John J. Grainger, William D. Stevenson, Gary W. Chang 2016.
4. Power System Analysis and Design by J. Duncan Glover, Thomas Overbye, Mulukutla S. Sarma 2016.

REFERENCE BOOKS:

1. Computer Methods in Power Systems, Stagg El – Abiad & Stags, Mc Graw-hill Edition, 1968.
2. Computer Techniques in Power System Analysis by M A Pai, 3rd Edition, TMH, 2014.
3. Computer Techniques and Models in Power Systems by K. Uma Rao, I. K. International, 2nd edition, 2014.
4. https://nptel.ac.in/courses/117/105/117105140/

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(A0221206) POWER SYSTEM PROTECTION

COURSE OBJECTIVES:

- To discuss the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
- The study of different Circuit Breakers and Relays
- The protection of Generators and Transformers
- The protection of various feeder bus bars from abnormal conditions and over voltages & importance on Neutral grounding for overall protection.

COURSE OUTCOMES:

- List the concept of faults and arc quenching methods on the power system.
- Summarize the working of different protective devices and protection methods.
- Employ the different methods for the protection of power system components.
- Compare and contrast different protecting devices in the power system.
- Synthesize the different schemes to protect the power system components.
- Demonstrate the ability to conduct experiments in the Electrical Engineering Laboratory in accordance with Health and Safety Regulations and to record, interpret and report on the experimental results.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	1	-	-	-	-	-	1	2	-	-
CO2	3	3	2	-	-	1	-	-	-	-	-	2	-	-	2
CO3	3	3	2	-	-	1	-	-	-	-	-	2	-	-	2
CO4	3	2	-	-	-	1	-	-	-	-	-	1	-	-	2
CO5	2	3	1	-	-	-	-	-	-	-	-	-	2	-	-
CO6	1	-	2	-	-	-	-	-	-	-	-	1	-	-	-

UNIT I ELECTROMAGNETIC RELAYS

Basic Requirements of Relays – Primary and Backup protection - Construction details of – Attracted armature, balanced beam, solenoid type, induction type-induction disc & induction cup

Relay classification: Over current relays & types- differential relays – Directional power relay and directional overcurrent relay and Distance relays- Universal Torque equation.

UNIT II STATIC RELAYS

Static Relays – Advantages and Disadvantages – block diagram of static relay-static over current relays(block diagram)-Definite time, Inverse and directional static relays – Comparators –Amplitude and Phase comparators- Duality between Amplitude and Phase Comparator, Static amplitude comparator-integrating and instantaneous comparators, static phase comparators-coincidence type of phase comparator-phase splitting type, integrating type, time bias type.

UNIT III CIRCUIT BREAKERS

Circuit Breakers: Elementary principles of arc interruption, arc voltage, Restriking Voltage and Recovery voltages - Restriking Phenomenon, Average and Max. RRRV, Numerical Problems - Current Chopping and Resistance Switching - CB ratings and Specifications: Types and Numerical Problems. – Auto reclosures.

Description and Operation of following types of circuit breakers: Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum and SF6 circuit breakers.

UNIT IV GENERATOR & TRANSFORMER PROTECTION

Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on % Winding Unprotected

Protection of transformers: Percentage Differential Protection- Numerical Problem on Design of CT s Ratio-Buchholtz relay Protection.

UNIT V PROTECTION OF FEEDERS, TRANSMISSION LINES & BUS-BARS

Requirements of line protection, Protection of Feeder (Radial, Parallel & Ring main) using over current Relays Protection of Transmission line-differential protection- voltage balance protection, translay protection – 3 Zone protection using Distance Relays - Carrier current protection- phase comparison carrier current protection.

Protection of Bus bars: Need of bus bar protection-busbar fault– Differential protection-high impedance relay scheme-frame leakage protection.

UNIT VI NEUTRAL GROUNDING & PROTECTION AGAINST OVER VOLTAGES

Ungrounded & grounded neutral systems-merits of neutral grounded systems-distinguish between equipment grounding & neutral grounding-methods of neutral grounding-Solid, Resistance, Reactance and Resonance Grounding-problems on Peterson coil grounding - Generation of Over Voltages in Power Systems-Lightning discharge -Protection against Lightning Over Voltages: Earthing screen- Overhead ground wire method- Lightning arrestor - Valve type and Zinc-Oxide Lighting Arresters.

TEXT BOOKS:

1. Switchgear and Protection – by Sunil S Rao, Khanna Publishers, 13th edition 2008.
2. Power System Protection and Switchgear by Badari Ram, D.N Viswakarma, TMH Publications, 2nd Edition, 2011.
3. Fundamentals of Power System Protection by Y. G. Paithankar and S. R. Bhide, PHI, 2nd edition 2003.

REFERENCE BOOKS:

1. Electrical Power Systems – by C.L. Wadhwa, New Age international (P) Limited, Publishers, 7th edition 2016.
2. Electrical power System Protection by C. Christopoulos and A. Wright, Springer International Edition, 2nd edition, 1999.
3. https://nptel.ac.in/courses/108/101/108101039/

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(A0420206) EMBEDDED CONTROLLERS
(Professional Elective-II)

COURSE OBJECTIVES:
- Understand need of microprocessors and microcontrollers in development of various projects.
- To know complete architectural, programming, interfacing details of 8085, 8086 microprocessors and 8051 microcontroller.

COURSE OUTCOMES:
- Learn and understand the instruction set of 8086 and 8051.
- Develop skill in simple assembly program writing for 8086, 8051 and applications.
- Learn and understand concept of interfacing of peripheral devices and their applications.
- Ability to learn Microprocessor and Microcontroller Architecture.
- Understand & design of microprocessors and microcontrollers based systems (small).

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	-	-	-	-	-	2	-	2	-	-
CO2	2	-	3	1	2	1	-	-	-	-	2	-	2	-	-
CO3	2	-	3	2	2	1	-	-	-	-	2	-	2	-	-
CO4	2	-	2	-	2	-	-	-	-	-	2	-	2	-	-
CO5	2	-	3	2	2	-	-	-	-	-	2	-	2	-	-

UNIT I INTRODUCTION-8086
Architecture-Block Diagram, Register Organization, Flag Register, Pin Diagram, Signal descriptions of 8086-common function signals, System Timing Diagrams, Memory Segmentation, Interrupt structure of 8086 and Interrupt Vector Table. Memory organization and memory banks accessing.

UNIT II INSTRUCTION FORMATS
Addressing Modes, Instruction Set of 8086, Assembler Directives, Macros and Procedures with sample programs based on Sorting, Multiplication, Division and multi byte arithmetic code conversion, String Manipulation instructions and Simple ALPs.

UNIT-III INTRODUCTION TO EMBEDDED SYSTEMS
Introduction, embedded controller, concept of microcontroller, comparison of microprocessor and microcontroller, Intel 8051 microcontroller architecture, pin diagram, special function registers, external memory interface with 8051, operation of I/O ports.

UNIT-IV INSTRUCTION SET OF 8051
Data exchange, byte level logical operations, bit level logical operations, rotate and swap operations, instruction affecting flags, incrementing, decrementing, arithmetic operations, jump and recall instruction, assembly language programming of 8051 Calls and subroutines, interrupts and returns

UNIT-V COUNTERS AND TIMERS IN 8051
Counters and timers in 8051, timer modes, Serial data input, output , serial data modes, interrupts, timer flag interrupt, serial port interrupt, external interrupts, software generated interrupt control, Addressing modes, external data moves, code memory, read only data moves. Push and Pop.

UNIT-VI 8051 MICRO CONTROLLER USING EMBEDDED C

Introduction to Embedded Systems-Installation of Keil IDE-Input and Output interfaces-Few programs on LEDs-Few programs on interfaces-Interfacing with DC Motor and Relays.

TEXT BOOKS:

1. Advanced microprocessor and peripherals by A.K. Ray and K.M.Bhurchandi, McGraw-Hill Education, 2000, 2nd Edition.
2. 8051 microcontroller and embedded systems by Mazidi Muhammad Ali, Pearson Education India, 2000, 2nd Edition.

REFERENCES:

1. Microprocessors and Interfacing: Programming and Hardware by Douglas V. Hall, Revised 2nd edition, 2007.
2. The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications by Walter A. Triebel, Avtar Singh, Pearson, 2003, 4th Edition.
3. 8051 Microcontroller: Internals, Instructions, Programming and Interfacing by Subrata Ghoshal, Pearson, 2010, 1st Edition.

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(A0222206) POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS
(Professional Elective-II)

COURSE OBJECTIVES:
- To provide knowledge about the stand alone and grid connected renewable energy systems.
- To equip with required skills to derive the criteria for the design of power converters for renewable energy applications.
- To analyse and comprehend the various operating modes of wind electrical generators and solar energy systems.
- To design different power converters namely AC to DC, DC to DC and AC to AC converters for renewable energy systems.
- To develop maximum power point tracking algorithms.

COURSE OUTCOMES:
After completion of this course, the student will be able to:
- Analyze the impacts of renewable energy generation on environment.
- Understand the importance and qualitative analysis of solar and wind energy sources.
- Apply the principle of operation of electrical machines for wind energy conversion and their performance characteristics.
- Design suitable power converters for solar PV and wind energy systems.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	-	-	-	-	-	2	2	3	-	-
CO2	3	3	2	2	2	-	-	-	-	-	2	1	3	-	-
CO3	2	3	1	2	1	-	-	-	2	-	2	-	3	-	-
CO4	2	2	1	2	2	-	-	-	2	-	2	1	3	-	-

UNIT I INTRODUCTION
Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

UNIT II ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION
Reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

UNIT III POWER ELECTRONICS FOR SOLAR
Block diagram of solar photo voltaic system: line commutated converters (inversion-mode) - Boost and buck-boost converters-selection of inverter, battery sizing, array sizing- standalone PV systems - Grid tied and grid interactive inverters- grid connection issues.

UNIT IV POWER ELECTRONICS FOR WIND
Three phase AC voltage controllers-AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, matrix converters- Stand-alone operation of fixed and variable speed wind energy conversion systems- Grid connection Issues -Grid integrated PMSG and SCIG Based WECS.

UNIT V ANALYSIS OF WIND AND PV SYSTEMS
Stand-alone operation of fixed and variable speed wind energy conversion systems and solar system- Grid connection Issues -Grid integrated PMSG, SCIG Based WECS, grid Integrated

solar system.

UNIT VI HYBRID RENEWABLE ENERGY SYSTEMS

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT).

TEXT BOOK:

1. S. N. Bhadra, D.Kastha, S.Banerjee, "Wind Electrical Systems", Oxford University Press, 2005.
2. B.H.Khan Non-conventional Energy sources Tata McGraw-hill Publishing Company, New Delhi, 2009.
3. Mukund R Patel, "Wind and Solar Power Systems", CRC Press, 1stEdition, 1999.
4. SN Bhadra, D. Kastha, S. Banerjee, "wind electrical systems", OXFORD higher education, 2018

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AUTONOMOUS
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

III B.Tech. II-Sem (EEE)

L	T	C
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(A0421206) VLSI DESIGN
(Professional Elective-II)
For branches: EEE & ECE

COURSE OBJECTIVES:
- In this course, the MOS circuit realization of the various building blocks that is common to any microprocessor or digital VLSI circuit is studied.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed.
- The main focus in this course is on the transistor circuit level design and realization for digital operation and the issues involved as well as the topics covered are quite distinct from those encountered in courses on CMOS Analog IC design.

COURSE OUTCOMES:
- Realize the concepts of digital building blocks using MOS transistor.
- Design combinational MOS circuits and power strategies.
- Design and construct Sequential Circuits and Timing systems.
- Design arithmetic building blocks and memory subsystems.
- Apply and implement FPGA design flow and testing.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	-	-	-	-	-	2	-	2	-	-
CO2	2	-	3	1	2	1	-	-	-	-	3	-	2	-	-
CO3	2	-	3	2	3	1	-	-	-	-	2	-	2	-	-
CO4	3	-	2	-	2	-	-	-	-	-	2	-	2	-	-
CO5	2	-	3	2	2	-	-	-	-	-	3	-	2	-	-

UNIT I MOS TRANSISTOR PRINCIPLE
NMOS and PMOS transistors, Process parameters for MOS and CMOS, Electrical properties of CMOS circuits and device modeling, Scaling principles and fundamental limits, CMOS inverter scaling, propagation delays, Stick diagram, Layout diagrams

UNIT II COMBINATIONAL LOGIC CIRCUITS
Examples of Combinational Logic Design, Elmore's constant, Pass transistor Logic, Transmission gates, static and dynamic CMOS design, Power dissipation – Low power design principles

UNIT III SEQUENTIAL LOGIC CIRCUITS
Static and Dynamic Latches and Registers, Timing issues, pipelines, clock strategies, Memory architecture and memory control circuits, Low power memory circuits, Synchronous and Asynchronous design

UNIT IV DESIGNING ARITHMETIC BUILDING BLOCKS
Data path circuits, Architectures for ripple carry adders, carry look ahead adders, High speed adders, accumulators, Multipliers, dividers, Barrel shifters, speed and area tradeoff

UNIT V IMPLEMENTATION STRATEGIES
Full custom and Semi-custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures.

