Bapatla Engineering College:: Bapatla

(*Autonomous*)

BAPATLA

DEARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

ACADEMIC RULES & REGULATIONS

(R20 REGULATIONS)

(w.e.f 2020-2021)

Four YearsB.Tech.Syllabi

Bapatla Engineering College:: Bapatla

(Autonomous under Acharya Nagarjuna University)

(Sponsored by Bapatla Education Society)

BAPATLA-522102, Guntur District, A.P.

www.becbapatla.ac.in

Bapatla Engineering College:: Bapatla

(Autonomous)

Department of Electrical and Electronics Engineering

COURSE STRUCTURE AND SYLLABAI FOR FOURYEAR B.TECH.

Vision of the Institute

To build centers of excellence, impart high quality education and instil high standards of ethics and professionalism through strategic efforts of our dedicated staff, which allows the college to effectively adapt to the ever-changing aspects of education.

To empower the faculty and students with the knowledge, skills and innovative thinking to facilitate discovery in numerous existing and yet to be discovered the fields of engineering, technology and inter-disciplinary endeavours.

Mission of the Institute

To impart the quality education at par with global standards to the students from all over India and in particular those from the local and rural areas.

To maintain high standards so as to make them technologically competent and ethically strong individuals who shall be able to improve the quality of life and economy of our country.

Vision of the Department

The Department of Electrical &Electronics Engineering provides programs of the highest quality to produce globally competent technocrats who can address challenges of the millennium to achieve sustainable socio - economic development.

Mission of the Department

1. To provide quality teaching blended with practical skills.
2. To prepare the students ethically strong and technologically competent in the field of Electrical and Electronics Engineering.
3. To motivate the faculty and students in the direction of research and focus to fulfill social needs.

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PROGRAM EDUCATIONAL OBJECTIVES (PEO'S)

PEO1	To build a strong foundation in the principles of Basic Sciences, Mathematics and Engineering to solve real world problems encountered in modern electrical engineering and pursue higher studies/ placement/ research.
PEO2	To develop an integration of knowledge of various courses to design an innovative and cost effective product in the broader interests of the organization & society.
PEO3	To provide an ability to lead and work in their profession with multidisciplinary approach, cooperative attitude, effective communication and interpersonal skills by participating in team oriented and open ended activities.
PEO4	To integrate an ability to enhance career development, adapt to changing professional and societal needs by engaging in lifelong learning

PROGRAM OUTCOMES (PO'S)

Program Outcomes		Engineering Graduates will be able to
PO1	Engineering knowledge	Apply the knowledge of mathematics, science, Engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage	Create, select, and apply appropriate techniques, Resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and teamwork	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to com prehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES (PSO'S)

PSO1	Electrical and Electronics Engineering graduates will be able to apply the Knowledge of mathematics and sciences in modern power industry.
PSO2	Electrical and Electronics Engineering graduates will be able to analyse and design efficient systems to generate, transmit, distribute and utilize electrical energy to meet social needs using power electronic systems.
PSO3	Electrical and Electronics Engineering graduates will be able to apply principles of management and economics for providing better services to the society with the technical advancements in renewable and sustainable energy integration.

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Academic Rules & Regulations

(R20 Regulations)
Regulations for Four Year Bachelor of Technology (B.Tech)
Degree Program for the Batches admitted from the academic year 2020-21
(Academic Regulations as amended in November 2021)

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1. **Award of B.Tech. Degree**
   A student will be declared eligible for the award of the B.Tech. degree if he/she fulfils the following academic regulations:

   i. Pursues a course of study for not less than four academic years and in not more than eight academic years. However, for the students availing Gap year facility, this period shall be extended by two years at the most and these two years would not be counted in the maximum time permitted for graduation. A lateral entry student pursues a course of study for not less than three academic years and in not more than six academic years

   ii. Registers for 160 credits and secures all 160 credits. However, a lateral entry student registers for 121 credits and secures all the 121 credits from III semester to VIII semester of Regular B. Tech. program.

   iii. The student will be eligible to get Under graduate degree with Honors or additional minor engineering if he/she completes an additional 20 credits

   iv. A student will be permitted to register either for Honors degree or additional minor engineeringbut not both.

2. Students, who fail to fulfil 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 and their admission stands cancelled. A lateral entry student should complete the course within six academic years from the year of their admission, failing which his/her admission in B.Tech course stands cancelled

3. **Courses of study**
   The following courses of study are offered at present as specializations for the B. Tech. course

S.No.	Title of the UG Programme	Abbreviation
1.	Civil Engineering	CE
2.	Computer Science & Engineering	CS
3.	Electrical & Electronics Engineering	EE
4.	Electronics & Communication Engineering	EC
5.	Electronics & Instrumentation Engineering	EI
6.	Information Technology	IT
7.	Mechanical Engineering	ME
8.	Cyber Security	CB
9.	Data Science	DS

10.	CSE (Artificial Intelligence & Machine Learning)	CM

4. Credits:

i. *Credit:* A unit by which the course work is measured. It determines the number of hours ofinstructions required per week. One credit is equivalent to one hour of teaching (Lecture) or two hours of practical work/field work per week.

ii. *Academic Year:* Two consecutive (one odd + one even) semesters constitute one academic year.

iii. *Choice Based Credit System (CBCS):* The CBCS provides choice for students to select from theprescribed courses.

iv. Each course in a semester is assigned certain number of credits based on following

Description	Hours/Week	Credits
Theory	03	03
Tutorial	01	01
Practical	03	1.5
Internship (At the end of IV & VI evaluated in V & VII resp.)	-	1.5/3.0
Project Work	24	12

5. Course Structure

Every course of the B.Tech program will be placed in one of the 8 categories with suggestedcredits as listed below.

S.No.	Category	Category Description	Abbreviated Category	Credits
1	Humanities and social science	Humanities and social science including Management courses	HS	10.5
2	Basic Sciences	Basic Science courses	BS	21
3	Engineering Science courses	Engineering Science Courses including workshop, drawing, basics of electrical / mechanical / computer etc.	ES	21
4	Professional core	Professional core Courses	PC	54
5	Job Oriented /Open Electives	Emerging and job oriented/ Open Elective Courses- from other technical	JO/OE	12
6	Professional Courses	Professional Elective Courses relevant to chosen specialization/ branch	PE	15
7	Project Work & Internship	Project Work, Seminar, Internship in industry elsewhere	PW/INT	16.5

		Constitution, Essence of Indian Traditional Knowledge (Non-Credit)		
9	Skill Oriented Courses	Skill Oriented Courses relevant to domain, interdisciplinary, communication skill, industry	SO	10
		Total Credits		160

6. Weightage for course evaluation

6.1 Course Pattern

- The entire course of study is for four academic years. Semester pattern shall be followed in all years.
- A student eligible to appear for the end examination in a subject, but absent or has failed in the end examination may appear for that subject at the next supplementary examination when offered.
- When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

6.2 Evaluation Process

The performance of the students in each semester shall be assessed course wise. All assessments will be done on absolute mark basis. However, for the purpose of reporting the performance of a candidate, letter grades and grade points will be awarded.

The performance of a student in each course is assessed with alternate assessment methods, term examinations on a continuous basis during the semester called Continuous Internal Evaluation (CIE) and a Semester End Examination (SEE) conducted at the end of the semester. For each theory, design and/or drawing course, there shall be a comprehensive Semester End Examination (SEE) of three hours duration at the end of each Semester, except where stated otherwise in the detailed Scheme of Instruction.
The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory and 100 marks for practical subject. In addition, Internships carried out after IV Semester & VI Semester shall be evaluated for 100 marks each and the Internship along with Project Work carried out in VIII Semester shall be evaluated for 100 marks. For theory subjects, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination. For practical subjects, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination. For project work, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination / Viva-Voce. The distribution of marks between Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) to be conducted at the end of the semester will be as follows:

Nature of the Course	**CIE**	**SEE**
Theory subjects	30	70
Practical	30	70

Project Work	30	70

6.3 Continuous Internal Evaluation (CIE) in Theory subjects:

6.3.1 In each Semester there shall be two Term examinations and some ***Alternate Assessment Tools (AAT)*** like Home Assignment, Class Test, Problem Solving, Group Discussion, Quiz, Seminar and Field Study in every theory course. The Alternate Assessment Tools with detailed modality of evaluation for each course shall be finalized by the teacher concerned before beginning of the course. It will be reviewed and approved by the Department Committee.

The Term Examination is conducted in the regular mode according to a schedule which will be common for a particular year of study. The maximum weightage for Term Examinations, AATs and the calculation of marks for CIE in a theory course is given in the following Table.

Particulars	**Term Exams (Max. 20 marks)**	**AAT (Max. 10 marks)**
Better Performed exam	75% of marks obtained	Continuous assessment by teacher as per the predetermined course delivery & assessment plan. (Minimum two & maximum four assessments). AAT marks shall be considered based on average of all tests conducted.
Other exam	25% of marks obtained	

A minimum of 15 (50%) marks are to be secured exclusively in the Continuous Internal Evaluation (CIE) in order to be declared as qualified in that course and eligible to write the Semester End Examination (SEE) of that course. If a student fails to obtain 15 marks in CIE, he can register for the course repetition as per the guidelines mentioned in 6.5.

Make up Test:

a) A student can appear for a Make-up Test for **maximum two theory subjects** of a semester to improve marks in the Continuous Internal Evaluation (CIE).

b) A student is eligible for **Make-up test** which is conducted after the second Mid Term examination and before SEE examination if he/she satisfies the following conditions.
   i) Unable to secure 50% internal marks (CIE) and has more than or equal to 50% attendance in a particular theory subject (After finalizing the internal marks).
   ii) Attendance in Remedial classes is more than or equal to 65% (if Remedial classes are conducted) or greater than 50% marks in the I Mid Term Examination and AAT 1 together.
   iii) Attended 50% of CIE tests (at least one AAT & one Mid Term Examinations).

c) The make-up test will be conducted for 30 marks (6 X 1M, 2X 12M) in Mid Examination format covering the entire syllabus and the marks obtained in this test

6.3.2 Semester End Examination (SEE) in Theory and Design Course:

a) For each theory, design and/or drawing course, there shall be a comprehensive Semester End Examination (SEE) of three hours duration at the end of each Semester for 70 marks, except where stated otherwise in the detailed Scheme of Instruction. Question paper setting shall be set by the teacher or teachers together in a multi section courses and to be verified as described in policy document.

b) A minimum of 25 marks are to be secured exclusively in the Semester End Examination (SEE) of theory, design and/or drawing course. However a minimum 40 marks are to be secured in CIE & SEE together for the award of the grade and securing the credits in that course.