UNIT VI Testing in VLSI
Defects, Fault Models, Path Sensitization, Scan, Built-in-self Test (BIST), IDDQ

TEXTBOOKS:

1. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, "Digital Integrated Circuits: A Design Perspective", Second Edition, Prentice Hall of India, 2003.
2. M.J. Smith, "Application Specific Integrated Circuits", Addisson Wesley, 1997

REFERENCES:

1. N.Weste, K.Eshraghian, "Principles of CMOS VLSI Design", Second Edition, Addision Wesley 1993
2. R.Jacob Baker, Harry W.LI., David E.Boyee, "CMOS Circuit Design, Layout and Simulation", Prentice Hall of India 2005
3. A.Pucknell, Kamran Eshraghian, "BASIC VLSI Design", Third Edition, Prentice Hall of India, 2007.

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III B.Tech., II-Sem (EEE)

L	T	C
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(A0223206) HIGH VOLTAGE DIRECT CURRENT TRANSMISSION
(Open Elective-II)

COURSE OBJECTIVE:
- This subject deals with the importance of HVDC transmission, analysis of HVDC converters, Faults and protections, Harmonics and Filters.

COURSE OUTCOMES:
- To understand the economic aspects of Transmission System
- To analyze the usage of HVDC convertors
- To understand the working of convertors and its control in HVDC system.
- To understand the reactive power control and alternate control strategies using shunt capacitors and synchronous condensers.
- To analyze the convertor faults and protection using filters, surge arrestors and smoothing reactors.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	-	-	-	-	-	-	-	-	-	-	-	2
CO2	2	3	2	2	-	-	-	-	-	-	-	-	-	-	2
CO3	2	3	2	2	-	-	-	-	-	-	-	-	-	-	2
CO4	2	3	2	-	-	-	-	-	-	-	-	-	-	-	2
CO5	2	3	2	-	-	-	-	-	-	-	-	-	-	-	2

UNIT I BASIC CONCEPTS
Economics & Terminal equipment of HVDC transmission systems: Types of HVDC Links – Apparatus required for HVDC Systems – Comparison of AC &DC Transmission, Application of DC Transmission System – Planning & Modern trends in D.C. Transmission.

UNIT II ANALYSIS OF HVDC CONVERTERS
Choice of Converter configuration – analysis of Graetz – characteristics of 6 Pulse & 12 Pulse converters – Cases of two 3 phase converters in star –star mode – their performance

UNIT III CONVERTER & HVDC SYSTEM CONTROL
Principal of DC Link Control – Converters Control Characteristics – Firing angle control – Current and extinction angle control – Effect of source inductance on the system; Starting and stopping of DC link; Power Control.

UNIT IV REACTIVE POWER CONTROL IN HVDC
Reactive Power Requirements in steady state-Conventional control strategies-Alternate control strategies-sources of reactive power-AC Filters – shunt capacitors-synchronous condensers.

UNIT V CONVERTER FAULT & PROTECTION
Converter faults – protection against over current and over voltage in converter station – surge arresters – smoothing reactors – DC breakers –Audible noise-space charge field-corona effects on DC lines-Radio interference.

UNIT VI HARMONICS& FILTERS
Generation of Harmonics –Characteristics harmonics, calculation of AC Harmonics, Non Characteristics harmonics, adverse effects of harmonics – Calculation of voltage & Current harmonics – Effect of Pulse number on harmonics -Types of AC filters, Design of Single tuned filters –Design of High pass filters.

TEXT BOOKS:

1. HVDC Power Transmission Systems: Technology and system Interactions – by K.R.Padiyar, New Age International (P) Limited, and Publishers.
2. EHVAC and HVDC Transmission Engineering and Practice – S. Rao.

REFERENCE BOOKS:

1. HVDC Transmission – J.Arrillaga.
2. Direct Current Transmission – by E.W.Kimbark, John Wiley & Sons.
3. Power Transmission by Direct Current – by E.Uhlmann, B.S.Publications.

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III B.Tech., II-Sem (EEE)

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(A0224206) HIGH VOLTAGE ENGINEERING
(Open Elective-II)

COURSE OBJECTIVE:
- This subject deals with the detailed analysis of Breakdown occur in gaseous, liquids and solid dielectrics.
- Information about generation and measurement of High voltage and current. In addition the High voltage testing methods are also discussed.

COURSE OUTCOMES:
- To introduce High Voltage technologies and applications.
- To analyze the breakdown in solid, gases and liquid dielectrics.
- To understand the generation and measurement of high voltages and currents.
- To coordinate over voltage phenomenon and insulation.
- To improve the testing skills in the field of high voltage electrical operators.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	-	-	-	-	-	-	-	-	-	-	-	2
CO2	2	3	2	2	-	-	-	-	-	-	-	-	-	-	2
CO3	2	3	2	2	-	-	-	-	-	-	-	-	-	-	2
CO4	2	3	2	-	-	-	-	-	-	-	-	-	-	-	2
CO5	2	3	2	-	-	-	-	-	-	-	-	-	-	-	2

UNIT I INTRODUCTION TO HIGH VOLTAGE TECHNOLOGY AND APPLICATIONS

Electric Field Stresses, Gas / Vacuum as Insulator, Liquid Dielectrics, Solids and Composites, Estimation and Control of Electric Stress, Numerical methods for electric field computation, Surge voltages, their distribution and control, Applications of insulating materials in transformers, rotating machines, circuit breakers, cable power capacitors and bushings.

UNIT II BREAK DOWN IN SOLID, GASEOUS AND LIQUID DIELECTRICS

Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, Breakdown in composite dielectrics, solid dielectrics used in practice
Gases as insulating media, collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's law - Liquid as Insulator, pure and commercial liquids, breakdown in pure and commercial liquids

UNIT III GENERATION& MEASUREMENT OF HIGH VOLTAGES AND CURRENTS

Generation of High Direct Current Voltages, Generation of High alternating voltages, Generation of Impulse Voltages, Generation of Impulse currents, Tripping and control of impulse generators. Measurement of High Direct Current voltages, Measurement of High Voltages alternating and impulse, Measurement of High Currents-direct, alternating and Impulse, Oscilloscope for impulse voltage and current measurements

UNIT IV OVER VOLTAGE PHENOMENON AND INSULATION CO-ORDINATION

Natural causes for over voltages – Lightning phenomenon, Overvoltage due to switching surges, system faults and other abnormal conditions, Principles of Insulation Coordination on High voltage and Extra High Voltage power systems.

UNIT V NON-DISTRUCTIVE TESTING OF MATERIAL AND ELECTRICAL APPARATUS

Measurement of D.C Resistivity, Measurement of Dielectric Constant and loss factor, Partial discharge measurements

UNIT VI HIGH VOLTAGE TESTING OF ELECTRICAL APPARATUS

Testing of Insulators and bushings, Testing of Isolators and circuit breakers, testing of cables, Testing of Transformers, Testing of Surge Arresters, Radio Interference measurements

TEXT BOOKS:

1. High Voltage Engineering by M.S.Naidu and V. Kamaraju – TMH Publications.
2. High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl, J.Kuffel by Elsevier.

REFERENCE BOOKS:

1. High Voltage Engineering by C.L.Wadhwa, New Age Internationals (P) Limited.
2. High Voltage Insulation Engineering by Ravindra Arora, Wolfgang Mosch, New Age International (P) Limited.

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(A0507203) DATABASE MANAGEMENT SYSTEMS
(Open Elective-II)
For branches: EEE, ECE, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:
- Advantages applications of DBMS and Database system structure.
- Schema design: ER model and conceptual design.
- Relational Model, Formal Query Languages and SQL basis.
- Storage and efficient retrieval of data: various indexing techniques.
- Schema refinement: normalization and redundancy removal and functional dependant.
- Transaction management: locking protocols, serializability concepts etc.

COURSE OUTCOMES:
- Understand the basic concepts of database and various data model used in database design and ER modelling concepts and architecture.
- Use different integrity constraints in defining database objects
- understand and apply their knowledge in solving procedural and non-procedural language queries
- Create good relational schema by applying normalization methodologies
- Determine the significance of concurrency control mechanism in transaction
- Illustration of various File organization techniques and different storage mediums.

MAPPING OF COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3		1							1	2		
CO2	3	2		3								1	1	2	2
CO3	2	2	2		2					1	2	1	1	2	
CO4	1	2		2	2							1	2		1
CO5	1	2	2									1	1	1	1

UNIT I
Database System Applications, database System VS file System – View of Data – Data Abstraction –Instances and Schemas – data Models – the ER Model – Relational Model – Database Languages – DDL – DML – Database Access for applications Programs – Database Users and Administrator – Transaction Management – Database System Structure – Storage Manager – the Query Processor- Data base design and ER diagrams – Beyond ER Design- Entities, Attributes and Entity sets – Relationships and Relationship sets – Additional features of ER Model – Conceptual Design with the ER Model.

UNIT II
Introduction to the Relational Model – Integrity Constraint Over relations – Enforcing Integrity constraints – Querying relational data – Logical database Design – Introduction to Views – Destroying /altering Tables and Views. Relational Algebra – Selection and projection set operations – renaming – Joins – Division – Examples of Algebra queries – Relational calculus – Tuple relational Calculus – Domain relational calculus.

UNIT III
The Form of a Basic SQL Query – Examples of Basic SQL Queries – Introduction to Nested Queries – Correlated Nested Queries, Set – Comparison Operators – Aggregate Operators – NULL values – Comparison using Null values – Logical connectivity's – AND, OR and NOT – Impact on SQL Constructs – Outer Joins – Disallowing NULL values – Complex Integrity Constraints in SQL, Triggers and Active Data bases.

UNIT IV

Schema refinement – Problems Caused by redundancy – Decompositions – Problems related to decomposition – Functional dependencies-reasoning about FDS – FIRST, SECOND, THIRD Normal forms – BCNF – Lossless join Decomposition – Dependency preserving Decomposition – Schema refinement in Data base Design – Multi valued Dependencies – FORTH Normal Form.

UNIT V

Overview Of Transaction Management: The ACID Properties, Transactions and Schedules, Concurrent Execution of transactions-Lock Based Concurrency Control, Performance of Locking, Transaction Support in SQL.

Concurrency Control: 2PL, Serializability and recoverability, Introduction Lock Management, Lock Conversions, Dealing with Deadlocks, Concurrency control without locking.

UNIT VI

Data on External Storage – File Organizations and Indexing – Cluster Indexes, Primary and Secondary Indexes – Index data Structures – Hash Based Indexing – Tree base Indexing – Comparison of File Organizations – The Memory Hierarchy, RAID, Disk Space Management, Buffer Manager, Files of Records, Page Formats, record Formats.

TEXT BOOKS:

1. Data base Management Systems, Raghu Ramakrishna, Johannes Gehrke, TATA McGraw Hill 3rd Edition 2017
2. Data base System Concepts, Silberschatz, Korth, McGraw hill, 6 edition, 2013.

REFERENCES:

1. Data base Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 11th Edition, 2016.
2. Fundamentals of Database Systems, ElmasriNavathe Pearson Education.
3. Introduction to Database Systems, C.J.Date Pearson Education.
4. https://www.oreilly.com/library/view/concepts-of-database/9789332537422/xhtml/bibliography.xhtml
5. https://en.wikipedia.org/wiki/Database
6. https://www.sanfoundry.com/best-reference-books-database-management-systems/

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III B.Tech., II-Sem (EEE)

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(A0422206) ARDUINO PROGRAMMING
(Skill Development Course)

COURSE OBJECTIVES:
- To Learn the Arduino programming language and IDE.
- To learn how to prototype circuits with Arduino UNO.
- To learn how to Program the Arduino board to make the circuits work for any given application.

COURSE OUTCOMES:
- Understand basics of Arduino programming and various types of functions libraries.
- Understand how to interface Arduino to various sensors and actuators.
- Gains Knowledge of interfacing various sensors and actuators.
- Able to Integrate hardware and software for embedded system for any given application

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		1									1	3		1
CO2												1			
CO3		1	2	1	1							2	1	2	2
CO4			3												
CO5		2	3	1	1							2	3	3	2

UNIT I Embedded System design
Basics, Introduction to embedded systems, Components of embedded system, Advantages and applications of embedded systems, Examples of real time embedded systems and how they are manufactured industry ready, Different Microcontroller Architectures (CISC, RISC, and ARISC), Internal Resources & Hardware Chips in Details, History of AVR Microcontrollers and Features.

UNIT II Learning Arduino Platform
Arduino Overview, **Introduction** to Arduino, Arduino History and Family, Features, Board Types, Arduino Uno board Description, Arduino Program Structure, Data Types, Variables & Constants, Operators, Control Statements , Loops, Functions, Strings , Time, Arrays.