6.3.3 Continuous Internal Evaluation (CIE) in laboratory courses:

The evaluation for Laboratory course is based on CIE and SEE. The CIE for 30 marks comprises of 15 marks for day-to-day laboratory work, 5 marks for record submission and 10 marks for a laboratory examination at the end of the semester. In any semester, a minimum of 90% of prescribed number of experiments / exercises specified in the syllabi for laboratory course shall be taken up by the students. They shall complete these experiments / exercises in all respects and get the record certified by the internal lab teacher concerned and the Head of the Department concerned to be eligible to appear for the Final Examination in that laboratory course.

A minimum of 15 (50%) marks are to be secured exclusively in the Continuous Internal Evaluation (CIE) in order to be declared as qualified in that lab course and eligible to write the SEE of that lab course. If a student fails to obtain 15 marks in CIE, he can register for the course repetition as per the guidelines mentioned in 6.5.

6.3.4 SemesterEnd Examination (SEE) in laboratory courses:

a) For each laboratory course, the Semester End Examination (SEE) shall be conducted by one internal and one external examiner appointed by the principal and the duration of the exam shall be for three hours. The SEE is for 70 marks which include 15 marks for write up, 35 marks for lab experiment/exercise, 15 marks for Viva-voce and 5 marks for general impression.

b) A minimum of 25 marks are to be secured exclusively in the Semester End Examination (SEE) of laboratory course. However, a minimum 40 marks are to be secured in CIE & SEE together for the award of the grade and securing the credits in that course.

6.3.5 Evaluation of Summer Internship and Industrial/Research Internship:

a) Summer Internship at the end of IV semester and Industrial/Research Internship at the end of VI carried out in industry are to be evaluated in V & VII semesters respectively based report and certificate provided by the industry. The report and certificate will be evaluated by the department committee for 100 marks. 50 marks shall be for the report and certificate and 50 marks based on seminars/presentation to the department committee by the student.

b) A minimum of 40 (40%) marks are to be secured exclusively to be declared as passed

6.3.6 Evaluation of the Project

a) The evaluation shall be based on CIE and SEE. The CIE is for 30 marks which consists of reviews at the end of each month as per the Process Document in the form of seminars/presentations for 15 marks and the project report submitted at the end of the semester which is evaluated for 15 marks. A minimum of 15 (50%) marks and 50% attendance are to be secured by the student exclusively in CIE in order to be declared as qualified in the project work and eligible to write the SEE in the project work.

b) SEE shall be evaluated in the form of a Viva-Voce and demonstration of the thesis work for 70 marks. Viva-voce Examination in project work shall be conducted by one internal examiner (Member of PWC) and one external examiner to be appointed by the principal. A minimum of 25 marks shall be obtained exclusively in SEE in order to be declared as passed in the Project work.

c) Completion of internships along with Project work in VIII Semester is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student must repeat and complete the internship.

6.4 There shall be mandatory courses with zero credits. There shall be no external examination. However, attendance in the mandatory course shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 50% or more in the internal examinations. In case, the student fails, a re-examination shall be conducted for failed candidates every six months/semester at a mutually convenient date of college/student satisfying the conditions mentioned in item 1 & 2 of the regulations.

6.5 Course Repetition (Repeater course)

The students not qualified to write SEE in a course may register for the repeater courses through course repetition and summer semester. The students have to apply to the Principal through the respective HOD by paying prescribed fees.

Course repetition: A student can take up a maximum of two theory courses in a semester immediately after the semester end examinations of that semester in accordance with the guidelines recommended by the Academic Council. The students who are not taking regular semester courses may additionally register for one more theory course.

The documents for monitoring the candidates registered for course repetition are available with the Heads of the Departments and Exam Section.

6.6 There shall be five Professional Elective Courses from V Semester to VII and for each elective there shall be choices such that the student shall choose a course from the list of choice courses offered by the department for that elective.

6.7 There shall be three Job Oriented elective Courses in all programs from V to VII semester.

One Open Elective course in VII semester will be offered by various departments. The student shall register for open elective in the VII semester offered by other departments insuchamannerthathe/shehasnot studied the same course in any form during theProgram.

The students shall be permitted to pursue up to a maximum of two elective courses (either Professional Elective Courses in clause 6.6 or Open Electives/ Job Oriented Courses in clause 6.7) under MOOCs (Massive Open Online Courses) offered by NPTEL and other reputed organizations as notified by the Department during the semester. Each of the Courses must be of minimum 8/12 weeks in duration. The student must acquire a certificate for the concerned

6.8 Thereshallbe a mandatory**inductionprogram**forthreeweeksbeforethecommencementoffirst semester.

6.9 **Minor in a discipline** (Minor degree/program) concept is introduced in the curriculum for all conventional B. Tech programs in which it offers a major. The main objective of Minor in a discipline is to provide additional learning opportunities for academically motivated students and it is an optional feature of the B. Tech. program.

a. i) Students who are desirous of pursuing their special interest areas other than the chosendisciplineofEngineeringmayoptforadditionalcoursesinminorspecialization 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 CivilEngineering
ii) 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 tracketc.

b. 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, VLSIetc.

c. The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respectiveBOS.

d. 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 theprogram.

e. 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 studentsmaybepermittedtoregisterfortheequivalentMOOCcoursesasapprovedby the concerned Head of the department in consultation withBOS.

f. AstudentshallbepermittedtoregisterforMinorprogramatthebeginningof4th semester provided that the student must have acquired a minimum of **8.0 SGPA** in each semester up to the end of 2nd semester without any backlogs. In case of the declaration of the3rd semester results after the commencement of the 4th semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Minor Program stands cancelled and he/she shall continue with the regular Program. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Minor registration active.

g. 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 Undergraduate Degree in Major Discipline (i.e. 160credits).

h. 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 theProgram.

i. In addition to the 16 credits, students must pursue at least 2 courses through MOOCs.Thecoursesmustbeofminimum8weeksinduration.Attendancewillnotbe monitored

course is a pass/fail course without any grades, the grade to be assigned as decided by the university/academiccouncil.

j. 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 industrialdemand.

k. 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 appropriategrades.

l. 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 ora "pass(P)"gradeandalsochoosetoomitthementionofthecourseasforthefollowing: 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 thetranscript.

m. IncaseastudentfailstomeettheCGPArequirementforB.TechdegreewithMinorat 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 bythem.

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

o. Minimum enrolment for a Minor course to be offered is 12

6.10 Honors degree in a discipline:

StudentsofaDepartment/DisciplineareeligibletooptforHonorsProgram offered by the sameDepartment/Discipline.

a. AstudentshallbepermittedtoregisterforHonorsprogramatthebeginningof4th semester provided that the student must have acquired a minimum of **8.0 SGPA** in each semester up to the end of 2nd semester without any backlogs. In case of the declaration of the3rd semester results after the commencement of the 4th semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Honors Program stands cancelled and he/she shall continue with the regular Program. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Honors registration active

b. Studentscanselecttheadditionalandadvancedcoursesfromtheirrespectivebranchin 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.

c. In addition to fulfilling all the requisites of a Regular B.Tech Program, a student shallearn20additionalcreditstobeeligiblefortheawardofB.Tech(Honors)degree. This is

d. 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 8/12weeks as recommended by the Board ofstudies.
e. 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 advancedcourses.
f. 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 withBOS.
g. Each pool can have theory as well as laboratory courses. If a course comes with a lab component,thatcomponentmustbeclearedseparately.TheconcernedBOSshall explorethepossibilityofintroducingvirtuallabsforsuchcourseswithlabcomponent. (Model pool list is enclosed in theAnnexure-2).
h. MOOC courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Students must acquire a certificate from the agencies approvedbytheBOSwithgradingormarksorpass/failinordertoearncredits.Ifthe MOOCcourseisapass/failcoursewithoutanygrades,thegradetobeassignedwillbe as decided by the BOS/academiccouncil.
i. The concerned BOS shall also consider courses listed under professional electives of therespectiveB.TechprogramsfortherequirementsofB.Tech(Honors).However,a student shall be permitted to choose only those courses that he/she has not studied in any form during theProgram.
j. 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 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.
k. 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 DegreewithHonorsandtheywillreceiveregularB.Techdegreeonly.However,such students will receive a separate grade sheet mentioning the additional courses completed bythem.
l. Honors must be completed simultaneously with a major degree program. A student cannot earn Honors after he/she has already earned bachelor'sdegree.

6.11 National Service Scheme (NSS)/YogaiscompulsoryforalltheUndergraduatestudents.Thestudentparticipationshallbefor aminimumperiodof45hoursduringthefirstyear.
GradeswillbeawardedasVeryGood,Good,Satisfactory in the mark sheet on the basis of participation, attendance, performance and behaviour. If a student gets Un-satisfactory grade,he/shehastorepeat theaboveactivityinthesubsequentyears along with the next yearstudents.

6.12 Students shall undergo two summer internships eachfor a minimum of sixweeks durationattheendofsecondandthird years of the program for 1.5 credits & 3 credits respectively.The organization in which the student wishes to carry out Internship need to be approved by Internal Department Committee comprising Head of Department and two senior faculty members.The student shall submit a detailed technical report along with internship certificate from the Internship organization in order to obtain the prescribed credits. The student shall submit the Internship Report along with Certificate of Internship. The evaluation of the first and second summer internships shall be conducted at the end of the V Semester & VII semester respectively.

There shall be internal evaluation for 100 marks and there shall not be external evaluation. The Internal Evaluation shall be made by the departmental committee (Head of the Department and two senior faculty of the department) on the basis of the internship report submitted by the student.

Completion of the internship is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such a case, the student shall repeat the internship in the subsequent summer provided that the student doesn't pursue two summer internships in the same summer.

Community Service Project focussing on specific local issues shall be an alternative to the six weeks of summer Internship, whenever there is any emergency and when students cannot pursue their summer internships. The Community Service Project shall be for 6 weeks in duration which includes preliminary survey for 1 week, community awareness programs for one week, community immersion program in consonance with Government agencies for 3 weeks and a community exit report (a detailed report) for one week. The community service project shall be evaluated for 100 marks by the internal departmental committee comprising Head of the Department and two senior faculty of the department. **However, the first priority shall be given to the internship.**

6.13 There shall also be a mandatoryfullinternshipinthefinalsemester (VIII Semester) oftheProgramalongwiththeproject work. The organization in which the student wishes to carry out the Internship need to be approved by Internal Department Committee comprising Head of the Department and two senior faculty. The faculty of the respective department monitors the student internship program along with project work. At the end of the semester, the candidate shall submit a certificate of internship and a project report. The project report and presentation shall be internally evaluated for 30 marks by the departmental project work committee. The Viva-Voce shall be conducted for 70 marks by a Project work committee and an External Examiner.