UNIT III Arduino Function Libraries
Arduino I/O functions, Advanced I/O Functions, Character functions, Math Library, Trigonometric Functions.

UNIT IV Learning Arduino Platform
Blinking Led, Fading Led, Reading Analog voltage, Led Bar Graph, Switches, Seven Segment Display, Multi Segment Displays, Relays (AC Appliance Control), LCD, Buzzer, DC motor, Stepper Motor.

UNIT V The basic sensors and actuators using Arduino
Introduction to sensors and actuators; How to connect and work with different sensors, such as IR Sensor, Ultrasonic Sensor, Humidity, PIR Sensor, Water Detector Sensor, Accelerometer, Sound, Light Distance, Pressure etc., to ARDUINO Board, Reading various sensor data on serial monitor and LCD Display.

UNIT VI Project Based on Embedded System Design Using Arduino board
ARDUINO based home automation, ARDUINO Based Solar Street Light system, ARDUINO Based Alarm Clock, ARDUINO Based Car Parking System, etc.

BOOKS/REFERENCES:

1) Arduino-Based Embedded Systems: By Rajesh Singh, Anita Gehlot, Bhupendra Singh, and Sushabhan Choudhury.
2) Arduino Cookbook by Michael Margolis, O'Reilly Media, Inc., 1st edition.
3) Arduino Made Simple by Ashwin Pajankar
4) https: //www.arduino.cc/en/Tutorial/HomePage
5) Arduino for beginners: Essential Skills Every Maker Needs, John Baichtal, Person Education, Inc

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(A0022203) CONSTITUTION OF INDIA

(Mandatory Learning Course)

For branches: CE, EEE, ME, ECE, CSE, CSE(DS) & CSE&BS

COURSE OBJECTIVES:

- To study the structure and composition of Indian Constitution
- To learn about the federalism in the Indian context.
- To Study the Panchayati Raj Institutions as a medium of decentralization
- To learn about the three organs of the state in the contemporary scenario.

COURSE OUTCOMES:

At the end of this course the students are able to;

- Understand historical background of the constitutional making and its importance for building a democratic India.
- Be aware of the History, features of Indian constitution, the role Governor and Chief Minister, role of state election commission, the decentralization of power between central, state and local self-government.
- Aware of Indian government, the structure of state government, the local Administration.
- Able to evaluate Preamble, Fundamental Rights and Duties, Zilla Panchayat, block level organization, various commissions.

UNIT I

History of Indian Constitution: History of Making of the Indian Constitution - History Drafting Committee - Composition & Working of Constitution.

UNIT II

Philosophy of the Indian Constitution: Preamble Salient Features of Indian Constitution.

UNIT III

Contours of Constitutional Rights & Duties: Fundamental Rights: Right to Equality - Right to Freedom - Right against Exploitation - Right to Freedom of Religion - Cultural and Educational Rights - Right to Constitutional Remedies - Directive Principles of State Policy.

UNIT IV

Organs of Governance: Parliament - Composition - Qualifications and Disqualifications Powers and Functions of Executive - President - Governor - Council of Ministers – Judiciary – Qualifications, Appointment and Transfer of Judges.

UNIT V

Local Administration: Role and Importance of Municipal Corporation Role and Importance Pachayati raj: Role and Importance Zilla Pachayat: Position and role - Village level: Role of Elected and Appointed officials - Importance of grass root democracy.

UNIT VI

Election Commission: Role and Functioning of Election Commission Role and Functioning of Chief Election Commissioner and Election Commissioners - Role and Functioning of State Election Commission.

TEXT BOOKS

1) Introduction to Constitution of India, D.D. Basu, Lexis Nexus
2) The Constitution of India, PM Bhakshi, Universal Law

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III B.Tech., II-Sem (EEE)

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(A0298206) POWER ELECTRONICS LAB

COURSE OBJECTIVES:

- This course is intended to acquire practical knowledge about the operation of various power converters.
- To understand the basics of triggering circuits required for various power converters.

COURSE OUTCOMES:

- To get Laboratory knowledge on basic power electronics circuits for control and conversion of electrical power.
- To familiarize the students by introducing modern engineering simulation tools like P-Sim, MATLAB and help them to simulate and analyses of different power Converters.
- To understand analysis and design of power electronics converters including AC-DC, DC-AC, and DC-DC through simulation.
- To understand the operating characteristics of different converters, regulators and inverters.
- To evaluate the performance factors of different converters practically.
- To verify the performance of different converters and inverters using software tool.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	2	1	1	1	-	-	3	2	2	1	3	-	-
CO2	3	2	3	1	-	-	-	-	2	1	1	1	3	-	-
CO3	3	2	3	1	-	-	-	-	2	1	1	1	3	-	-
CO4	2	3	3	2	-	-	-	-	3	2	3	1	3	-	-
CO5	2	3	3	2	-	-	-	-	3	2	3	1	3	-	-
CO6	3	2	1	1	3	1	-	-	2	1	2	2	3	-	-

CHOOSE ANY TEN EXPERIMENTS IN THE FOLLOWING LIST

1. Single Phase Half-wave converter with R and RL load.
2. Single Phase Fully controlled bridge converter with R and RL load.
3. Single Phase Half controlled converter with R and RL load.
4. Single Phase Dual converter with RL load
5. Single Phase AC Voltage Controller with R and RL Load.
6. Single Phase Cyclo-converter with R and RL Load.
7. Three Phase Fully controlled bridge converter with R and RL load.
8. Three Phase Half controlled bridge converter with R and RL load.
9. Step down Chopper with R and RL load
10. Step up Chopper with R and RL load.
11. Single Phase full bridge Inverter with R and RL load.
12. Three Phase Inverter with 180^0 conduction mode.
13. Three Phase Inverter with 120^0 conduction mode.
14. Speed control of DC Motor using first quadrants Chopper.
15. Speed control of DC Motor using four quadrants Chopper.
16. Simulation of step-down chopper.
17. Simulation of step-up chopper.
18. Simulation of single-phase full bridge inviter by using PWM control.
19. Simulation of three phase inverter.
20. With 180º Conduction mode
21. With 120º Conduction mode.
22. Simulation of three phase inverter by using PWM control.

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(A0499206) EMBEDDED CONTROLLERS LAB

COURSE OBJECTIVES:

- To enhance the programming skills of students.
- To drive the students in understanding the instruction sets of 8086, 8051 and TASM.
- To learn the programming for applications such as stepper motor, traffic light controller, LAC and ALC etc.

COURSE OUTCOMES:

- To familiarize with developing of assembly level programs and providing the basics of the processors.
- To provide a theoretical & practical introduction to microcontrollers and microprocessors, assembly language programming techniques.
- To understand programmable peripheral devices and their Interfacing.
- An in-depth knowledge of applying the concepts on real- time applications.
- Becomes skilled in various 8086 Instruction set and Assembler Directives.
- Design of hardware interfacing circuit, using Embedded C for microcontroller and under design considerations.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	-	-	-	2	2	1	-	2	-	-
CO2	3	2	2	-	1	2	-	-	1	1	-	-	2	-	-
CO3	3	2	3	1	1	-	-	-	1	1	-	-	2	-	-
CO4	2	3	2	1	1	-	-	1	1	1	-	-	2	-	-
CO5	2	3	1	2	1	-	-	1	1	2	-	1	2	-	-
CO6	3	2	1	1	2	2	-	-	2	1	-	-	2	-	-

EXPERIMENTS ON MICROPROCESSOR 8086 KITS:-

Introduction 8086

1. Arithmetic operations of 8-bit and 16-bit numbers
2. Finding of largest number in a given array
3. Finding of smallest number in a given array
4. Finding out of number of even and odd numbers
5. finding out of number of positive and negative numbers
6. Sum of square of N-numbers
7. Sorting of given numbers
8. Fibonacci series
9. Factorial of a given number
10. Decimal to Hex and Hex to decimal Conversion.

EXPERIMENTS ON COMPUTER SYSTEM:-

1. Introduction to TASM
2. Arithmetic operations of 8-bit and numbers-
3. Finding of largest and smallest number in a given array
4. Finding of smallest number in a given array
5. Finding out number of even and odd numbers
6. Finding out number of positive and negative numbers
7. Sorting of given numbers.
8. Binary addition of given two numbers

EMBEDDED 'C' - INTERFACING USING 8051

1. Introduction
2. LED Controlling
3. LCD Interfacing
4. Interfacing with DC Motor and Relays
5. TIMER concepts
6. TIMER as Counter
7. Stepper Motor Interfacing

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(A0299206) POWER SYSTEMS LAB

COURSE OBJECTIVES:

- The knowledge of electrical fault condition is required to deploy proper different protective relays in different locations of electrical equipment.

COURSE OUTCOMES:

- To analyze the experiment results according to relevant theory.
- To Examine protection of Power System with various Protective relays.
- To Review sequence impedances of 3 Phase Alternators and 3 Phase Transformers.
- To understand the principle of Protective Schemes and Various faults in the power system scenario.
- To understand the behavior and characteristics of different equipment's.
- Verification of theoretical concepts through experimentation.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	1	-	-	-	1	-	1	2	-	-	3
CO2	3	3	1	-	1	-	-	-	1	-	2	2	-	-	3
CO3	3	3	1	-	1	-	-	-	1	-	2	2	-	-	3
CO4	3	3	1	-	1	-	-	-	1	-	1	2	-	-	3
CO5	2	2	1	-		-	-	-	1	-	-	1	-	-	3
CO6	3	3	1	-	1	-	-	-	2	-	-	1	-	-	3

LIST OF EXPERIMENTS:

1. Determination of +ve, -ve and zero sequence impedances of three phase alternator.
2. Determination of +ve, -ve and zero sequence impedances of three phase transformer.
3. Equivalent circuit of a three phase three winding transformer.
4. Fault Analysis(LG, LLG) on a three phase unloaded alternator
5. Fault Analysis(LL, LLLG) on a three phase unloaded alternator
6. IDMT over current relay
7. Directional over current relay
8. Inverse over current relay
9. % Differential relay
10. Solid and Liquid Insulation Tests
11. Earth resistance measurement
12. Capacitance grading method

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(A0228207) POWER SEMICONDUCTOR DRIVES
(Professional Elective-III)

COURSE OBJECTIVES
- This course is an extension of Power Electronics applications to AC and DC drives.
- Control of DC motor drives with single phase and three phase converters and choppers are given in detail.
- The control of AC motor drives with variable frequency converters and variable voltage are presented.

COURSE OUTCOMES:
- Acquire the knowledge of power electronics converters and their control to drive different AC and DC machines.
- Analyze the working operation and solution to numerical problems of the drives and machines.
- Understand the characteristics and waveforms related to output voltage of power electronic converters and speed control of machines.
- Apply the acquired knowledge in implementation and choosing of power electronic converters to their relevant motors.
- Able to design the appropriate converter power ratings which are suitable to the industries.
- Inherent to the usage of simulation tools in power electronics and drives.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	-	-	-	-	2	-	2	-	2	3	-
CO2	3	3	2	2	-	-	-	-	3	-	2	-	2	3	-
CO3	3	3	2	2	-	-	-	-	3	-	2	-	2	3	-
CO4	3	3	2	1	-	-	-	-	2	-	2	-	2	3	-
CO5	2	3	2	-	-	-	-	-	1	--	2	-	2	3	-
CO6	1	3	1	-	-	-	-	-	-	-	2	-	2	3	-

UNIT I CONTROL OF DC MOTORS BY 1-Φ CONVERTERS & 3-Φ CONVERTERS
Introduction to Thyristor controlled Drives, Single Phase Fully controlled converters connected to DC separately excited and DC series motors – continuous current operation – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque Characteristics- Problems on Converter fed DC motors.

Three phase fully controlled converters connected to DC separately excited and DC series motors – continuous current operation -output voltage and current waveforms – Speed and Torque expressions – Speed – Torque characteristics – Problems.

UNIT II FOUR QUADRANT OPERATION OF DC DRIVES
Introduction to Four quadrant operation – Motoring operations, Electric Braking – Plugging, Dynamic and Regenerative Braking operations - Four quadrant operation of DC motors by dual converters – Closed loop operation of DC motor (Block Diagram Only).

UNIT III CONTROL OF DC MOTORS BY CHOPPERS
Single quadrant, Two –quadrant and four quadrant chopper fed DC separately excited and series excited motors – Continuous current operation – Output voltage and current wave forms – Speed torque expressions – speed torque characteristics – Problems on Chopper fed DC Motors – Closed Loop operation (Block Diagram Only).