Completion of internship is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such a case, the student shall repeat the internship along with project work for next six months.

6.14 There shall be five skill-oriented courses offered during III semester to VII semester. Out ofthefiveskillcourses,twoshallbeskill-orientedprogramsrelatedtothedomainand these two shallbe completedinsecondyear.Of the remaining three skill courses, one shall 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.

The student can choose between a skill advanced course being offered by the college or to choose a certificate course being offered by industries/Professional bodies/APSSDC or any other accredited bodies which are duly approved by the Internal Department

Course Completion Certificatefromtheagencies / professionalbodies.
The Internal Department Committee comprising Head of Department and two senior faculty shall evaluate the grades / marks awarded for a course by external agencies and convert to the equivalent marks / grades.

7. Attendance Requirements:

- A student shall be eligible to appear for semester end examinations (SEE), if he/she acquires a minimum of 75% of attendance in aggregate of all the subjects in a semester.
- Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted on medical ground duly approved by the principal.
- Shortage of Attendance below 65% in aggregate shall in NO case be condoned.
- Further the student must obtain a minimum of 50% attendance in each subject failing which; the student shall not be permitted to write the SEE of that subject. Student has to register this subject through course repetition and satisfy the CIE qualification criteria of attendance and marks in the subsequent semesters.
- 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.
- A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester when offered next.
- A stipulatedfeeshallbepayabletowardscondonationofshortageofattendance to the college.

8. Minimum Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.7.

8.1 A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project, if he/she secures not less than 15 marks in CIE and 25 marks in SEE. In case of, internships, project work viva – voce, he/she should secure 40% of the total marks. For mandatory courses minimum 15 marks in CIE are to be secured.

8.2 B.Tech students: A student shall be promoted from II to III year only if he/she fulfils the academic requirement of securing 40% of the credits in the subjects that have been studied up to III Semester from the following examinations.

- One regular and two supplementary examinations of I Semester.
- One regular and one supplementary examination of II Semester.
- One regular examination of III semester.

Lateral Entry students: A student shall be promoted from II to III year only if he/she fulfils the academic requirement of securing 40% of the credits in the subjects that have been studied up to III Semester from the following examinations.

- One regular examination of III semester.

8.3 B.Tech students: A student shall be promoted from III year to IV year only if he/she

whether the candidate takes the end examination or not as per the normal course of study.

- ✓ One regular and four supplementary examinations of I Semester.
- ✓ One regular and three supplementary examinations of II Semester.
- ✓ One regular and two supplementary examinations of III Semester.
- ✓ One regular and one supplementary examinations of IV Semester.
- ✓ One regular examination of V Semester.

Lateral entry students: A student shall be promoted from III year to IV year only if he/she fulfils the academic requirements of securing 40% of the credits in the subjects that have been studied up to V semester from the following examinations, irrespective of whether the candidate takes the end examination or not as per the normal course of study.

- ✓ One regular and two supplementary examinations of III Semester.
- ✓ One regular and one supplementary examinations of IV Semester.
- ✓ One regular examination of V Semester.

If a student is detained for want of credits for particular academic year by sections 8.2 and 8.3 above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V Semester or VII Semester as the case may be.

8.4 A student shall register and put up minimum attendance in all 160 credits and earn all the 160 credits. Marks obtained in all 160 credits shall be considered for the calculation of aggregate percentage of marks obtained. In case of lateral entry students, the number of credits is 121.

8.4.1 Students who fail to earn 160 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.
Lateral entry students who fail to earn 121 credits as indicated in the course structure within six academic years from the year of their admission shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.

9. Course Pattern:

(i) A student eligible to appear for the end examination in a subject, but absent or has failed in the end examination may appear for that subject at the next supplementary examination when offered.
When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

(ii) **With–holding of Results**
If any case of indiscipline or malpractice is pending against candidate, the result of

next higher semester. The issue of awarding degree is liable to be withheld in such cases.

(iii) **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 fall.

Table – Conversion into Grades and Grade Points assigned

Range in which the marks in the subject fall	Grade	Grade Points Assigned
≥ 90	S (Superior)	10
80-89	A (Excellent)	9
70-79	B (Very Good)	8
60-69	C (Good)	7
50-59	D (Average)	6
40-49	E (Below Average)	5
< 40	F (Fail)	0
Absent	Ab (Absent)	0

A student obtaining Grade F shall be considered failed and will be required to reappear for that subject when the next supplementary examination offered. Same is the case with a student who obtains 'Ab' in end examination.

For **mandatory** courses "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

10. Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)

(i) The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.,

$$\text{SGPA} = \frac{\sum_{i=1}^{n} C_i \times GP_i}{\sum_{i=1}^{n} C_i}$$

where, C_i is the number of credits of the i^{th} subject and GP_i is the grade point scored by the student in the i^{th} course.

(ii) The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.,

$$\text{CGPA} = \frac{\sum_{j=1}^{m} SGPA_j \times TC_j}{\sum_{j=1}^{m} TC_j}$$

where "$SGPA_j$" is the SGPA of the j^{th} semester and TC_j is the total number of credits in that semester.

(iii) Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

(iv) While computing the SGPA, the subjects in which the student is awarded Zero grade points will also be included.

(v) Grade Point:It is a numerical weight allotted to each letter grade on a 10-point scale.

(vi) Letter Grade:It is an index of the performance of students in a said course. Grades are denotedby letters S, A, B, C, D, E and F.

11. Award of Class

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

Class Awarded	CGPA Secured
First Class with Distinction	≥ 7.5
First Class	≥ 6.5 < 7.5
Second Class	≥ 5.5 < 6.5
Pass Class	≥ 5.0 < 5.5

12. Gap Year

Gap year concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after II year to pursue entrepreneurship full time. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. An evaluation committee shall be constituted by the College to evaluate the proposal submitted by the student and the committee shall decide whether or not to permit the student(s) to avail the Gap Year.

13. Transitory Regulations

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the 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, and they will be in the academic regulations into which they get readmitted.

they will be in the academic regulations into which the candidate is presently re-joining.

14. Minimum Instruction Days

The minimum instruction days including exams for each semester shall be 90 days.

15. Medium of Instruction

The Medium of Instruction is **English** for all courses, laboratories, internal and external examinations and project reports.

16. Rules of Discipline

(i) Use of mobile phones with camera, in the campus is strictly prohibited.
(ii) Students shall behave and conduct themselves in a dignified and courteous manner in the campus/Hostels.
(iii) Students shall not bring outsiders to the institution or hostels.
(iv) Students shall not steal, deface, damage or cause any loss to the institution property.
(v) Students shall not collect money either by request or coercion from others within the campus or hostels.
(vi) Students shall not resort to plagiarism of any nature/extent. Use of material, ideas, figures, code or data without appropriate acknowledgement or permission of the original source shall be treated as cases of plagiarism. Submission of material, verbatim or paraphrased, that is authored by another person or published earlier by oneself shall also be considered as cases of plagiarism.
(vii) Use of vehicles by the students inside the campus is prohibited.
(viii) Any conduct which leads to lowering of the esteem of the organization is prohibited.
(ix) Any material to be uploaded to social media sites need to be approved by Head of the Department concerned/Dean/Principal.
(x) Any student exhibiting prohibited behaviour shall be suspended from the institute. The period of suspension and punishment shall be clearly communicated to the student. The student shall lose the attendance for the suspended period.

(xi) Dress Code
Boys : All the boy students should wear formal dresses. Wearing T-shirts and other informal dresses in the campus is strictly prohibited.
Girls : All the girls students shall wear saree / chudidhar with dupatta

17. Punishments for Malpractice cases – Guidelines

The examinations committee may take the following guidelines into consideration while dealing with the suspected cases of malpractice reported by the invigilators/squad members etc, during end examinations. The punishment may be more severe or less severe depending on the merits of the individual cases.

S.No.	Nature of Malpractice/Improper conduct	Punishment
1	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers	Expulsion from the examination hall and cancellation of the performance in that course only.

	course 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 student which can be used as an aid in the course of the examination).	
2	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course.
3	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that semester/year examinations.
4	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any other student 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 course only of all the students involved. In case of an outsider, he will be handed over to the police and a case shall be registered against him.
5	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses including practical examinations and project work of that semester/year.
6	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses including practical examinations and project work of that semester/year.
7	Smuggles in the Answer book or takes out or arranges to send out the question paper during the examination or answer book during or after the examination	Expulsion from the examination hall and cancellation of performance in that course and all the other courses including practical examinations and project work of that semester/year. The student is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeit of seat.

	Chief 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 means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	be expelled from examination halls and cancellation of their performance in that course and all other courses of that semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case shall be registered against them.
9	Leaves the exam hall taking away answer script or intentionally tears up the script or any part there of inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses including practical examinations and project work of that semester/year. The candidate is also debarred for two consecutive semesters from classwork and all end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
10	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses including practical examinations and project work of that semester/year. The student is also debarred and forfeits the seat.
11	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in S.No7 to S.No	For Student of the college: Expulsion from the examination hall and cancellation of the performance in that course and all other courses including practical examinations and project work of that semester/year. The candidate is also debarred and forfeits

		and, a police case shall be registered against them.
12	Impersonates any other student in connection with the examination	The student who has impersonated shall be expelled from examination hall. The student is debarred from writing the remaining exams, and rusticated from the college for one academic year during which period the student will not be permitted to write any exam. If the imposter is an outsider, he will be handed over to the police and a case shall be registered against him. The performance of the original student who has been impersonated, shall be cancelled in all the courses of the examination including practicals and project work of that semester/year. The student is rusticated from the college for two consecutive years during which period the student will not be permitted to write any exam. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
13	If any malpractice is detected which is not covered in the above S.No 1 to S.No 12 items, it shall be reported to the college academic council for further action and award suitable punishment.	
14	Malpractice cases identified during sessional examinations will be reported to the examination committee nominated by Academic council to award suitable punishment.	

18.0ADDITIONAL ACADEMIC REGULATIONS:

18.1 Any attempt to impress upon the teachers, examiners, faculty and staff of Examinations, bribing for either marks or attendance will be treated as malpractice.

18.2 When a component of Continuous Internal Evaluation (CIE) or Semester End Examination (SEE) is cancelled as a penalty, he/she is awarded zero marks in that component.

19.0 **AMENDMENTS TO REGULATIONS:**

The Academic Council of Bapatla Engineering College (Autonomous) reserves the right to revise, amend, change or nullify the Regulations, Schemes of Examinations and / or Syllabi, Academic schedules, Examination schedules, Examination pattern, Moderation to students, Special opportunity to complete degree beyond stipulated time and any other matter pertained that meets to the needs of the students, society and industry without any notice and the decision is final.

Discipline and Code of Conduct for Students

The following are some of the important rules of discipline. All students are required to be aware of and act consistently with these values.

1. Students must punctually attend all lectures, practicals, tutorials, assignments, tests, examinations, etc. A student whose attendance and/or progress in the various tests and examinations are not satisfactory and who does not perform the required number of assignments, tutorials and/or practicals are likely to lose their terms. Prolonged absence even on ground of ill health may also lead to loss of terms. Defaulters will not be sent up for Final /University Examinations.
2. The identity card is meant for identifying bonafide students and is used for permitting the students to participate in various activities and programs of the college. Every student must wear Identity card as long as he/she is in the college campus. It must be produced by the student whenever demanded by the member of the teaching or non-teaching staff of the college. Every student must wear his/her Identity card in the college every day. He/She must take proper care of it to avoid its misuse by other students and outsiders. In case the Identity card is lost, the matter should be immediately reported to the Principal and an application should be made for a duplicate Identity card, which will be issued on payment of charges.
3. The conduct of the students in the classes and in the premises of the college shall be such as will cause no disturbance to teachers, fellow students or other classes.
4. Every student shall wear a clean formal dress while coming to the college also when representing the college for various activities out station.
5. No Society or Association shall be formed in the College and no person should be invited in the college campus without the specific permission of the Principal.
6. No student is allowed to display any Notice/Circular/Poster/Banner in the College premises without the prior permission of the Principal.
7. Using foul languagein the college campus is prohibited. If any student is caught using foul language, disciplinary action shall be initiated against the student.
8. Use of **BEC name tag or logo** by the students for their caste, political, religious, personal reasons is prohibited. Further placing banners on caste, political, religious, personal reasons, promoting cinema heroes & political leaders, taking possessions and burning fire crackersin front of the collegeis strictly prohibited. If any student is involved in such activities in and around the campus, severe disciplinary action will be taken including rusticating from the college and filing a criminal case.
9. Outsiders are not permitted in the college premises without the prior permission of the Principal. College students are not allowed to bring their relatives/friends to the college premises without the permission of the principal.
10. All meetings, cultural programs, debates, elocutions etc. organized on the college premises must be held in presence of teaching staff members and with the prior permission of the Principal. The subjects of debates/elocutions must have the prior approval of the principal

11. Conducting fresher's meet, farewell meets etc. by the students outside the campus are prohibited. If any student is involved in such activities (organizing as well as participating), severe disciplinary action will be taken including rusticating from the college.
12. Students must take proper care of the college property. Strict action will be taken against students damaging College property and will be required to compensate the damage.
13. Students should not be involved in academic offences including cheating or plagiarism in academic course work malpractices at the College/Board/University Examinations
14. Smoking is strictly prohibited in the college premises.
15. If, for any reason, the continuance of a student in the College is found detrimental to the best interest of the college, the Management may ask the student to leave the college without assigning any reasons and the decision will be final and binding on the student.
16. Playing music on Transistors, Tape-Recorders, Car Stereos, Mobile phones or any other similar gadgets with or without earphones is strictly prohibited in the college premises. Defaulters will be punished and their instrument shall be confiscated.
17. Use of Mobile phones is strictly prohibited in the academic area of the college, Defaulters will be penalized and their instrument confiscated.
18. Students who are travelling to college on personal vehicles (2/4 wheelers) need to have valid driving license issued by RTO and follow all the rules listed by RTO. Students have to park the vehicle in the parking area of the college.
19. Students must not hang around in the college premises while the classes are at work.
20. Students must not attend classes other than their own without the permission of the authority concerned.
21. Students shall do nothing inside or outside the college that will interface with the discipline of the college or tarnish the image of the college.
22. Students are not allowed to communicate any information about college matters to Press.
23. Matters not covered above will be decided at the discretion of the Principal.

Acts of misbehavior, misconduct, indiscipline or violation of the Rules of Discipline mentioned above liable for one more punishments as stated below:

A. Warning to the students.
B. Warning to the student as well as inform the parents.
C. Imposition of a fine.
D. Denial of gymkhana, library, laboratory, N.C.C., N.S.S. student aid or any other facility for a specified period or for the whole Term/Year.
E. Expulsion from College for a specified period
F. Cancellation of Terms.
G. Refusal of admission in the term or academic year.
H. Cancellation of admission.
I. Rustication.

Anti Ragging Rules and Regulations
(As per AICTE Norms)

1. What constitutes Ragging: - Ragging constitutes one or more of any of the

a. any conduct by any student or students whether by words spoken or written or by an act which has the effect of teasing, treating or handling with rudeness a fresher or any other student;
b. indulging in rowdy or undisciplined activities by any student or students which causes or is likely to cause annoyance, hardship, physical or psychological harm or to raise fear or apprehension thereof in any fresher or any other student;
c. asking any student to do any act which such student will not in the ordinary course do and which has the effect of causing or generating a sense of shame, or torment or embarrassment so as to adversely affect the physique or psyche of such fresher or any other student;
d. any act by a senior student that prevents, disrupts or disturbs the regular academic activity of any other student or a fresher;
e. exploiting the services of a fresher or any other student for completing the academic tasks assigned to an individual or a group of students.
f. any act of financial extortion or forceful expenditure burden put on a fresher or any other student by students;
g. any act of physical abuse including all variants of it: sexual abuse, homosexual assaults, stripping, forcing obscene and lewd acts, gestures, causing bodily harm or any other danger to health or person;
h. any act or abuse by spoken words, emails, posts, public insults which would also include deriving perverted pleasure, vicarious or sadistic thrill from actively or passively participating in the discomfiture to fresher or any other student;
i. any act that affects the mental health and self-confidence of a fresher or any other student with or without an intent to derive a sadistic pleasure or showing off power, authority or superiority by a student over any fresher or any other student.

2. Actions to be taken against students for indulging and abetting ragging in technical institutions Universities including Deemed to be University imparting technical education:-

a) The punishment to be meted out to the persons indulged in ragging has to be exemplary and justifiably harsh to act as a deterrent against recurrence of such incidents.
b) Every single incident of ragging a First Information Report (FIR) must be filed without exception by the institutional authorities with the local police authorities.
c) The Anti-Ragging Committee of the institution shall take an appropriate decision, with regard to punishment or otherwise, depending on the facts of each incident of ragging and nature and gravity of the incident of ragging.
d) Depending upon the nature and gravity of the offence as established the possible punishments for those found guilty of ragging at the institution level shall be any one or any combination of the following:-

(iii) Withholding/withdrawing scholarship/fellowship and other benefits
(iv) Debarring from appearing in any test/examination or other evaluation process
(v) Withholding results
(vi) Debarring from representing the institution in any regional, national or international meet, tournament, youth festival, etc.
(vii) Suspension/expulsion from the hostel
(viii) Rustication from the institution for period ranging from 1 to 4 semesters
(ix) Expulsion from the institution and consequent debarring from admission to any other institution.
(x) Collective punishment: when the persons committing or abetting the crime of ragging are not identified, the institution shall resort to collective punishment as a deterrent to ensure community pressure on the potential raggers.

Guidelines for Remedial Classes and Make-up Test (R20 Regulations)

The guidelines for conducting the remedial classes:

d) Faculty need to identify the underperforming students in their respective subject. An underperforming student is one, whose marks less than 50% in the I Mid Term Examination and AAT 1 together. A list of such students should be prepared by the faculty soon after the I Mid Term examination is over and get it signed by the concerned HOD.
e) Faculty should conduct remedial classes for the underperforming students with an objective of improving their marks in the CIE. Minimum number of remedial classes to be taken should be 20% of the classes taken prior the I Mid Term Examination which is 6 classes. Teaching methodology is left to the faculty member, but he/she should keep the objective in mind.
f) Regular students who could not appear for the I Mid Term Examination and AAT (with genuine reason) should appear to the remedial classes with the prior permission of the HOD.
g) The entire process of conduct of remedial classes should be well documented and is subjected to academic audit.

The guidelines for conducting the Make-up test:

h) A student can appear for a Make-up Test for **maximum two theory subjects** of a semester to improve marks in the Continuous Internal Evaluation (CIE).
i) A student is eligible for **Make-up test** which is conducted after the second Mid Term examination and before SEE examination if he/she satisfies the following conditions.

iv) Unable to secure 50% internal marks (CIE) and has more than or equal to 50% attendance in a particular theory subject (After finalizing the internal marks).
v) Attendance in Remedial classes is more than or equal to 65% (if Remedial

vi) **Attended 50% of CIE tests (at least one AAT & one Mid Term Examinations).**

j) The make-up test will be conducted for 30 marks (6 X 1M, 2X 12M) in Mid Examination format covering the entire syllabus and the marks obtained in this test are final. However, the maximum marks awarded will be 15 only.

k) The eligible students have to apply by paying a fee prescribed by the institution and submit the application along with a letter of request indicating the genuineness of his/her candidature to be eligible for the make-up test. Applications should be approved by the concerned HOD. After approval from the HOD the concerned department will conduct the make-up test and send the updated CIE marks to COE immediately.

APPLICATION FOR MAKE-UP TEST

Date:

1. Name of the Candidate :
2. Register Number :
3. Academic Year :
3. Branch :
4. Year & Semester of Study :
5. Student Mobile No. :

Make-up test Applied For:

S.No.	Sub Code	Subject Title	% of Subject Attendance in Regular Classes	CIE Marks				(To be filled by the concerned subject faculty)	
				AAT-1	Mid-1	AAT-2	Mid-2	% Attendance in Remedial Classes*	Signature
01									
02									

* Write 'NA' if the student name is not in the remedial class list.

Signature of the Student Signature of the HOD

Fee Particulars:

The make-up test fee has to be paid through HDFC payment gateway and a printout of the receipt has to be taken. The student has to submit the office copy of the receipt in the COE office, get the signature and has to submit the signed application form along with student copy of the receipt in the department.