UNIT IV CONTROL OF INDUCTION MOTOR FROM STATOR SIDE

Variable voltage characteristics-Control of Induction Motor by Ac Voltage Controllers – Waveforms – speed torque characteristics. Variable frequency characteristics-Variable frequency control of induction motor by Voltage source and current source inverter and cyclo converters- PWM control – Comparison of VSI and CSI operations – Speed torque characteristics – numerical problems on induction motor drives – Closed loop operation of induction motor drives (Block Diagram Only)

UNIT V CONTROL OF INDUCTION MOTOR FROM ROTOR SIDE

Static rotor resistance control – Slip power recovery – Static Scherbius drive – Static Kramer Drive – their performance and speed torque characteristics – advantages - applications – problems

UNIT VI CONTROL OF SYNCHRONOUS MOTORS

Separate control &self-control of synchronous motors – Operation of self-controlled synchronous motors by VSI and CSI cycloconverters. Load commutated CSI fed Synchronous Motor – Operation – Waveforms – speed torque characteristics – Applications – Advantages and Numerical Problems.

TEXT BOOKS:

1. Fundamentals of Electric Drives – G K Dubey Narosa Publications, 2002
2. Power Electronic Circuits, Devices and applications -M. H. Rashid, Pearson, 2014.

REFERENCE BOOKS:

1. Power semiconductor controlled drives – G K Dubey, Simon & Schuster, 1993.
2. Power semiconductor drives - S.B.Dewan, Gordon R.Slemon, A.Straughen, Wiley, 1984.
3. Modern Power Electronics and AC Drives -B. K. Bose, Prentice Hall PTR, 2002.
4. Principles of Electric Machines and Power Electronics - P. C. Sen, Wiley India Pvt. Limited, 2007.
5. Thyristor DC drives-P.C.Sen, Krieger Publishing company, 1991.
6. https://nptel.ac.in/courses/108/104/108104140/

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(A0229207) POWER SYSTEM HARMONICS
(Professional Elective-III)

COURSE OBJECTIVES:
- To know the importance of reducing harmonics in power systems.
- To know about analysis and effects of Harmonics on the system.
- To know about the sources of harmonics and Filters to attenuate or eliminate them.

COURSE OUTCOMES:
- To understand sources of harmonics in the power system.
- To represent the mathematical model of THD of harmonics.
- To analyze the Types and order of harmonics available in the power system.
- To design the Tuned filters and damped filters for the attenuation or elimination of harmonics.

MAPPING OF COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	2	2	-	-	1	1	-	-
CO2	3	3	1	-	2	2	-	-	1	1	-	-
CO3	3	3	2	1	1	1	-	-	1	1	-	-
CO4	2	3	2	1	1	-	-	1	1	1	-	-

UNIT I HARMONIC ANALYSIS:
Representation of harmonics, Fourier series and Coefficients, odd, even and half wave symmetry, phase sequence. Measures of harmonic distortion: voltage and current distortion factors, active and reactive power, apparent power, distortion power, power factor, current and voltage crest factors. Power in passive elements: power in a pure resistance, power in a pure inductance and power in a pure capacitance. Series and parallel resonance.

UNIT II HARMONIC SOURCES:
Types of harmonic sources, Harmonic in transformers, normal excitation characteristics, determination of current wave shape in transformers, inrush current harmonics in transformers, Harmonic in rotating machines: MMF distribution of ac windings, slot harmonics, voltage harmonics produced by synchronous machines, rotor saliency effects, voltage harmonics produced by induction motors. Distortion caused by arcing devices: Electric arc furnaces and discharge type lighting. Distortion caused by DC power supplies.

UNIT III EFFECTS OF HARMONIC DISTORTION IN POWER SYSTEMS:
Thermal losses in harmonic environment: Copper losses, iron losses, dielectric losses. Harmonic amplification in capacitor banks. Effects of harmonics in transformers. Effects of harmonics in rotating machines: induced EMF, chorded windings, distributed winding, winding factor. Harmonic interference with power system protection: harmonic problems during fault conditions. Effects of harmonics on consumer equipment. Interference with communications.

UNIT IV LIMITS OF HARMONIC DISTORTION:
Voltage harmonic distortion limits: IEEE limits, IEC limits EN limits and NORSOK limit. Current harmonic distortion limits: IEEE limits IEC limits and NORSOK limits. Harmonic Analysis - Fourier series and coefficients, the Fourier transforms, discrete Fourier transform, fast Fourier transform, Window function- numerical problems.

UNIT V ELIMINATION OF POWER SYSTEM HARMONICS

Passive filters: Tuned filters and damped filters. Active filters: Series and parallel connection of active filters. Role of power converters, transformers, rotating machines and capacitor banks in reduction of harmonics. Harmonic filter design: Series tuned filters and second order damped filters.

UNIT VI POWER QUALITY MONITORING

Power quality Monitoring considerations: Power line disturbance analyzer, power quality measurement equipment, harmonic spectrum analyzer, flicker meters, disturbance analyzer

TEXT BOOKS:

1. "Power System Harmonics" by J. Arrillaga and N. R. Watson, Wiley
2. "Power Systems Harmonics" by George J. Wakileh, Springer

REFERENCE BOOKS:

1. Handbook of Power Quality, by Angelo Baggini (Ed.) Wiley, 2008
2. 'Power Quality', by C. Sankaran CRC Press, 2002
3. 'Power Quality', by G. T. Heydt, Stars in circle publication, Indiana, 1991.
4. https://nptel.ac.in/courses/108106025

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(A0230207) ADVANCED CONTROL SYSTEM
(Professional Elective-III)

COURSE OBJECTIVE:
- This subject deals with state space, describing function, phase plane and stability analysis including controllability and Observability.
- It also deals with modern control and optimal control systems.

COURSE OUTCOME:
- To understand how the state space system representation provides an internal description of the system including possible internal oscillations or instabilities.
- To Design Controllability and Observability.
- To derive the describing function for different types of non-linear and then do the stability analysis.
- To understand how the system design minimizes or maximizes the selected performance index.

MAPPING OF COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	-	2	2	2	-	-	-	-	2	-	-
CO2	3	2	-	-	2	-	2	2	2	-	-	-	2	-	-
CO3	3	-	-	2	3	2	2	2	2	-	-	-	2	-	-
CO4	-	2	2	-	2	2	2	2	-	-	-	-	2	-	-

UNIT I STATE VARIABLE DESCRIPTION

Concept of State – State Equations for Linear Continuous time Models – Non uniqueness of state model – State diagrams for continuous time state models – Solution of state equations – State transmission matrix.

UNIT II CONTROLLABILITY AND OBSERVABILITY

Tests for controllability and Observability for continuous time systems – Time varying case, minimum energy control, time invariant case, Principle of Duality, Controllability and Observability of state models in Jordan canonical form and other canonical forms.

UNIT III DESCRIBING FUNCTION ANALYSIS

Introduction to nonlinear systems, Types of nonlinearities, Concepts of describing functions, Derivation of describing functions for Dead zone, Saturation, backlash, relay with dead zone and Hysteresis - Jump Resonance.

UNIT IV PHASE-PLANE ANALYSIS

Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, Singular points, Phase-plane analysis of nonlinear control systems

UNIT V MODAL CONTROL

Effect of state feedback on controllability and observability, Design of State Feedback Control through Pole placement - Full order observer and reduced order observer.

UNIT VI STABILITY ANALYSIS

Stability in the sense of Lyapunov - Lyapunov's stability and Lypanov's instability theorems direct method of Lyapunov for the Linear and Nonlinear continuous time autonomous systems

TEXT BOOKS:

1. Modern Control System Theory by M. Gopal, 1993, New Age International Publishers.
2. Modern Control Engineering by K. Ogata, Prentice Hall of India, 2009

REFERENCE BOOKS:

1. Advanced Control Theory by A.Nagoor Kani, CBS Publishers & Distributors Pvt. Ltd, 2020, 3rd Edition.
2. Control Systems Engineering by I.J. Nagarath and M.Gopal, New Age International (P) Ltd, 2009.
3. Systems and Control by Stainslaw H. Zak, Oxford Press, 2002.
4. Digital Control and State Variable Methods by M. Gopal, Tata Mc Graw-Hill Companies, 2008.

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(A0225207) DISTRIBUTION AND UTILIZATION OF ELECTRICAL ENERGY
(Professional Elective-IV)

COURSE OBJECTIVES:
- This course helps to know the concept of distribution of electrical Energy considering economical aspects.
- This Course deals with the various types of Electrical Tariff methods.
- This subject deals with the fundamentals of illumination and its classification and the electric heating and welding.
- It gives the detailed study of electrical traction systems.

COURSE OUTCOMES:
- To know the different ways of distribution and utilization of electrical Energy.
- To know the fundamentals of distribution and utilization of electrical Energy.
- To know the effective planning of returns on distribution of electrical energy.
- To analyze the various factors involved in proper utilization of Electrical Energy.
- To know the various terminology used in calculating Illumination.
- To know the various mechanical terms involved in Electric Traction System.

MAPPING OF COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	-	-	-	2	1	-	2	-	-	3
CO2	3	3	1	2	-	-	-	-	2	1	-	2	-	-	3
CO3	3	3	-	2	-	-	-	-	2	1	-	2	-	-	3
CO4	1	2	-	2	-	-	-	-	2	1	-	2	-	-	3
CO5	3	2	-	2	-	2	-	-	2	1	-	2	-	-	3
CO6	3	3	1	2	-	-	-	-	2	1	-	2	-	-	3

UNIT-I DISTRIBUTION SYSTEM
Necessity of Distribution System, Definition, types of Distribution Systems, overhead and underground system, Feeders, Distributors-types of DC distributors, DC distributor fed at one end – concentrated loading, DC distributor fed at both ends- concentrated loading- with two ends fed with equal voltages.

AC Distribution calculations, methods of solving AC Distribution Problems-Power factor referred to receiving end voltage and referred to load voltage.

UNIT-II ECONOMIC ASPECTS OF POWER GENERATION
Load Curve, Load duration Curves- Load, demand, Diversity, Capacity, Utilization and plant use factors-numerical problems.

UNIT-III TARIFF METHODS
Necessity of Tariff, Ideal characteristics of tariff, types of tariff, flat rate, block-rate tariff, two-part tariff, three-part tariff & power factor tariff methods & numerical problems.

UNIT IV ILLUMINATION
Introduction - terms used in illumination - Laws of Illumination - Sources of light – Construction and working of Incandescent Lamp, Fluorescent Tube, Sodium vapour and Mercury vapour lamps – Comparison of different light sources. Properties of good lighting – Factors affecting the design of good lighting scheme – Street lighting and Flood lighting - Numerical problems on Law of Illumination.

UNIT V ELECTRIC HEATING & WELDING

Heating: Advantages of electric heating - Resistance heating – Properties and materials of good heating element - Design of heating element - Induction heating and Dielectric heating. Numerical Problems on design of heating element.

Electric welding - Resistance and Arc welding - Electric welding equipment – Comparison between A.C. and DC. Welding.

UNIT VI ELECTRIC TRACTION

Introduction, different systems of traction, Advantages of electric traction, structure of the ac locomotive, overhead equipment, Comparison between A. C and D. C Traction, Speed-time curves of different services, simplified speed time curves (trapezoidal and quadrilateral) – Numerical Problems on speed time curves.

TEXT BOOKS:

- Principles of power systems - by V.K.Mehata and Rohit Mehata S.Chand.
- Utilization of Electric power and electric traction –by G.C.Garg, khanna Publishers.
- Utilization of Electrical Power – by R. K. Rajput, Laxmi Publications.
- Power Systems Engineering by R.K Rajput, Laxmi Publishhers

REFERENCES BOOKS:

- Element Power station design and practice by M.V Deshpande, wheeler Publishing
- Power System Analysis and Design by B.R.Gupta, Wheeler Publishing.
- Electrical Power Systems by C.L.Wadwa.
- Utilization of Electrical Power including Electric drives and Electric traction by N.V.Suryanarayana, New Age International (P) Limited, Publishers.

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(A0423206) DIGITAL SIGNAL PROCESSING
(Professional Elective-IV)
For branches: EEE & ECE

COURSE OBJECTIVES:
- Enhance the analytical ability of the students in facing the challenges posed by growing trends in communication, control and signal processing areas.
- Develop ability among students for problem formulation, system design and solving skills
- Understand Various Discrete-time signals and class of linear shift-invariant systems will be studied using the convolution sum, and the frequency domain, using transformations.

COURSE OUTCOMES:
- To understand the basics in DT signals analytically & visualize them in the Time domain.
- To analyze the types Fourier transform technique.
- To implement DFT's using FFT.
- To attain ability to design basic appropriate type of design method for FIR filters.
- To Describe the basic types decimation and interpolation factors for high performance filters

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	1	-	-	1	-	-
CO2	2	2	-	-	1	-	-	-	-	-	-	1	1	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO5	2	2	1	-	-	-	-	-	-	-	-	1	1	-	-

UNIT I INTRODUCTION
Review of Discrete Time Signals and Sequences, Frequency domain representation of Discrete Time Signals and Systems, DTFT. Discrete Fourier series: Properties of Discrete Fourier Series, DFS representation of periodic sequences. Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Computation of DFT. Review of Z-Transforms, applications of Z-Transforms, Relation between Z-Transform and DFS.