Amount paid in Rs	Date of payment	Signature of Exam Section Clerk

Note:

1. As per the "Make-up test guidelines", the eligible students have to fill this form, with the signature of the concerned subject faculty and the HOD.
2. After making the payment, the filled form along with a photocopy of the payment receipt has to be submitted in the department.
3. The make-up test will be scheduled and conducted by the department.

Guidelines for Internships

As per R20 guidelines, every student has to undergo internship twice, once between IV and V semester, the other between VI and VII Semester. The first internship is for a duration of 4 weeks and the second internship is for a duration of 6 weeks.

There shall be a departmental internship committee consisting of the Head of the Department and two faculty members nominated by the HOD. The committee shall identify the potential organizations which can provide internship opportunity to the students. The department shall enter into an MOU with the concerned organization and the details will be shared with the students.

The students shall be informed to apply for undergoing internship in the specified proforma. The details and consent of the organization in which he/she is seeking for internship are to be furnished. Further, the student along with the parent must submit an undertaking form. The committee shall scrutinize the applications and approve the same. If a student fails to acquire internship, he/she may be permitted to undergo equivalent work (mini project, research project, fabrication work, field work, research paper, etc.,) in the department under the guidance of a faculty member.

After the completion of the internship, the student must submit the report and attend a departmental internal assessment for award of grade and credits.

Internship Approval Proforma

Name of the Department
Name of the Student
Registered No
Email id
Mobile No
Academic Year

Internship Details

Internship Organization
Duration in weeks
Start Date of Internship
End Date of Internship
Probable Date of Certificate Submission

Note:
1. The consent letter from the organization is to be enclosed
2. Undertaking form from the student and parent

Signature of the Student

Recommendations of the Internship Committee:

Signature of the Head of the Department

Guidelines for Massive Open Online Courses (MOOCs)

1. Head of the department should constitute a three member MOOC committee under his chairmanship along with two more members.

2. The committee should take the responsibility of

(i) Notifying the MOOC courses twice in a semester (May and November) along with the details of portals offering the MOOC such as NPTEL/SWAYAM.

(ii) Checking the relevance of courses to the concerned branch.

(iii) Verifying the syllabus of chosen MOOC course and to ensure that it is not studied in the regular curriculum (either full or partial)

3. A student willing to take MOOCS course should apply in the prescribed format to the concerned Head of the Department at least one week prior to the commencement of the MOOC course.

4. The MOOC committee should ensure the following

(i) The course duration must be minimum of 12 weeks

(ii) The course should contain a proctored examination for evaluation

(iii) The agency offering MOOCs should be a recognized and reputed one and approved bv

5. Students should submit the Course completion certificate with marks memos to the department MOOCs committee.

6. If the certifying authority/agency is not able to conduct the exam, then the student can show certified course progress, applied hall ticket and mail communication from the authority as proofs and can avail the extension time by one semester for submitting the course completion certificate.

7. After the student submits the MOOCs certificates, the committee should recommend 3 credits and the appropriate grade to be allocated to the student and send to the Controller of Examination.

8. If a student fails to successfully complete and acquire the certificate as per the guidelines and timelines specified by the concerned MOOCs authority, he/she has to register for that course subsequently. Unsuccessful candidates in the first attempt shall be marked as supplementary.

MOOCS APPLICATION

Date:

Name of the department:
Name of the Student:
Registered No:
Email id:
Mobile No:
Academic Year & Semester

S.No	Course Title	MOOCS Agency	Duration in Weeks	Course Start & End date	Probable Date of Certificate Submission	MOOCs Course in lieu of (Professional Elective/Job Oriented)	Remarks

Note: Syllabus, Timelines and Guidelines of the MOOC course should be attached.

Signature of the Student

Recommendations of the MOOCs Committee:

Signature of the Head of the Department

Guidelines for Project work

1. In R20 regulations, there is no theory or practical courses in VIII semester. An exclusive 12 credit course is included as Project Work and Internship. The student should mandatorily undergo internship as well as project work parallelly. At the end of the semester the student should submit an internship completion certificate along with a project report. A student shall also be permitted to submit project report on the work carried out during the internship.

2. The departmental internship committee is advised to strictly adhere to the established guidelines for internships. Furthermore, it is recommended that internships for students be limited to organization/ industry authorized by **APSCHE/AICTE INTERNSHIP PORTAL/PUBLIC SECTOR ORGANIZATIONS**. This restriction applies to both online and offline internship opportunities.

3. The Head of the department should constitute a three-member Project Work Committee (PWC) under his chairmanship with three faculty members as defined in the Process Document for project work (R20 regulation). The PWC shall adhere to the process explained in the said document.

4. Evaluation of the Project work:
   i) The evaluation shall be based on CIE and SEE. The CIE is for 30 marks which consists of reviews at the end of each month as per the Process Document in the form of seminars/presentations for 15 marks and the project report submitted at the end of the semester which is evaluated for 15 marks. A minimum of 15 (50%) marks and 50% attendance are to be secured by the student exclusively in CIE in order to be declared as qualified in the project work and eligible to write the SEE in the project work.
   ii) SEE shall be evaluated in the form of a Viva-Voce and demonstration of the thesis work for 70 marks. Viva-voce Examination in project work shall be conducted by one internal examiner (Member of PWC) and one external examiner to be appointed by the principal. A minimum of 25 marks shall be obtained exclusively in SEE in order to be declared as passed in the Project work.
   iii) Completion of internships along with Project work in VIII Semester is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student has to repeat and complete the internship.
5. The project work committee should ensure the following, if the students are doing project work at any organization/ industry.
   i) The student gets placement before commencement of eighth semester and joined the organization/Industry as advance placement. The student who

ii) The above students will be informed to apply in the specified proforma for approval to undergo for project work along with the details and consent of the organization in which he/she is seeking for doing project work. Further, the student and the parent/guardian have to submit an undertaking form to the concerned department. The PWC shall scrutinize the applications and approve.

iii) The list of such approved students undertaking project work in organization/ industry shall be maintained in the department by the PWC.

iv) The students who are undertaking the project work out side the campus have to necessarily submit the monthly attendance duly certified by the concerned authority in the organization/ industry.

v) The PWC will have to maintain interaction regularly with the out-side organization/ concerned who are offering the project works.

vi) During the course of project work, the student has to attend the departmental internal reviews/assessment periodically as notified by the department mandatory. After the completion of the project work, the student has to submit the report and attend semester end assessment examination by paying prescribed exam fee for award of grade and credits.

vii) The students who are undertaking the project work outside the campus will have to complete their project work with in the stipulated period (as per Academic Calander) along with the inhouse project work students and also submit the internship completion certificate at the end of the semester.

Project work Approval Proforma

Date:

Name of the Department	
Name of the Student	
Registered No.	
Email id	
Mobile Number	
Academic Year and Semester	

Project Work Details:

Organization/Industry Name	
Duration in weeks	
Start Date of Project work	
End Date of Project work	
Probable Date of Project work completion Certificate Submission	

Note: 1. The Consent letter from the organization/Industry is to be enclosed.

Signature of the Student

Recommendations of the Project work Committee (PWC):

Signature of the Project Coordinator

Signature of the Head of the Department

Process document for Project work

As per the R20 regulations, students are required to do a project work in the VIII semester and submit a report. The following is the process to be followed for the project work.

A. Projects Batches and Guide allocation

1) The Head of the department should constitute a three-member Project Work Committee (PWC) under his chairmanship with three faculty members. One of them shall be a senior faculty member and acts as a Project Coordinator.
2) List of faculty members and their specializations, research areas will be communicated to the students. The information is disseminated via email, notice boards and display on the website. List of projects and their titles/themes should be identified and same may be communicated to all the students. Project batches are formed based on the performance of the students up to VI semester.
3) Students are given an option of specifying their choices for the project titles/guides and the final allocation of guides to project batches is done based on the merit order and the choices opted by the project batches.
4) It is to be ensured that no project batch should have more than 4 students.
5) Not more than two batches should be allocated to each project guide.

B. Project classification and mapping with program outcomes and program specific outcomes.

Projects may be broadly classified into the following categories.

1. Application oriented: When the project is related to hardware, then all the components are procured and assembled to get the desired outcome. If it is related to software, then a complete working version of the application is to be created.
2. Research oriented: In this category extensive review of literature is done. This aims to learn and implement new methods or procedures and validate results.
3. Simulation projects: These projects may be hardware or software related. The students will create a working prototype for the same.

- The PWC should ensure that the projects are selected in such a way that the program outcomes and program specific outcomes are mapped with the themes of the project works.
- A document consisting of project titles, area of specialization, project guides should be prepared and submitted to the concerned HOD and should be put on the website. The themes of the works may be changed with the consent of the project guide.

1) Project slots (24 hours per week) should be allocated as per the existing scheme and curriculum.
2) A laboratory or a class room should be identified for executing the project works. It is preferred to have a separate laboratory for the purpose of conducting the project works.
3) Each project batch is allowed to consult their respective guide to discuss about their Progress during the project slot.
4) At the end of every month there will be an overall assessment of each project by the PWC by scheduling project reviews in association with project guides.
5) The performance of the students should be evaluated in each review and should be documented.
6) Department staff meeting should be conducted to discuss the performance of the students in the projects and should be documented.

D. Methodology to assess individual as well as collective Contribution/understanding of Project:

1. The project guide should monitor the presence (attendance) of each student in the project work
2. The project guide should ensure that the batch allocated to him is able to understand the objectives of the project. The guide should also identify the requirements (hardware and software) of the project. If a particular software or hardware is not available, same may be communicated to the HOD and may be procured based on the financial and budgetary requirements.
3. Evaluation of the project is based on
4. Understanding the objectives of the project.
5. Day to day work done by the students (Should be documented)
6. Partial/Full completion of the project
7. Students presentation and demonstration
8. Results and documentation
9. Evaluation is intimated to the students for further improvement

F. Papers published/Awards won/conferences attended

1. It is encouraged for every project batch to publish/communicate a paper in any national/ international conference/journal. The project guide may encourage the students so that the work of their batch is published as a research paper.
2. Students must be given some awareness/training program for effective writing of a research paper. The research papers should be checked with anti-plagiarism software before the submission to the concerned journal or conference.
3. A report should be prepared by the concerned coordinator comprising all the research papers published and should be made available in the library and soft copies must be put on the website for availability to the students.