UNIT II FAST FOURIER TRANSFORMS
Radix-2 Fast Fourier Transforms (FFT), Decimation in Time and Decimation in Frequency FFT Algorithms, Inverse FFT.

UNIT III REALIZATION OF DIGITAL FILTERS
Solution of Difference Equations of Digital Filters, Block Diagram Representation of Linear Constant Coefficient Difference Equations, Basic structures of IIR systems: Direct form-I realization, Direct form-II realization, Cascade form realization, Parallel form realization, Basic structures of FIR systems: Direct form realization, Cascade form realization, Lattice structures of IIR systems, Lattice structures of FIR systems. Conversion from Lattice structure to direct form, Conversion from direct from to Lattice structure, Lattice-ladder structure.

UNIT IV IIR DIGITAL FILTERS
Analog filter approximations Butterworth and Chebyshev, Design of IIR digital filters from analog filters, Design examples, Frequency Transformations in Analog Domain and Frequency Transformations in digital domain, Illustrative Problems.

UNIT V FIR DIGITAL FILTERS

Characteristics of FIR Digital Filters, Frequency Response - Design of FIR Digital Filters Using Window Techniques, Frequency Sampling Technique, Comparison of IIR and FIR filters, Illustrative Problems

UNIT VI MULTIRATE DIGITAL SIGNAL PROCESSING FUNDAMENTALS

Basic Sampling Rate Alteration Devices, Multirate Structures for Sampling Rate Converters, Multistage Design of Decimator and Interpolator, Poly-Phase Decomposition. Applications of DSP: Spectral analysis of non-stationary Signals, Trans multiplexers

TEXT BOOKS:

1. Digital signal processing, principles, Algorithms and applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education India, 2007, 7th Edition.
2. Digital signal processing, A computer base approach by Sanjit K Mitra, Tata Mcgraw Hill, 2009, 3rd Edition.
3. Discrete Time Signal Processing by A.V.Oppenheim and R.W. Schaffer, PHI, 2nd Edition.

REFERENCES:

1. Digital signal processing: Andreas Antoniou, TATA McGraw Hill, 2006.
2. A Text book on Digital Signal processing – R S Kaler, M Kulkarni,, Umesh Gupta, I K International Publishing House Pvt. Ltd, 2009.
3. Digital signal processing: M H Hayes, Schaum's outlines, TATA Mc-Graw Hill, 2007.

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(A0231207) POWER QUALITY
(Professional Elective-IV)

COURSE OBJECTIVES:
- To have knowledge about the Voltage sags.
- To develop ability in understanding Power interruptions and Harmonics
- To know about the devices used to reduce the harmonics

COURSE OUTCOMES:
- To understand the basics in power quality such as sag, swell and interruptions, power quality, voltage quality etc.,
- To analyze the power quality disturbances and determine the remedy in improving power quality.
- Apply the concept of different power quality issues and application of Custom power devices improving power quality
- Realize the technical impact harmonic distortions
- Describe the basic filters to reduce harmonic distortion.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	-	-	-	-	-	-	2	-	1	-	-	3
CO2	2	2	2	2	-	-	-	-	-	-	-	1	-	-	3
CO3	3	1	1		-	-	-	-	1	2	-	-	-	-	3
CO4	2	3	1	2	-	-	-	-	1	1	-	1	-	-	3
CO5	2	2	-	-	-	-	-	-	-	-	-	1	-	-	3

UNIT I: INTRODUCTION
Power quality, Voltage quality, Concern, power quality Evaluation procedure, Transients, Long-duration- short duration-voltage variations, voltage imbalance, wave form distortion, voltage fluctuation, power frequency variations, power quality terms, CBEMA and ITI curves

UNIT II: VOLTAGE SAGS AND INTERRUPTIONS
Sources of sagas and interruptions, Estimating voltage sag performance, fundamental principles of protection, solutions at the end-user level, Motor-starting sags, and utility system fault-clearing issues.

UNIT III: TRANSIENT OVER VOLTAGES
Sources of over voltages, principles of over voltage protection, devices for over voltage protection, utility capacitor-switching transients, utility system lightning protection, switching transient problems with loads

UNIT IV: FUNDAMENTALS OF HARMONICS
Harmonic Distortion, voltage versus current distortion, harmonics versus transients, power system quantities under non-sinusoidal conditions, Harmonic indices, Harmonic sources from commercial loads, Harmonic sources from Industrial loads, system response characteristics, effects of harmonic distortion

UNIT V: EVALUATION OF HARMONICS
Harmonic distortion evaluations, Principles of Controlling Harmonics, Harmonic studies, Devices for Controlling Harmonic Distortion

UNIT VI: LONG-DURATION VOLTAGE VARIATIONS
Principles of regulating the voltage, Devices for voltage regulation, utility voltage regulator Application, capacitors for voltage regulation flicker- power quality measuring equipment

TEXT BOOKS:

1. Electrical Power Systems Quality, Roger C. Dugan, Mark F. McGranaghan, Surya Santoso, H.Wayne Beaty, McGraw Hill Education Pvt. Ltd, 2012, 2nd Edition.
2. Power quality by C. Sankaran, CRC Press, 2002, 1st Edition.

REFERENCE BOOKS:

1. Electrical systems quality Assessment by J. Arrillaga, N.R. Watson, S. Chen, John Wiley & Sons, 2000.
2. Understanding Power quality problems by Math H. J. Bollen, Wiley-IEEE Press, 1999, 1st Edition.
3. Power system harmonic analysis by J. Arrillaga, John Wiley & Sons, 1997
4. Power quality in electrical systems by Alexander Kusko, Marc T. Thompson, McGraw Hill, 2007, 1st Edition.

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(A0235207) RENEWABLE ELECTRICAL ENERGY SOURCES
(Professional Elective-V)

COURSE OBJECTIVES:

- It introduces solar energy its radiation, collection, storage and application.
- It also introduces the Wind energy, Biomass energy, geothermal energy and ocean energy as alternative energy sources.

COURSE OUTCOMES:

- To understand the fundamentals and main characteristics of renewable energy sources and their differences compared to fossil fuels.
- Analyze the technological basis for harnessing renewable energy sources.
- Describe the main components of different renewable energy systems.
- Collect and organize information on renewable energy technologies as a basis for further analysis and evaluation.
- Design renewable/hybrid energy systems that meet specific energy demands, are economically feasible and have a minimal impact on the environment.
- Discuss how to utilize local energy resources (renewable and non- renewable) to achieve the sustainable energy system.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	-	-	3	3	3	1	-	-	-	-	-	3
CO2	1	-	2	1	2	3	3	-	2	-	-	1	-	-	3
CO3	1	2	2	1	2	1	2	-	2	-	-	2	-	-	3
CO4	1	2	2	2	2	-	1	2	2	-	-	2	-	-	3
CO5	2	2	3	2	2	1	1	-	-	-	-	2	-	-	3
CO6	1	2	3	-	2	3	3	3	-	-	-	3	-	-	3

UNIT I

SOLAR RADIATION AND ITS MEASUREMENT: Availability of energy sources- energy scenario in India -Solar Constant-Spectral distribution of extraterrestrial radiation-terrestrial solar radiation-solar radiation geometry-computation of cosθ for any location having any orientation- sunrise, sunset and day length- empirical equation for estimating the availability of solar radiation-solar radiation measurements-solar radiation data for India.

UNIT II

SOLAR ENERGY COLLECTORS: Introduction-Flat Plate Collector-Effect of Design parameters on performance- laws of thermal radiation-radiation heat transfer between real bodies-transmissivity of cover system-performance analysis of a liquid flat plate collector- total loss coefficient and heat losses-concentrating collectors-types-thermodynamic limits to concentration-performance analysis of cylindrical parabolic collector-compound parabolic concentrator-tracking CPC and solar swing-performance analysis of CPC

UNIT III

SOLAR PHOTOVOLTAIC SYSTEM: Introduction-Semiconductor materials and doping- n-type and p-type semiconductors-photon energy-Fermi level- p-n junction-photovoltaic effect-PV cell characteristics- efficiency of solar cells-limits to cell efficiency-semiconductor materials for solar cells-standalone applications-solar photovoltaic hybrid system-grid interactive solar PV system –solar photovoltaics in India

UNIT IV

WIND ENERGY; Basic principles of wind energy conversion-site selection considerations-Basic components of wind energy conversion systems-classification of wind turbines-types of rotors (Horizontal & Vertical Axis) and design considerations-Aerodynamic operation of wind turbines-Wind Energy extraction- Extraction of wind turbine power- Wind characteristics-Advantages & Disadvantages of WECS

UNIT V

FUEL CELLS: Introduction- Principle of operation of an acidic fuel cell Methanol fuel cell-type of fuel cells- Energy output of fuel cell-efficiency & emf of fuel cell-Gibbs-Helmholtz equation- Characteristics of fuel cell- Thermal efficiency of fuel cell- Advantages & Disadvantages of fuel cells.

UNIT VI

BIO-MASS & GEOTHERMAL: Bio- mass Resources-Bio-Mass Conversion Technologies-Bio-Chemical Conversion-Bio-mass Gasification

Structure of Earth's Interior-Plate tectonic theory-Geothermal Field-Geo thermal Resources-geo thermal power generation-Geo thermal-Preheat hybrid with conventional plant-Utilization of geo thermal energy.

TEXT BOOKS:

1) "Renewable Energy Sources and emerging Technologies" by D.P Kothari, K.C Singhal and Rakesh Ranjan-Eastern Economy Edition-Prentice Hall of India.
2) "Renewable Energy Resources" by G N Tiwari and M K Ghosal- Narosa Publications

REFERENCE BOOKS:

1) Renewable Energy Sources by John Twidell & Tony Weir.
2) Non-Conventional Energy Systems: Principles, Progress and Prospects by K.M.Mital, Wheeler Publishing
3) Non-Conventional Energy Sources by G.D. Rai, Khanna Publishers
4) Renewable energy sources and emerging technologies by D.P.Kothari, K.C.Singhal, PHI.

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(A0236207) SPECIAL MACHINES AND CONTROL
(Professional Elective-V)

COURSE OBJECTIVES:
- It introduces Special machines-Principle of operation.
- It also introduces Working operation and speed control techniques

COURSE OUTCOMES:
- To understand the fundamentals and main characteristics of Special Machines
- Analyze the working operation of Special Machines.
- Describe the main components in construction of Special Machines
- Applications of Special Machines described
- Speed Control Characteristics are analysed for Special Machines
- Few Numerical problems discussed as per the design considerations

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	3	3	3	1	-	-	-	-	-	3
CO2	3	3	-	1	2	3	3	-	2	-	-	1	-	-	3
CO3	1	2	-	1	2	1	2	-	2	-	-	2	-	-	3
CO4	-	1	2	2	2	-	1	2	2	-	-	2	-	-	3
CO5	1	1	-	2	2	1	1	-	-	-	-	2	-	-	3
CO6	3	3	3	-	2	3	3	3	-	-	-	3	-	-	3

UNIT I STEPPER MOTORS
Constructional features, Principle of operation, Modes of excitation torque production in Variable Reluctance (VR) stepping motor, Dynamic characteristics, Drive systems and circuit for open loop control, closed loop control of stepping motor.

UNIT II SWITCHED RELUCTANCE MOTORS
Mathematical model of Switched Reluctance Motor-Operating principle-Construction and functional Aspects-Average torque and Energy Conversion Ratio-The Commutation windings-The flux current position curve fitting, Control Techniques

UNIT III PERMANENT MAGNET BRUSHLESS DC MOTORS
Modelling of Permanent Magnet Brushless DC Motor – Operating principle-Mathematical modeling of PM Brushless DC motor-PMDC Motor Drive Scheme. Torque and emf equation, Torque-speed characteristics

UNIT IV PERMANENT MAGNET SYNCHRONOUS MOTORS
Principle of operation, EMF, power input and torque expressions, Phasor diagram, Power Controllers, Torque speed characteristics

UNIT V SERVOMOTORS AND AC TACHOMETERS
Servomotor – Types – Constructional features – Principle of Operation – Characteristics - Control – Microprocessor based applications-Schematic diagram of AC tachometers-Operating principle of AC tachometers-Numerical problems.

UNIT VI LINEAR MOTORS
Linear Motors: Linear Induction Motor (LIM) Classification – Construction – Principle of operation – Concept of Current sheet –Goodness factor – DC Linear Motor (DCLM) types – Circuit equation – DCLM control-applications.

TEXT BOOKS:

1) N.Mohan, Undel and& Robbins: Power Electronics Converters, Applications & Design
2) Power Electronics Control of AC Motors-MD Murphy &FG Turn Bull Pergman Press.
3) Miller, T.J.E. "Brushless Permanent Magnet and Reluctance Motor Drives", Clarendon Press, Oxford, 1989.
4) Kenjo, T and Naganori, S "Permanent Magnet and brushless DC motors", Clarendon Press, Oxford, 1989.