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Department of Electrical & Electronics Engineering
Course Structure Summary

S.No.	Category	Category Description	Abbreviated Category	Credits
1	Humanities and social science	Humanities and social science including Management courses	HS	10.5
2	Basic Sciences	Basic Science courses	BS	21
3	Engineering Science courses	Engineering Science Courses including workshop, drawing, basics of electrical / mechanical / computer etc.	ES	24.5
4	Professional core	Professional core Courses	PC	50.5
5	Job Oriented /Open Electives	Emerging and job oriented/ Open Elective Courses- from other technical	JO/OE	12
6	Professional Courses	Professional Elective Courses relevant to chosen specialization/ branch	PE	15
7	Project Work & Internship	Project Work, Seminar, Internship in industry elsewhere	PW/INT	16.5
8	Mandatory courses	Environmental Studies, Induction training, Universal human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge (Non-Credit)	MC	0
9	Skill Oriented Courses	Skill Oriented Courses relevant to domain, interdisciplinary, communication skill, industry	SO	10
		Total Credits		160

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SCHEME OF INSTRUCTION & EXAMINATION (Semester System)

For

Electrical and Electronics Engineering

First Year B.Tech(SEMESTER – I)

Effects from A.Y 2020-21(R20 Regulation)

Course Code	Category	Course title	Scheme of Instruction (Hours per week)					Scheme of Examination (Maximum marks)			No. of Credits
			L	T	PS	P	Total	CIE	SEE	Total	
20EE101/MA01	BS	Linear algebra and ordinary differential equations	2	1	0	0	3	30	70	100	3
20EE102/PH01	BS	Waves and Modern Physics	3	0	0	0	3	30	70	100	3
20EE103/EL01	HS	Communicative English	3	0	0	0	3	30	70	100	3
20EEL101/MEL01	ES	Engineering Graphics	1	0	0	4	5	30	70	100	3
20EEL102/PHL01	BS	Physics Lab	0	0	0	3	3	30	70	100	1.5
20EEL103/ELL01	HS	English Communication skills Lab	0	0	0	3	3	30	70	100	1.5
20EEL104/MEL02	ES	Workshop Practice	0	0	0	3	3	30	70	100	1.5
20EE104/MC01	MC	Environmental Studies	2	0	0	0	2	30	0	30	0
TOTAL			**11**	**1**	**0**	**13**	**25**	**240**	**490**	**730**	**16.5**
INDUCTION PROGRAM		First Three Weeks (Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Familiarization to Dept./Branch & Innovations)									

CIE: Continuous Internal Evaluation SEE: Semester End Examination

L: Lecture, T: Tutorial, P: Practical PS: Problem Solving

BS: Basic Science courses HS: Humanities and Social Science ES: Engineering Science Courses

MC: Mandatory course

1 Hr. Lecture (L) per week - 1 credit

1 Hr. Practical (P) per week - 0.5 credits

1 Hr. Tutorial (T) per week - 1 credit

1 Hr. Problem Solving (PS) per week - 0 credits

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SCHEME OF INSTRUCTION & EXAMINATION (Semester System)

For

Electrical and Electronics Engineering

First Year B.Tech(SEMESTER – II)

Effects from A.Y 2020-21(R20 Regulation)

Course Code	Category	Course title	Scheme of Instruction (Hours per week)					Scheme of Examination (Maximum marks)			No. of Credits
			L	T	PS	P	Total	CIE	SEE	Total	
20EE201/ MA02	BS	Numerical methods& Advanced Calculus	2	1	0	0	3	30	70	100	3
20EE202/ PH03	BS	Semiconductor Physics and Nano Materials	3	0	0	0	3	30	70	100	3
20EE203/ CY01	BS	Engineering Chemistry	3	0	0	0	3	30	70	100	3
20EE204/ CS01	ES	Programming for Problem Solving	3	0	1	0	4	30	70	100	3
20EE205	PC	Circuit Theory	3	0	1	0	4	30	70	100	3
20EE206/ CE02	ES	Engineering Mechanics	3	0	1	0	4	30	70	100	3
20EEL201 /CY L01	BS	Chemistry Lab	0	0	0	3	3	30	70	100	1.5
20EEL202	PC	Circuit Theory Lab	0	0	0	3	3	30	70	100	1.5
20EEL203 /CS L01	ES	Programming for Problem Solving Lab	0	0	0	3	3	30	70	100	1.5
NSS	National Service Scheme		-	-	-	-	-	-	-	-	-
TOTAL			**17**	**1**	**3**	**9**	**30**	**270**	**630**	**900**	**22.5**

CIE: Continuous Internal Evaluation SEE: Semester End Examination
L: Lecture, T: Tutorial, P: Practical PS: Problem Solving
BS: Basic Science courses HS: Humanities and Social Science ES: Engineering Science Courses
MC: Mandatory course

1 Hr. Lecture (L) per week - 1 credit
1 Hr. Practical (P) per week - 0.5 credits
1 Hr. Tutorial (T) per week - 1 credit
1 Hr. Problem Solving (PS) per week - 0 credits
2 Hours Practical (Lab) per week - 1 credit

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SCHEME OF INSTRUCTION & EXAMINATION (Semester System)

For

Electrical and Electronics Engineering

Second Year B.Tech(SEMESTER – III)

Effects from A.Y 2020-21(R20 Regulation)

Course Code	Category	Course title	Scheme of Instruction (Hours per week)					Scheme of Examination (Maximum marks)			No. of Credits
			L	T	PS	P	Total	CIE	SEE	Total	
20EE301/ MA03	BS	ProbabilityandStatistics	2	1	0	0	3	30	70	100	3
20EE302	PC	NetworkAnalysis	3	0	1	0	4	30	70	100	3
20EE303	PC	ElectroMagneticFields	3	0	0	0	3	30	70	100	3
20EE304	PC	DC Machines and Transformers	3	0	1	0	4	30	70	100	3
20EE305/EL02	HS	Technical English	2	0	0	0	2	30	70	100	2
20EEL301/ SOC1	SO	Software Tools to Electrical Engineering (Skill Oriented Course-I)	1	0	0	2	3	30	70	100	2
20EEL302	ES	Measurementand InstrumentationLab	2	0	0	2	4	30	70	100	3
20EEL303/ IT01	ES	DataStructuresand AlgorithmsLab	1	0	0	2	3	30	70	100	2
20EE306/ MC02	MC	ProfessionalEthicsand HumanValues	2	0	0	0	2	30	0	30	0
NSS	National Service Scheme		-	-	-	-	-	-	-	-	-
TOTAL			**19**	**1**	**2**	**6**	**28**	**270**	**560**	**830**	**21**

CIE: Continuous Internal Evaluation SEE: Semester End Examination

L: Lecture, T: Tutorial, P: Practical PS: Problem Solving

BS: Basic Science courses HS: Humanities and Social Science ES: Engineering Science Courses

MC: Mandatory course SO: Skill Oriented Course

1 Hr. Lecture (L) per week - 1 credit

1 Hr. Practical (P) per week - 0.5 credits

1 Hr. Tutorial (T) per week - 1 credit

1 Hr. Problem Solving (PS) per week - 0 credits

2 Hours Practical (Lab) per week - 1 credit

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SCHEME OF INSTRUCTION & EXAMINATION (Semester System)

For

Electrical and Electronics Engineering

Second Year B.Tech(SEMESTER – IV)

Effects from A.Y 2020-21(R20 Regulation)

Course Code	Category	Course title	Scheme of Instruction (Hours per week)					Scheme of Examination (Maximum marks)			No. of Credits
			L	T	PS	P	Total	CIE	SEE	Total	
20EE401	PC	AnalogElectronics	3	0	0	0	3	30	70	100	3
20EE402	PC	DigitalElectronics	3	0	1	0	4	30	70	100	3
20EE403	PC	Induction MotorsandSynchronousmachines	3	0	1	0	4	30	70	100	3
20EE404	PC	Signals& Systems	3	0	1	0	4	30	70	100	3
20EE405	PC	Generation and Transmission	3	0	0	0	3	30	70	100	3
20EEL401/ SOC2	SO	Python (Skill Oriented Course-II)	1	0	0	2	3	30	70	100	2
20EEL402	PC	Analog and DigitalElectronicsLab	0	0	0	3	3	30	70	100	1.5
20EEL403	PC	DC Machines and Transformers Lab	0	0	0	3	3	30	70	100	1.5
20EEL404/ ELL02	HS	SoftSkillsLab	0	0	0	2	2	30	70	100	1
Internship during summer (4 Weeks)											
TOTAL			**16**	**0**	**3**	**10**	**29**	**270**	**630**	**900**	**21**
20EEM4/20 EEH4	**Minor/Honor Course**		**4/3**	**0/1**	**0**	**0**	**4**	**30**	**70**	**100**	**4**

CIE: Continuous Internal Evaluation SEE: Semester End Examination

L: Lecture, T: Tutorial, P: Practical PS: Problem Solving

BS: Basic Science courses HS: Humanities and Social Science ES: Engineering Science Courses

MC: Mandatory course SO: Skill Oriented Course PC: Professional Core

1 Hr. Lecture (L) per week - 1 credit

1 Hr. Practical (P) per week - 0.5 credits

1 Hr. Tutorial (T) per week - 1 credit

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SCHEME OF INSTRUCTION & EXAMINATION

For

Electrical and Electronics Engineering

Third Year B.Tech(SEMESTER – V)

Effects from A.Y 2020-21(R20 Regulation)

Course Code	Category	Course title	Scheme of Instruction (Hours per week)					Scheme of Examination (Maximum marks)			No. of Credits
			L	T	PS	P	Total	CIE	SEE	Total	
20EE501	ES	Micro Processor and Microcontroller	3	0	0	0	3	30	70	100	3
20EE502	PC	Power System Analysis	3	0	1	0	4	30	70	100	3
20EE503	PC	ControlSystems	3	0	1	0	4	30	70	100	3
20EE504	PC	PowerElectronics	3	0	1	0	4	30	70	100	3
20EE505/ PE1	PE	Professional Elective-I	3	0	0	0	3	30	70	100	3
20EEL501/ SOC3	SO	ApplicationofIOTin ElectricalEngineering (Skill Oriented Course-III)	1	0	0	2	3	30	70	100	2
20EEL502	ES	Micro Processor and Microcontroller Lab	0	0	0	2	2	30	70	100	1
20EEL503	PC	Induction Motorsand Synchronousmachines Lab	0	0	0	3	3	30	70	100	1.5
20EEL504	PC	Control Systems Lab	0	0	0	3	3	30	70	100	1.5
20EEL505/ INT01	INT	Summer Internship	-	-	-	-	-	-	100	100	1.5
20EE506/ MC03	MC	Indian Constitution	2	0	0	0	2	30	0	30	0
TOTAL			**18**	**0**	**3**	**10**	**31**	**300**	**730**	**1030**	**22.5**
20EEM5/ 20EEH5	**Minor/Honor Course**		**4/3**	**0/1**	**0**	**0**	**4**	**30**	**70**	**100**	**4**