REFERENCES:

1) Kenjo, T, "Stepping Motors and their Microprocessor control", Clarendon Press, Oxford, 1989.
2) Naser A and Boldea I, "Linear Electric Motors: Theory, Design and Practical Application", Prentice Hall Inc., New Jersey,1987
3) Floyd E Saner, "Servo Motor Applications", Pittman USA, 1993.

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(A0237207) FACTS CONTROLLERS AND APPLICATIONS
(Professional Elective-V)

COURSE OBJECTIVES:
- It introduces Flexible AC Transmission.
- It also introduces various FACTS control devices

COURSE OUTCOMES:
- To understand the fundamentals and main characteristics of FACTS devices
- Analyze the technological basis for FACTS devices.
- Describe the main components of FACTS devices
- Collect and organize information on FACTS devices as a basis for further analysis and evaluation.
- Design FACTS devices for reactive power compensation.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	-	-	2	1	-	1	-	-	-	-	-	3
CO2	1	-	2	1	2	-	2	1	2	-	-	1	-	-	3
CO3	1	2	2	1	2	2	2	1	2	-	-	2	-	-	3
CO4	1	2	2	2	2	2	2	2	2	-	-	2	-	-	3
CO5	2	2	3	2	2	2	3	2	-	-	-	2	-	-	3

UNIT I INTRODUCTION

FACTS Concepts: Transmission interconnections power flow in an AC system, loading capability limits, Dynamic stability considerations, importance of controllable parameters basic types of FACTS controllers, benefits from FACTS controllers.

UNITII STATIC SHUNT COMPENSATION

Static shunt compensation: Objectives of shunt compensation, mid point voltage regulation voltage instability prevention, improvement of transient stability, Power oscillation damping.

UNIT III METHODS OFCONTROLLABLE VAR GENERATION:

Variable impedance type static var generators: Thyristor Controlled and Thyristor Switched Reactor (TCR and TSR), Thyristor Switched Capacitor (TSC), Fixed Capacitor Thyristor Controlled Reactor Type Var Generator FC-TCR, Thyristor Switched Capacitor- Thyristor Controlled Reactor Type Var Generator; Switching converter type var generators, Hybrid var generators.

UNIT IV SVC AND STATCOM

Static Var Compensators: SVC and STATCOM-The Regulation Slope, Transfer Function and Dynamic Performance-Transient Stability Enhancement and Power Oscillation Damping; Comparison between STATCOM and SVC: V-I and V-Q Characteristics, Transient Stability, Response Time, Capability to Exchange Real Power, Operation with Unbalanced AC System, Loss Versus Var Output Characteristic.

UNIT V STATIC SERIES COMPENSATION

Concept of series capacitive compensation, improvement of transient stability, power oscillation damping; Variable Impedance Type Series Compensators-GTO Thyristor-Controlled Series Capacitor-(GCSC), Thyristor-Switched Series Capacitor(TSSC), Thyristor-Controlled Series Capacitor(TCSC), Basic Operating Control Schemes For GCSC,TSSC and TCSC.

UNIT VI UNIFIED POWER FLOW CONTROLLER (UPFC)

Introduction: The Unified Power Flow Controller-Basic Operating Principles, Conventional Transmission Control Capabilities, Independent Real and Reactive Power Flow Control, Control Structure, Basic Control System for P and Q Control.

TEXT BOOKS:

1. N.G.Hingorani & L.Gyugyi, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, IEEE Press, 1999.
2. X.P. Zang, C. Rehtanz and B. Pal, Flexible AC Transmission Systems: Modeling and Control, Birkhauser, 2006.
3. Y. H. Song and A. T. Johns, Flexible AC Transmission Systems, IET, 1999.
4. R. Mohan Mathur, Rajiv K. Varma, "Thyristor-based facts controllers for electrical transmission systems", Wiley-IEEE, 2002
5. K.R. Padiyar, "Facts Controllers in Power Transmission & Distribution", New Age International Publishers

REFERENCE BOOKS:

1. Enrique Acha, Claudio R. Fuerte-Esquivel, Hugo Ambriz-Perez, Cesar Angeles-Camacho, "FACTS: Modeling and Simulation in Power Networks", John Wiley & Sons Ltd., 2004.
2. S. Sivanagaraju, S.Sathyabarayana, "Electric Power Transmission and Distribution", Pearson Education, 2009.

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(A0226207) ELECTRICAL ENERGY RESOURCES
(Open Elective-III)

COURSE OBJECTIVES:
- To understand the concepts and phenomenon of Power Generation by some conventional sources.
- To introduce photovoltaic systems, pronounce the solar radiation, measurements and characteristics of solar PV cell.
- To understand in detail photovoltaic energy conversion system and applications.
- Understand and analyze the basics of wind power energy
- Analyze the principle of operation of wind generators to have knowledge of design considerations.
- Describe the basic types and mechanical characteristics and model of wind turbine.

COURSE OUTCOMES:
- Demonstrate the generation of electricity from various Conventional sources of energy, have a working knowledge on types energy sources.
- Estimate the solar energy, Utilization of it, Principles involved in solar energy collection and conversion of it to electricity generation.
- Illustrate solar energy and explain the operational methods of their utilization.
- Acquire the knowledge on Wind energy.
- Explore the concepts involved in wind energy conversion system by studying its components, types and performance.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	-	-	3	3	-	1	-	-	-	-	-	3
CO2	1	-	2	1	2	3	3	-	2	-	-	1	-	-	3
CO3	1	2	2	1	2	1	2	-	2	-	-	2	-	-	3
CO4	1	2	2	2	2	-	1	2	2	-	-	2	-	-	3
CO5	2	2	3	2	2	1	1	-	-	-	-	2	-	-	3
CO6	1	2	3	-	2	3	3	3	-	-	-	3	-	-	3

UNIT-I ENERGY GENERATION WITH CONVENTIONAL SOURCES:
Thermal Power Stations: Thermal steam power plants – Schematic arrangement of steam power station- selection of site, Efficiency of steam Power Station, Equipment of steam power station, advantages and disadvantages of steam power station.
Hydro Power Stations (HPS): Selection of site, Classification, Layout, description of Main Components.

UNIT-II: NUCLEAR POWER STATION:
Nuclear Fission, Chain reaction, Nuclear Fuels-Principle of operation of Nuclear reactor-its Parts, Radiation Hazards, Shielding and Safety Precautions-Types of nuclear reactors and brief description of PWR, BWR & FBR.

UNIT-III: SOLAR ENERGY MEASUREMENT AND SOLAR COLLECTORS
Introduction to PV, world energy scenario – need for sustainable energy sources – current status of Renewable energy sources — solar spectrum — Solar constant, Solar radiation-,Solar radiation geometry - measurement of solar radiation- pyranometer, solar collectors-Types.

UNIT-IV: SOLAR PHOTOVOLTAIC
Introduction to Solar cells - PV modules, Solar cell - PV module design- Parameters of solar cells - PV module effect of solar radiation on efficiency, Solar – PV module – I-V

characteristics, P-V characteristics. Estimation of and measurement of PV module Power, Selection of PV module-Advantages-disadvantages-applications of Solar energy.

UNIT-V: WIND ENERGY FUNDAMENTALS

Basic principles of wind energy conversions, the nature of the wind, The power in the wind, The forces on the blades, wind energy conversion, wind data and energy estimation, site selection considerations.

UNIT-VI: WIND ENERGY CONVERSATION SYSTEMS

Basic components of wind energy conversion systems, classification of wind energy conversation systems, advantages and disadvantages of WEC, applications of wind energy, interconnected systems. Horizontal and vertical axial Machines.

TEXT BOOKS:

1. Principle of Power System by V.K Mehta Rohit Mehta., S.Chand Publications, 2005.
2. Solar Photovoltaic Technology and Systems by Chetan Singh Solanki, PHI, 2nd Edition, 2011.
3. Wind Electrical systems by S.N Bhadra, D.Kastha, S.Banerjee, Oxford Publications, Seventh Impression, 2005.
4. Non – conventional Energy sources by G.D RAI, Khanna Publisher,1998.

REFERENCE BOOKS:

1. Wind and solar power systems by Mukund R.Patel, CRC Press, 1st Edition, 1999.
2. Solar Energy fundamentals and modeling techniques, McGraw Hill Education, 1st Edition, 2017.
3. Gilbert M. Masters: Renewable and Efficient Electric Power Systems, John Wiley & Sons, 2004
4. R.K Rajput, “Power Systems Engineering”, 2nd edition revised, Laxmi Publishers, 2006.
5. C. L. Wadwa, “Electrical Power Systems”, New Age International (P) Limited, 2009.

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(A0232207) SMART GRID TECHNOLOGIES
(Open Elective-III)

COURSE OBJECTIVES:
- To provide students with a working knowledge of fundamentals and development of Smart Grid, from the basic concepts of power systems.
- Know the importance of smart grid technology functions over the present grid.
- Get the knowledge about the renewable energy storage technology associated with smart grid.

COURSE OUTCOMES:
At the end of this course, the student would be able to
- The student would be able to understand the features of Smart Grid
- The student would be able to Assess the role of automation and digitization in Transmission and Distribution
- The student would be able to develop skills required for smart grid planning & formulation of regulations.
- The student would be able to analyse Smart grids and Distributed energy resources(DER) with evolutionary algorithms
- The student would be able to understand operation and importance of data acquisition devices and their location in Voltage and Frequency control.

MAPPING OF COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	-	2	-	2	1	-	1	-	-	3
CO2	3	3	2	2	-	-	2	-	2	1	-	2	-	-	3
CO3	3	3	2	2	1	1	2	-	2	1	3	2	-	-	3
CO4	1	2	1	2	1	1	1	-	2	1	2	2	-	-	3
CO5	2	2	3	2	1	1	1	-	2	1	2	2	-	-	3

UNIT I: SMART GRID ARCHITECTURAL DESIGNS
Introduction – Comparison of Power grid with Smart grid – power system enhancement – communication and standards - General View of the Smart Grid Market Drivers - Stakeholder Roles and Function - Measures - Representative Architecture - Functions of Smart Grid Components.

UNIT II: SMART GRID COMMUNICATIONS AND MEASUREMENT TECHNOLOGY
Communication and Measurement - Monitoring, Phasor Measurement Unit (PMU), Smart Meters, Wide area monitoring systems (WAMS) - Advance metering concept **-** Advanced metering infrastructure- GIS and Google Mapping Tools- Multiagent systems technology.

UNIT III: PERFORMANCE ANALYSIS TOOLS FOR SMART GRID DESIGN
Introduction to Load Flow Studies - Challenges to Load Flow in Smart Grid and Weaknesses of the Present Load Flow Methods - Load Flow State of the Art: Classical, Extended Formulations, and Algorithms –Load flow for smart grid design-Contingencies and their classification- Contingencies studies for smart grid.

UNIT IV: STABILITY ANALYSIS TOOLS FOR SMART GRID
Voltage Stability Analysis Tools-Voltage Stability Assessment Techniques-Voltage Stability Indexing-Application and Implementation Plan of Voltage Stability in smart grid-Angle stability assessment in smart grid

UNIT V: PATHWAY FOR DESIGNING OF SMART GRID

Introduction-Barriers and solutions to smart grid Development- General Level Automation-Bulk power systems automation of smart grid at transmission level- Distribution Management System- Distribution system automation requirement of power grid- Outage Management System- End user of the smart grid.

UNIT VI: RENEWABLE ENERGY AND STORAGE

Renewable Energy Resources-Sustainable Energy Options for the Smart Grid-Penetration and Variability Issues Associated with Sustainable Energy Technology- Demand Response Issues-Electric Vehicles and Plug-in Hybrids-PHEV Technology-Environmental Implications-Storage Technologies- Energy trading - Grid integration issues of renewable energy sources

TEXT BOOKS:

1. Smart Grid - Fundamentals of Design and Analysis by James Momoh, Wiley & sons Inc, IEEE press 2012.
2. Smart Grid: Technology and Applications by Janaka B. Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, John Wiley & sons Inc, 2012.

REFERENCE BOOKS:

1. Smart Grid: Integrating Renewable, Distributed and Efficient Energy by Fereidoon P. Shoshonis, Academic Press, 2012.
2. The smart grid: Enabling energy efficiency and demand response by Clark W.Gellings, Fairmont Press Inc, 2009.

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(A0233207) ENERGY MANAGEMENT & AUDIT
(Professional Elective-III)

COURSE OBJECTIVES:
- It introduces solar energy its radiation, collection, storage and application.
- It also introduces the Wind energy, Biomass energy, geothermal energy and ocean energy as alternative energy sources.