CIE: Continuous Internal Evaluation SEE: Semester End Examination

Professional Elective – I:

1A. Electrical PowerDistributionSystem
1B. Renewable Energy Sources
1C. Electrical Machine Design
1D. Digital Signal Processing

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SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
Electrical and Electronics Engineering
Third Year B.Tech(SEMESTER – VI)
Effects from A.Y 2020-21(R20 Regulation)

Course Code	Category	Course title	Scheme of Instruction (Periods per week)					Scheme of Examination (Maximum marks)			No. of Credits
			L	T	PS	P	Total	CIE	SEE	Total	
20EE601	PC	Power System Protection	3	0	0	0	3	30	70	100	3
20EE602/ PE2	PE	Professional Elective -II	3	0	0	0	3	30	70	100	3
20EE603/ PE3	PE	Professional Elective - III	3	0	0	0	3	30	70	100	3
20EE604/ JO1	JO	Job Oriented Elective - I	2	0	0	2	4	30	70	100	3
20EE605/ JO2	JO	Job Oriented Elective - II	2	0	0	2	4	30	70	100	3
20EEL601/ SOC4	SO	Quantitative Aptitude	1	0	0	2	3	30	70	100	2
20EEL602	PC	Power Electronics Lab	0	0	0	3	3	30	70	100	1.5
20EEL603	PC	Power Systems Lab	0	0	0	3	3	30	70	100	1.5
20EEL604	PC	Electronics Design Lab	0	0	0	3	3	30	70	100	1.5
20EE606/ MC04	MC	Essence of IndianTraditional Knowledge	2	0	0	0	2	30	0	30	0
Industry /Research Internship during summer (5 Weeks)											
TOTAL			**16**	**0**	**0**	**15**	**31**	**300**	**630**	**930**	**21.5**
20EEM6/20 EEH6	**Minor/Honor Course**		**4/3**	**0/1**	**0**	**0**	**4**	**30**	**70**	**100**	**4**

CIE: Continuous Internal Evaluation
SEE: Semester End Examination

Professional Elective – II:
- 2A. Switched Mode Power Supply
- 2B. Electric Drives
- 2C. HVDC & FACTS

Professional Elective – III:
- 3A. Machine Modelling and Analysis
- 3B. DigitalControlSystems
- 3C. Optimization Techniques

Job Oriented Elective I:
- 1A. Data Analytics
- 1B. Embedded Systems
- 1C. Operations Research

Job Oriented Elective II:
- 2A. PIC Microcontrollers and ARM Processors
- 2B. Solar PV and Wind Plant Design

Bapatla Engineering College:: Bapatla

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SCHEME OF INSTRUCTION & EXAMINATION (Semester System)

For

Electrical and Electronics Engineering

Fourth Year B.Tech(SEMESTER – VII)

Effects from A.Y 2020-21(R20 Regulation)

Course Code	Category	Course title	Scheme of Instruction (Periods per week)					Scheme of Examination (Maximum marks)			No. of Credits
			L	T	PS	P	Total	CIE	SEE	Total	
20EE701	PC	Power System Operation Control and Stability	3	0	1	0	4	30	70	100	3
20EE702/ PE4	PE	Professional Elective - IV	3	0	0	0	3	30	70	100	3
20EE703/ PE5	PE	Professional Elective - V	3	0	0	0	3	30	70	100	3
20EE704/O	OE	Open Elective Course	3	0	0	0	3	30	70	100	3
20EE705/ JO3	JO	Job Oriented Elective - III	2	0	0	2	4	30	70	100	3
20EE706/ ME01	HS	Industrial Management & Entrepreneurship Development	3	0	0	0	3	30	70	100	3
20EEL701/ SOC5	SO	Industrial Automation (Skill Oriented Course-V)	1	0	0	2	3	30	70	100	2
20EEL702/ INT02	INT	Industry /Research Internship	-	-	-	-	-	-	100	100	3
Guide Allocation and Literature Survey for Final year Project work											
TOTAL			**18**	**0**	**1**	**4**	**23**	**210**	**590**	**800**	**23**
20EEM7/ 20EEH7	**Minor/Honor Course**		**4/3**	**0/1**	**0**	**0**	**4**	**30**	**70**	**100**	**4**

CIE: Continuous Internal Evaluation

SEE: Semester End Examination

Professional Elective – IV:

4A. High Voltage Engineering
4B. Solar & Fuel cell Energy Systems
4C. Adaptive Control Systems
4D. Advanced Electrical Drives

Professional Elective – V:

5A. Smart Grid Technology and Applications
5B. AI Applications to Electrical Engineering
5D. Computer Application on power Systems

Job Oriented Elective III:

3A. VLSI Design
3B. Metaheuristic Techniques to Electrical Engineering
3C. Electric Vehicles

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OPEN ELECTIVES

DEPARTMENT	CODE	SUBJECT
AIML	CM1	Artificial Intelligence
	CM2	Introduction to Machine Learning
CIVIL	CE1	Air Pollution and Control
	CE2	Remote Sensing and GIS
CB	CB1	Digital Forensics
	CB2	Introduction to Information Security and Cyber Laws
CSE	CS1	Database Management System
	CS2	Java Programming
DS	DS1	Data Warehousing and Data Mining
	DS2	Social Network Analysis
ECE	EC1	Digital Image Processing
	EC2	Embedded System & Design
EEE	EE1	Non-Conventional Energy Sources
	EE2	Electrical Energy Conservation and Auditing
	EE3	Industrial Electrical Systems
EIE	EI1	Sensors and Signal Conditioning
IT	IT1	Cyber Security
	IT2	Web Technologies
MECH	ME1	Automobile Engineering
	ME2	Renewable energy sources
	ME3	Project Management
	ME4	Entrepreneurship Development
CHEMISTRY	CY1	Chemistry in Space technology
	CY2	Artificial Intelligence in Sustainable Chemistry
	CY3	Material Chemistry in daily life
ENGLISH	EL1	Professional Communication
MATHS	MA1	Graph Theory
	MA2	Linear Algebra
PHYSICS	PH1	Nanomaterials and Technology
	PH2	Optoelectronic devices and applications
	PH3	Fiber optics communication
NCC	NCC	National Cadet Corps

Bapatla Engineering College:: Bapatla

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SCHEME OF INSTRUCTION & EXAMINATION (Semester System)

For

Electrical and Electronics Engineering

Fourth Year B.Tech(SEMESTER – VIII)

Effects from A.Y 2020-21(R20 Regulation)

Course Code	Category	Course title	Scheme of Instruction (Periods per week)					Scheme of Examination (Maximum marks)			No. of Credits
			L	T	PS	P	Total	CIE	SEE	Total	
20EE801/PW	PW	Project Work& Internship	0	0	0	24	24	30	70	100	12
20EEMM1/ 20EEHM1	Minor/Honor Course (Through MOOC only)		0	0	0	0	0	0	0	0	2
20EEMM2/ 20EEHM2	Minor/Honor Course (Through MOOC only)		0	0	0	0	0	0	0	0	2

CIE: Continuous Internal Evaluation SEE: Semester End Examination

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Minor Courses (20 Credits): Courses offered to non EEE branch B.Tech., students for obtaining Minor degree in Electrical and Electronics Engineering.

S.NO	Course Title	Prerequisite Course
Level-I		
A	Linear Control System	Basic Electrical and Electronics Engineering
B	Basics of Signals and Systems	Basic Maths
C	Utilization of Electrical Energy	Basic Electrical and Electronics Engineering
Level -II		
D	Power Generation and Transmission	Basic Electrical and Electronics Engineering
E	Principles of Power Electronics	Basic Electrical and Electronics Engineering
F	Digital Control Systems	Linear Control System
Level -III		
G	Power Quality	Basic Electrical and Electronics Engineering, Power Generation and Transmission
H	Smart Grid	Power Generation and Transmission
I	Energy Management & Audit	Basic Electrical and Electronics Engineering, Power Generation and Transmission
Level -IV		
J	Industrial Drives	Principles of Power Electronics
K	Solar & Fuel cell Energy Systems	Basic Electrical and Electronics Engineering
L	Hybrid Electrical Vehicles	Principles of Power Electronics, Industrial Drives

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Honor Courses (20 Credits): Additional courses offered to B.Tech., EEE students to obtain Honors degree in Electrical and Electronics Engineering

S.NO	Course Title	Prerequisite Course
A	Power Systems Dynamics and Control	Induction motors and Synchronous Machines (20EE403)
B	Advanced Power System Protection	Power System Protection (20EE601)
C	Advanced Electrical Drives	Electrical Drives (20EE602/603)
D	Smart Grid Technology and Applications	Generation and Transmission (20EE405) and Power System Analysis (20EE502)
E	Non-Linear Control Systems	Control Systems (20EE503)
F	Adaptive Control Systems	Control Systems (20EE503)
G	Energy Storage Systems	Basic physics and Chemistry
H	Electrical and Hybrid Vehicles	Induction motors and Synchronous Machines (20EE403) and Power Electronics (20EE504)
I	Sensors and Actuators	Basic Physics
J	Optimization Techniques	Basic Maths
K	Machine Learning for Engineering Applications	Probability and Statistics (20EE301)
L	Big data Analytics for Smart Grid	Generation and Transmission (20EE405) and Power System Analysis (20EE502)
M	Extra High Voltage AC Transmission	High Voltage Engineering (PE71)
N	Block Chain Technology for Electrical Systems	Generation and Transmission (20EE405) and Power System Analysis (20EE502)
O	Automotive Electrics	Measurements and Instrumentation

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LINEAR ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS

I B.Tech – I Semester (Code: 20EE101/MA01)

Lectures	2	Tutorial	1	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: None

Course Objectives: To make the students

- Solve a system of linear homogeneous and non-homogeneous equations, finding the inverse of a given square matrix and also its Eigen values and Eigen vectors.
- Identify the type of a given differential equation and select and apply the appropriate analytical technique for finding the solution of first order and higher order ordinary differential equations.
- Create and analyze mathematical models using higher order differential equations to solve application problems that arise in engineering.
- Solve a linear differential equation with constant coefficients with the given initial conditions using Laplace Transforms.

Course Outcomes:At the end of this course, students will be able to

CO1: Find the eigen values and eigen vectors of a given matrix and its inverse.