COURSE OUTCOMES:
- To understand the fundamentals and main characteristics of renewable energy sources and their differences compared to fossil fuels.
- Analyze the technological basis for harnessing renewable energy sources.
- Describe the main components of different renewable energy systems.
- Collect and organize information on renewable energy technologies as a basis for further analysis and evaluation.
- Design renewable/hybrid energy systems that meet specific energy demands, are economically feasible and have a minimal impact on the environment.
- Discuss how to utilize local energy resources (renewable and non- renewable) to achieve the sustainable energy system.

MAPPING OF COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	-	-	3	3	3	1	-	-	-	-	-	3
CO2	1	-	2	1	2	3	3	-	2	-	-	1	-	-	3
CO3	1	2	2	1	2	1	2	-	2	-	-	2	-	-	3
CO4	1	2	2	2	2	-	1	2	2	-	-	2	-	-	3
CO5	2	2	3	2	2	1	1	-	-	-	-	2	-	-	3
CO6	1	2	3	-	2	3	3	3	-	-	-	3	-	-	3

UNIT I INTRODUCTION
Energy Scenario – global, sub continental and Indian, Energy economy relation, Future energy demand and supply scenario, Integrated energy planning with particular reference to Industrial Sector in India, Captive power units and others – demand v/s supply.

UNIT II TYPES OF ENERGY
Physical Aspects of Energy: Classification of energy – Hydel, Thermal, Nuclear, Wind, & from Waste Products. Efficiency and effectiveness of energy utilization in Industry. Energy and energy analysis. Renewable and non- renewable energy, Conventional and unconventional energy.

UNIT III DEMAND SIDE MANAGEMENT
Energy Demand Management: Energy utilization, Instrumentation and data analysis, financial aspects of energy management, Energy management as a separate function and its place in plant management hierarchy. Energy Planning, Energy Staffing, Energy Organization, Energy Requirement. Energy Costing, Energy Budgeting, Energy Monitoring, Energy Consciousness, Energy Conversions, Energy Efficient Equipment, Energy Management Professionals, Environment Pollution due to Energy Use, Components of Pollution, Harmful Effects of Pollution, Measures taken to combat Pollution.

UNIT IV ENERGY AUDIT AND ENERGY SAVING
Energy Audit and analysis, Energy load measurements, System evaluation and simulation, Energy saving techniques and guidelines: Administrative control, Proper Measurement and monitoring system, Process control, proper planning & scheduling, Increasing capacity

utilization, Improving equipment control, waste heat recovery, Change of energy source. Up gradation of Technology. Change of product specifications, Use of High efficiency equipment, Design modification for better efficiency, improved periodic maintenance;

UNIT V ENERGY CONTROL CENTERS

Remote Telemetry; Remote Terminal Units; IEC TC 57 (870-5-1) Protocol Standard; Data Acquisition Procedure; Data Handling and Organization; Real Time Database; Alarm and Events; Disturbance Processing; Fault Locating Technology; Real Time Display; MIMIC Boards; Supervisory Remote Control; Load Dispatch Control Centers; Distribution Control Centers; Time Keeping Systems;

UNIT VI INTEGRATION OF DISTRIBUTED AND RENEWABLE ENERGY SYSTEMS TO POWER GRIDS

DC-to-AC Converters; AC-to-AC Converters; DC-to-DC Converters; Plug-In Hybrid Electric Vehicles; Energy Storage Technologies; Micro grids.

TEXT BOOKS:

1. Paul W., O'callaghan; "Energy Management", McGraw Hill Book company
2. Steve Doty, Wayne C. Turner; "Energy Management Handbook", airmont Press Inc., GA 30047
3. Barny L. Capehart, Wainey C. Turner, William J. Kennedy; "Guide to Energy Management", Fairmont Press Inc., GA 30047

REFERENCE BOOKS:

1. Handbook of Energy Engineering, Albert Thumann & Paul Mehta, The Fairmont Press, INC.
2. NPC energy audit manual and reports.
3. Cleaner Production – Energy Efficiency Manual for GERIAP, UNEP, Bangkok prepared by National Productivity Council.

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(A0227207) FUNDAMENTALS OF ELECTRIC AND HYBRID ELECTRIC VEHICLS
(Open Elective-IV)

COURSE OBJECTIVES:
- To study the concepts and drive train configurations of electric drive vehicles
- To provide different electric propulsion systems and energy storage devices
- To explain the technology, design methodologies and control strategy of hybrid electric vehicles
- To describe the working principle of electric vehicles.
- To emphasize battery charger topologies for plug in hybrid electric vehicles

COURSE OUTCOMES:
- Understand the concepts and drivetrain configurations of electric drive vehicles
- Interpret different electric propulsion systems and energy storage devices
- Describe about working principle of electric vehicles.
- Appreciate the technology, design methodologies and control strategy of hybrid electric vehicles
- Realize battery charger topologies for plug in hybrid electric vehicles

MAPPING OF COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	2	-	-	2	-	-	3	3	-	-
CO2	3	2	3	2	2	2	-	-	2	-	-	3	3	2	-
CO3	3	2	2	2	-	2	-	-	-	-	-	2	2	3	-
CO4	3	2	3	2	-	2	-	2	2	-	2	2	1	3	-
CO5	3	2	2	2	-	2	-	2	2	-	-	2	2	2	-

UNIT I INTRODUCTION TO ELECTRIC VEHICLES

EV System – EV Advantages – Vehicle Mechanics – Performance of EVs – Electric Vehicle drivetrain – EV Configurations– EV Market – Types of Electric Vehicle in use Today – Electric Vehicles for the Future.

UNIT II BATTERY ELECTRIC VEHICLE MODELING

Tractive Effort in Normal Driving – Energy Consumption-Tractive Effort – Modelling Vehicle Acceleration – Modelling Electric Vehicle Range– EV Motor Sizing. Single Pedal Driving concepts

UNIT III DESIGN CONSIDERATIONS

Aerodynamic Considerations-Consideration of Rolling Resistance –Transmission Efficiency– Consideration of Vehicle Mass- General Issues in Design

UNIT IV INTRODUCTION TO ELECTRIC VEHICLE BATTERIES

Electric vehicle battery efficiency – electric vehicle battery capacity – electric vehicle battery charging – electric vehicle battery fast charging – electric vehicle battery discharging – electric vehicle battery performance – testing.

UNIT V HYBRID ELECTRIC VEHICLES

HEV Fundamentals -Architectures of HEVs- Interdisciplinary Nature of HEVs – State of the Art of HEVs – Advantages and Disadvantages – Challenges and Key Technology of HEVs – Concept of Hybridization of the Automobile-Plug-in Hybrid Electric Vehicles – Design and Control Principles of Plug-In Hybrid Electric Vehicles – Fuel Cell Hybrid Electric Drive Train Design – HEV Applications for Military Vehicles.

UNIT VI PLUG-IN HYBRID ELECTRIC VEHICLES:

Introduction to PHEVs, PHEV Architectures, Fuel Economy of PHEVs, Power Management of PHEVs, PHEV Design and Component Sizing, HEV to PHEV Conversions, Vehicle-to-Grid Technology

TEXT BOOKS:

1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles Fundamentals, Theory and Design by Mehrdad Ehsani, Uimin Gao and Ali Emadi, CRC Press, 2010, 2nd Edition.
2. Electric Vehicle Technology Explained by James Larminie, John Lowry, John Wiley & Sons Ltd, 2003.
3. Electric Vehicle Battery Systems by Sandeep Dhameja, Newnes New Delhi, 2002.

REFERENCES BOOKS:

1. Hybrid electric Vehicles Principles and applications with practical perspectives by Chris Mi, Dearborn, M. Abul Masrur, David Wenzhong Gao, John Wiley & Sons, Ltd., 2011.
2. Electric & Hybrid Vehicles Design Fundamentals by Iqbal Hussain, CRC Press, 2011, 2nd Edition.

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(A0446207) MICROCONTROLLER-BASED SYSTEM DESIGN
(Open Elective-IV)

COURSE OBJECTIVES:
- To introduce the architecture of PIC microcontroller
- To educate on use of interrupts and timers
- To educate on the peripheral devices for data communication and transfer
- To introduce the functional blocks of ARM processor
- To educate on the architecture of ARM processors

COURSE OUTCOMES:
- To understand the basics and requirement of processor functional blocks.
- Observe the specialty of RISC processor Architecture.
- Incorporate I/O hardware interface of a processor based automation for consumer application with peripherals.
- Incorporate I/O software interface of a processor with peripherals.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in commercial embedded processors.

MAPPING OF COs & POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	-	-	-	-	-	2	-	2	-	-
CO2	2	-	3	1	3	1	-	-	-	-	1	-	1	-	-
CO3	3	-	3	2	2	1	-	-	-	-	2	-	2	-	-
CO4	2	-	2	-	2	-	-	-	-	-	1	-	1	-	-
CO5	3	-	3	2	2	-	-	-	-	-	2	-	2	-	-

UNIT I INTRODUCTION TO PIC MICROCONTROLLER

Introduction to PIC Microcontroller–PIC 16C6x and PIC16C7x Architecture–PIC16cxx–-Pipelining - Program Memory considerations – Register File Structure - Instruction Set - Addressing modes – Simple Operations.

UNIT II INTERRUPTS AND TIMER

PIC micro controller Interrupts- External Interrupts-Interrupt Programming–Loop time subroutine - Timers-Timer Programming– Front panel I/O-Soft Keys– State machines and key switches– Display of Constant and Variable strings.

UNIT III PERIPHERALS AND INTERFACING

I2C Bus for Peripherals Chip Access– Bus operation-Bus subroutines– Serial EEPROM—Analog to Digital Converter–UART-Baud rate selection–Data handling circuit–Initialization - LCD and keyboard Interfacing -ADC, DAC, and Sensor Interfacing.

UNIT IV INTRODUCTION TO ARM PROCESSOR

ARM Architecture –ARM programmer's model –ARM Development tools- Memory Hierarchy –ARM Assembly Language Programming–Simple Examples–Architectural Support for Operating systems.

UNIT V ARM ORGANIZATION

Stage Pipeline ARM Organization– 5-Stage Pipeline ARM Organization–ARM Instruction Execution- ARM Implementation– ARM Instruction Set– ARM coprocessor interface–Architectural support for High Level Languages – Embedded ARM Applications.

TEXT BOOKS:

1. Design with PIC Micro-Controllers by Peatman, J.B, Pearson Education, 2004, 3rd

Edition.
2. ARM System on Chip Architecture by Furber.S., Addison Wesley trade Computer Publication, 2000, 2nd Edition.

REFERENCES:

1. PIC Microcontroller by Mazidi, M.A., Rollin Mckinlay, Danny causey Printice Hall of India, 2007.

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L	T	C
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(A0240206) SOFT COMPUTING TECHNIQUES
(Open Elective-IV)

COURSE OBJECTIVES:
- It introduces fundamentals of Soft computing techniques.
- It also introduces the Fundamentals about the Fuzzy systems with design aspects

COURSE OUTCOMES:
- To understand the fundamentals for requirements of Fuzzy systems.
- Analyze the technological basis Fuzzy systems.
- Describe the main components of Fuzzy systems.
- Collect and organize information on Fuzzy systems as a basis for further analysis and evaluation.
- Design Fuzzy systems that meet specific considerations of a system

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	3	3	3	1	-	-	-	-	-	-
CO2	3	3	3	1	2	3	3	-	2	-	-	1	-	-	-
CO3	1	2	1	1	2	1	2	-	2	-	-	2	-	-	-
CO4	-	1	-	2	2	-	1	2	2	-	-	2	-	-	-
CO5	1	1	1	2	2	1	1	-	-	-	-	2	-	-	-

UNIT I OVERVIEW OF COURSE
Brief introduction to the platforms and required background for the course. Basics of Soft Computing- Introduction to Soft Computing. The main components and characteristics of Soft Computing

UNIT II FUZZY LOGIC AND SYSTEMS
Fuzzy Sets and Membership Functions- Operations on Fuzzy Sets- Fuzzification- Fuzzy Numbers -Uncertain Fuzzy Values-Fuzzy Numbers and its L-R representation-Operations on Fuzzy Numbers-Fuzzy Relations-Cartesian product-Binary Fuzzy Relations. IF-THEN fuzzy relation-n-ary Fuzzy Relations-Compositions of Fuzzy Relations-max-min composition-max-product composition

FUZZY INFERENCE SYSTEMS
Architecture of Fuzzy Inference System-Fuzzy Inference Rules and Reasoning-Defuzzification-Applications of Fuzzy Logic -Fuzzy Control Systems-Pattern Analysis and Classification-Fuzzy Expert Systems

UNIT III NEURAL NETWORKS
Artificial Neural Networks-Models of Neuron-Architecture of Neural Networks-Feed-forward Neural Networks-Recurrent Neural Networks-Network layers-Perceptrons

UNIT IV LEARNING METHODS FOR NEURAL NETWORKS
Supervised Learning-Unsupervised Learning-Reinforcement Learning-Transfer Function-Back-Propagation Algorithm-Applications of Neural Networks

UNIT V GENETIC ALGORITHMS&APPLICATIONS
Genetic algorithms and evolutionary – computation - Basics of Genetic Algorithms-Representation methods -Selection -Crossover –Mutation - Genetic Algorithms on optimization and planning-Traveling Salesman Problem-Genetic Algorithms in Business and their role in Decision Making

UNIT VI HYBRID SYSTEMS

Fuzzy-Evolutionary System -Neuro-Fuzzy System - Neuro-Fuzzy-Evolutionary System - Neuro-Evolutionary System

TEXT BOOKS:

1. Neuro-Fuzzy and soft computing by J S R Jang, CT Sun and E.Mizutani , PHI PVT LTD.
2. Principles of soft computing –by sivandudam and Deepa publisher –John mikey India.

REFERENCE BOOKS:

1. S. Haykins- Neural Networks: A comprehensive foundation.

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(A0541207) STRUCTURED QUERY LANGUAGE
(Skill Development Course)

COURSE OBJECTIVES:
- Relational Model, Formal Query Languages and SQL basis.
- Storage and efficient retrieval of data: various indexing techniques.
- Schema refinement: normalization and redundancy removal and functional dependant.
- Transaction management: locking protocols, serializability concepts etc.

COURSE OUTCOMES:
- Understand the basic concepts of database and various data model used in database design and ER modelling concepts and architecture.
- Use different integrity constraints in defining database objects
- understand and apply their knowledge in solving procedural and non-procedural language queries
- Create good relational schema by applying normalization methodologies
- Determine the significance of concurrency control mechanism in transaction
- Illustration of various File organization techniques and different storage mediums.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3		1							1	2		
CO2	3	2		3								1	1	2	2
CO3	2	2	2		2					1	2	1	1	2	
CO4	1	2		2	2							1	2		1
CO5	1	2	2									1	1	1	1

UNIT-I
Features of SQL, DDL (Data Definition Language), Rules for Creating a Table, DML (Data Manipulation Language), Difference between TRUNCATE and DELETE Command, TCL (Transaction Control Language), DCL (Data Control Language).

UNIT-II
Data Types in SQL Server, Types of constraints in SQL Server, To create a Table with Example.

UNIT-III
OPERATORS IN SQL: Assignment operator, Arithmetic operator, Comparison operator, Logical operator, Set operator.

UNIT-IV
CLAUSES IN SQL: where, order by, top N clause, group by, having clause, differences between where and having clause, Constraint in SQL.

UNIT-V
Joins In SQL: Equi Join, Inner Join, Outer Join, Left Outer Join, Right Outer Join, Full Outer Join, Non Equi Join, Self-Join, Cross Join, Natural Join.

UNIT-VI
Views: Introduction to Views in SQL, Advantages and Disadvantages of Views, Creat Views in SQL, Types of Views, Classifications of Normalization forms in SQL: FIRST, SECOND, THIRD normal forms.

TEXT BOOKS:

1. Data base Management Systems, Raghu Ramakrishna, Johannes Gehrke, TATA McGraw Hill, 2017, 3rd Edition.
2. Data base System Concepts, Silberschatz, Korth, McGraw hill, 2013, 6th Edition.

REFERENCES:

1. Data base Systems design, Implementation, and Management, Peter Rob & Carlos Coronel, 2016, 11th Edition.
2. Fundamentals of Database Systems by Elmasri Navathe, Pearson Education India, 6th Edition, 2013.
3. An Introduction to Database Systems by C.J.Date, Pearson Education India, 7th Edition, 1999.
4. https://www.oreilly.com/library/view/concepts-of-database/9789332537422/xhtml/bibliography.xhtml
5. https://en.wikipedia.org/wiki/Database
6. https://www.sanfoundry.com/best-reference-books-database-management-systems.

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(A0017203) MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS
(Humanities and Social Sciences)
For branches: CE, EEE & ECE

COURSE OBJECTIVES:
- To enhance the knowledge of the students regarding importance of management and managerial problems with optimum solutions
- To provide the knowledge regarding the concept of demand and demand forecasting methods
- To provide the knowledge regarding forms of business organizations
- To provide awareness regarding capital budgeting decisions(long term investment decisions)
- To introduce the concepts –financial accounting and financial analysis
- To give an idea of practicing techniques of ratio analysis

COURSE OUTCOMES:
The student will be able to……
- Identify managerial problems with optimum solutions
- Analyse the demand factors on a product that may be existed/new
- Know various methods of demand forecasting
- Understand different business organizations
- Know the techniques and evolution of capital budgeting
- Understand financial performance through financial statements

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	2	-	-	2	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	1	2	2	-	-	-	-	-
CO5	-	3	2	1	1	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	1	3	-	-	-	-

UNIT I:
INTRODUCTION TO MANAGERIAL ECONOMICS: Definition, nature and scope of managerial economics- relation with other disciplines- Demand Analysis: Demand Determinants, Law of Demand and its exceptions

UNIT II:
ELASTICITY OF DEMAND: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand forecasting, factors governing demand forecasting, methods of demand forecasting (Survey methods, Statistical methods, Expert opinion method, Test marketing, Controlled experiments, Judgmental approach to Demand Forecasting)

UNIT III:
TYPES OF BUSINESS ORGANISATIONS AND NEW ECONOMIC ENVIRONMENT: Characteristic features of business, features and evaluation of sole proprietorship, partnership, Joint Stock Company, public enterprises and their types, changing business environment in post-liberalization scenario.

UNIT IV:
CAPITAL AND CAPITAL BUDGETING: Capital and its significance, types of capital, estimation of fixed and working capital requirements, methods and sources of raising

finance.Nature and scope of capital budgeting, features of capital budgeting proposal, methods of capital budgeting – payback method, accounting rate of return (ARR) and Net present value method (Simple problems).

UNIT V:

INTRODUCTION TO FINANCIAL ACCOUNTING: Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).

UNIT VI:

FINANCIAL ANALYSIS THROUGH RATIOS: Computation, Analysis and Interpretation of financial statements through Liquidity Ratios (Current and Quick ratio), Activity ratios (Inventory Turnover Ratio and Debtor Turnover Ratio), Capital Structure Ratios (Debt- Equity Ratio, Interest Coverage Ratio) and Profitability ratios (Gross Profit Ratio, Net Profit Ratio, Operating Ratio, P/E Ratios and EPS), Du Pont Chart.

TEXT BOOKS:

1. Management Economics and Financial Analysis, Aryasri, 4/e, TMH, 2009.
2. Managerial Economics, Varshney & Maheswari, Sultan Chand, 2009.

REFERENCES

1. Financial Accounting and Analysis, Premchand Babu, Madan Mohan, Himalaya, 2009
2. Managerial Economics and Financial Analysis, S.A. Siddiqui, and A.S. Siddiqui, New Age
3. Principles of Business Economics, Joseph G. Nellis and David Parker, 2/e, Pearson.
4. Managerial Economics in a Global Economy, Domnick Salvatore, Cengage, 2009.
5. Managerial Economics, H.L.Ahuja, 3/e, S.Chand, 2009

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(A0094207) COMPREHENSIVE VIVA-VOCE

There shall be comprehensive Viva-Voce examination at the end of 7th semester. Comprehensive Viva Examination shall be conducted by the committee consisting of senior faculty (based on the recommendation of HOD), an external Examiner from other institutions and HOD and evaluated for 50 marks.

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(A0095207) INDUSTRIAL / RESEARCH INTERNSHIP

COURSE OBJECTIVE:

- To develop competency of applying engineering knowledge to real life problems

COURSE OUTCOMES:

At the end of the project work the students are able to:

- Formulate prototype/models and/or experimental set-up and/or simulation and other systems capable of meeting the objectives.
- Identify methods and materials to carry out experiments/develop code
- Analyse the results to come out with concrete solutions.
- Write a technical report citing relevant information of the project apart from developing a presentation.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	2	1	-	-	-	2	2	-	1	-	1	-
CO2	3	2	-	2	2	-	-	-	-	2	-	-	1	-	2	1
CO3	3	3	-	-	2	1	-	-	-	2	2	-	1	-	1	-
CO4	2	2	-	2	-	-	-	-	-	3	-	1	-	-	2	1

The student has to undergo research / industry internship in III year, II-Semester break for a period of two months in a reputed organization. The finalization of the summer internship organization will be done by HOD, two senior faculty members of the department and same will be recommended to the Principal for approval. The outcome of the research / industry internship will be evaluated during 7th semester which carries 3 credits. Certificate from the organization has to be submitted to this effect attested by HoD and Internship in charge to the academic section.

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L	T	C
0	0	1

(A0096208) TECHNICAL SEMINAR

COURSE OBJECTIVES:

- To understand the basic concepts of technical and practical issues of course specialization
- To import a well-organized report writing skill of technical writing

COURSE OUTCOMES:

At the end of the Seminar the students are able to:

- Identify and compare technical and practical issues related to the area of course specialization
- Outline annotated bibliography of research demonstrating scholarly skills
- Prepare a well-organized report employing elements of technical writing and critical thinking.
- Demonstrate the ability to describe, interpret and analyze technical issues and develop competence in presenting.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	2	2	1	2	2	2	1	2	2	2	1
CO2	1	2	-	2	-	2	1	1	2	1	1	2	2	2	-
CO3	1	2	-	-	-	1	1	2	2	2	1	2	1	2	-
CO4	1	2	1	2	-	1	1	1	2	1	1	1	1	1	2

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L	T	C
0	0	5

(A0097208) INTERNSHIP IN INDUSTRY

COURSE OBJECTIVE:

- To develop competency of applying engineering knowledge to real life problems

COURSE OUTCOMES:

At the end of the project work the students are able to:

- Formulate prototype/models and/or experimental set-up and/or simulation and other systems capable of meeting the objectives.
- Identify methods and materials to carry out experiments/develop code
- Analyse the results to come out with concrete solutions.
- Write a technical report citing relevant information of the project apart from developing a presentation.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	2	1	-	-	-	2	2	-	1	-	1
CO2	3	2	-	2	2	-	-	-	-	2	-	-	1	-	2
CO3	3	3	-	-	2	1	-	-	-	2	2	-	1	-	1
CO4	2	2	-	2	-	-	-	-	-	3	-	1	-	-	2

The student has to undergo 6 months internship in IV year, II-Semester for a complete period of 06 months in a reputed industry/organization. The finalization of the summer internship industry/organization will be done by HOD, two senior faculty members of the department and same will be recommended to the Principal for approval. The outcome of the industry internship will be evaluated during 8^{th} semester which carries 05 credits. Certificate from the organization has to be submitted to this effect attested by HoD and Internship in charge to the academic section.

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L	T	C
0	0	6

(A0098208) PROJECT WORK

COURSE OBJECTIVE:

- To develop competency of applying engineering knowledge to real life problems

COURSE OUTCOMES:

At the end of the project work the students are able to:

- Formulate prototype/models and/or experimental set-up and/or simulation and other systems capable of meeting the objectives.
- Identify methods and materials to carry out experiments/develop code
- Analyse the results to come out with concrete solutions.
- Write a technical report citing relevant information of the project apart from developing a presentation.

MAPPING OF COs & POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	2	1	-	-	-	2	2	-	1	-	1
CO2	3	2	-	2	2	-	-	-	-	2	-	-	1	-	2
CO3	3	3	-	-	2	1	-	-	-	2	2	-	1	-	1
CO4	2	2	-	2	-	-	-	-	-	3	-	1	-	-	2
CO5	3	3	-	-	2	1	-	-	-	2	2	-	1	-	1
CO6	3	2	-	2	2	-	-	-	-	2	-	-	1	-	2

The project topic should be approved by Internal Department Committee (IDC) / Identified by organization where the student is carrying out 6 months internship. Out of total 150 marks for the project work, 50 marks shall be for Internal Evaluation and 100 marks for the End Semester Examination. The evaluation of project work shall be conducted at the end of the IV year II semester. The external project viva voce examination will be conducted by the committee consisting of an external Examiner from other institute, Head of the Department and the supervisor of the project. The Internal evaluation for 50 marks shall be on the basis of one technical seminars (25 marks) and remaining 25 for main project related activities. The Internal evaluation of the project work for 50 marks shall be conducted by the committee consisting of head of the Department or his nominee, senior faculty member and the supervisor of project.

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ACTION FOR IMPROPER CONDUCT IN EXAMINATIONS

S.No	Nature of Malpractices/Improper conduct *If the candidate:*	Punishment
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject onlyof all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection withthe examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has beenimpersonated, shall be cancelled in all the subjects of the examination (including practicals and projectwork) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additionalsheet, during or After the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language inthe answer paper or in letters to the	Cancellation of the performance in that subject.

	Examiners or writes to the Examiner requesting him to award pass marks.	
6.	Refuses to obey the orders of the Chief Superintendent/Assistant–Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair meansor misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not The candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned inclause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examinationhall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the

		remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of Internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Principal or College Academic committee for furtheraction to award suitable punishment.	