CO2: Apply the appropriate analytical technique to find the solution of a first order ordinary differential equation.

CO3: Solve higher order linear differential equations with constant coefficients arise in engineering applications.

CO4: Apply Laplace transform to solve differential equations arising in engineering.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	2	3	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	2	3	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	2	3	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	2	3	-	-

UNIT – I

Linear Algebra: Rank of a Matrix; Elementary transformations of a matrix; Gauss-Jordan method of finding the inverse; Consistency of linear System of equations: Rouches theorem, System of linear Non-homogeneous equations, System of linear homogeneous equations; vectors; Eigen values; properties of Eigen values(without proofs); Cayley-Hamilton theorem (without proof).

[Sections: 2.7.1; 2.7.2; 2.7.6; 2.10.1; 2.10.2; 2.10.3; 2.12.1; 2.13.1; 2.14; 2.15.]

UNIT – II

Differential Equations of first order: Definitions; Formation of a Differential equation; Solution of a Differential equation; Equations of the first order and first degree: variables separable; Linear Equations; Bernoulli's equation; Exact Differential equations; Equations reducible to Exact equations: I.F found by inspection, I.F of a Homogeneous equation, In the equation M dx+ N dy = 0, $\frac{\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}}{N}$ is a function of x and $\frac{\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}}{M}$ is a function of y. Applications of a first order Differential equations: Newton's law of cooling; Rate of decay of Radio-active materials.

[Sections: 11.1; 11.3; 11.4; 11.5; 11.6; 11.9; 11.10; 11.11; 11.12.1; 11.12.2; 11.12.4; 12.6; 12.8]

UNIT – III

Linear Differential Equations: Definitions; Theorem; Operator D; Rules for finding the complementary function; Inverse operator; Rules for finding the Particular Integral; Working procedure to solve the equation; Method of Variation of Parameters; Applications of Linear Differential Equations: Oscillatory Electrical Circuits.

[Sections: 13.1; 13.2.1; 13.3; 13.4; 13.5; 13.6; 13.7;13.8.1;14.1;14.5].

UNIT – IV

Laplace Transforms: Definition; conditions for the existence; Transforms of elementary functions; properties of Laplace Transforms; Transforms of derivatives; Transforms of integrals; Multiplication by t^n; Division by t; Inverse transforms- Method of partial fractions; Other methods of finding inverse transforms; Convolution theorem(without proof); Application to differential equations: Solution of ODE with constant coefficients using Laplace Transforms.

[Sections:21.2.1; 21.2.2; 21.3; 21.4; 21.7; 21.8; 21.9; 21.10; 21.12; 21.13; 21.14; 21.15.1]

TEXT BOOKS:

B.S.Grewal, "Higher Engineering Mathematics", 44thedition, Khanna publishers, 2017.

REFERENCE BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th edition, John Wiley & Sons.K. J. Ayala, "8051 Microcontroller", Delmar Cengage Learning, 3rd Edition, 2007.
2. N.P.Bali and M.Goyal, "A Text book of Engineering Mathematics" Laxmi Publications, 2010.

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WAVES AND MODERN PHYSICS
I B.TECH – I SEMESTER (CODE-20EE102/PH01)
(Common for ECE, EEE, EIE)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Course Objectives: Students will be able

- To familiarize the students in getting knowledge about modern optics and their Engineering applications.
- To make aware of the students to obtain circuit knowledge regarding electrical, Electronics and Magnetism.
- To make the students Analyse the quantum theory and solving the various Physical problems using quantum mechanics.
- To get the knowledge of various methods of analytical techniques for material their utility, design and fabrication of several devices.

Course Outcomes: At the end of the course the students should be able to

CO1: Learn about principle and working of different types of lasers and their applications. Know about principle, types of optical fibers and their effective utilization in optical communications.

CO2: Analyze the electromagnetic principles in electrical and electronic circuits and Maxwell's equations.

CO3: Study about quantum mechanics and its applications.

CO4: Read about properties and applications of ultrasonic in various fields. Know about radio isotopes and their applications

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	2	2	2	2	-	-	-	-	-	-	-	2	-
CO2	3	-	3	3	3	3	2	-	-	-	-	2	-	-	2
CO3	3	3	-	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	2	3	-	-	-	-	-	-	-	-	2	-

UNIT-I (ADVANCED OPTICS)

Lasers: Interaction of radiation with matter. Einstein co-efficient, Properties of laser,Population inversion, LASER principle, pumping schemes-Three level and four level laser, types of lasers: solid-state lasers (Ruby), gas lasers (He-Ne), Semiconductor lasers; applications of lasers in industry and medicine.

FibreOptics: Importance of optical fibre, Structure and principle of optical fibre, acceptance angle and numerical aperture, Types of optical fibres based on modes and refractive index, V-

number, losses associated with optical fibres, fibre optical communication, advantages of optical fiber.

UNIT-II (ELECTRO-MAGNETIC INDUCTION AND MAXWELL'S EQUATIONS)

Maxwell's equations in vacuum and conducting medium.Velocity of electromagnetic wave in vacuum. Electromagnetic oscillations in LC circuit, LCR series resonance in A.C circuit and resonant frequency, Quality factor. Concept of skin effect, Energy in an electromagnetic field; Flow of energy and Poynting vector.Principle of circulating charge and cyclotron, Hall Effect.

UNIT-III (MODERN PHYSICS)

Dual nature of light, De Broglie concept of matter waves, Davisson-Germier experiment, Heisenberg uncertainty principle and applications (nonexistence of electron in nucleus and finite width of spectral lines), one dimensional time independent and dependent Schrodinger wave equation, physical significance of wave function, application of Schrödinger wave equation to particle in a one dimensional potential box, concept of quantum tunnelling and construction and working of Scanning Tunnelling Electron Microscope.

UNIT-IV (ANALYTICAL TECHNIQUES)

Ultrasonics: Properties of ultrasonics', Production of ultrasonic waves by magnetostriction and piezo-electric method, Determination of velocity of ultrasonic wave in liquids by Ultrasonic interferometer. Medical applications, Ultrasonic Imaging technique (Doppler Ultrasound Imaging advantages and limitations), industrial applications, NDT: Pulse echo technique, Time of flight diffraction technique.

Nuclear Techniques: Radio isotopes and its applications (medical and Industrial), GM counter, Scintillation counter.

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TEXT BOOK:

1. M.V.Avadhanulu, P.G.Kshirsagar, "Engineering physics", S.Chand& Company Pvt. Ltd.

2. PalaniSwamy, "Engineering physics", Scitech publication

REFERENCE BOOKS:

1. Dr.P.srinivasaRao, Dr.K.Muralidhar, "Basic engineering physics"Himalaya Publication

2. Dr.P.SrinivasaRao, Dr.K.Muralidhar, "Applied physics" Himalaya publication

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COMMUNICATIVE ENGLISH
I B.TECH – I SEMESTER (Code: 20EE103/EL01)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Course Objectives: Students will be able

- To comprehend the importance, barriers and strategies of listening skills in English.
- To illustrate and impart practice Phonemic symbols, stress and intonation.
- To practice oral skills and receive feedback on learners' performance.
- To practice language in various contexts through pair work, role plays, group work and dialogue conversations.

Course Outcomes: At the end of the course the students should be able to

CO1: Understand how to build academic vocabulary to enrich their writing skills.
CO2: Produce accurate grammatical sentences.
CO3: Analyse the content of the text in writing.
CO4: Produce coherent and unified paragraphs with adequate support and detail.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	2	2	3	2	2	-	-	2
CO2	-	-	-	-	-	-	-	2	2	3	2	2	-	-	2
CO3	-	-	-	-	-	-	-	2	2	3	2	2	-	-	2
CO4	-	-	-	-	-	-	-	2	2	3	2	2	-	-	2

UNIT-I

1.1 **Vocabulary Development**: Word formation-Formation of Nouns, Verbs & Adjectives from Root words-Suffixes and Prefixes
1.2 **Essential Grammar:** Prepositions, Conjunctions, Articles
1.3 **Basic Writing Skills**: Punctuation in writing
1.4 **Writing Practices**: Mind Mapping, Paragraph writing (structure-Descriptive, Narrative, Expository & Persuasive)

UNIT-II

2.1 **Vocabulary Development**: Synonyms and Antonyms
2.2 **Essential Grammar**: Concord, Modal Verbs, Common Errors
2.3 **Basic Writing Skills**: Using Phrases and clauses
2.4 **Writing Practices**: Hint Development

UNIT III

3.1 **Vocabulary Development**: One word Substitutes
3.2 **Essential Grammar**: Tenses, Voices
3.3 **Basic Writing Skills**: Sentence structures (Simple, Complex, Compound)
3.4 **Writing Practices**: Note Making

UNIT IV

4.1 **Vocabulary Development**: Words often confused
4.2 **Essential Grammar**: Reported speech, Common Errors
4.3 **Basic Writing Skills**: Coherence in Writing: Jumbled Sentences
4.4 **Writing Practices**: Paraphrasing & Summarising

Reference Books

1. Communication Skills, Sanjay Kumar & Pushpa Latha. Oxford University Press: 2011.
2. Practical English Usage, Michael Swan. Oxford University Press: 1995.
3. Remedial English Grammar, F.T.Wood. Macmillan: 2007.
4. Study Writing, Liz Hamp lyons& Ben Heasley. Cambridge University Press:2006

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ENGINEERING GRAPHICS

I B.Tech – I Semester (Code: 20EEL101/MEL01)

Lectures	1	Tutorial	0	Problem Solving	0	Practical	4	Credits	3
Continuous Internal Evaluation			30	Semester End Examination (3 Hours)					70

Prerequisites: None

Course Objectives: To make the studentsto learn

- Clear picture about the importance of engineering graphics in the field of engineering
- Drawing skills and impart students to follow Bureau of Indian Standards
- An idea about Geometric constructions, Engineering curves, orthographic projections, and pictorial projections
- Imagination skills about orientation of points, lines, surfaces, and solids
- Basic drafting skills of Auto CAD

Course Outcomes: By the end of the course the student will be able to

CO1: Draw projections of points and projections of lines using Auto CAD
CO2: Plot projections of surfaces like circle, square and rhombus
CO3: Plot the Projections of solids like Prisms and pyramids
CO4: Convert the of Orthographic views into isometric views of simple objects

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	2	-	-
CO3	1	2	3	-	-	-	-	-	-	-	-	-	1	-	-
CO4	1	2	1	-	-	-	-	-	-	-	-	-	1	-	-

UNIT – I

INTRODUCTION: Introduction to Drawing instruments and their uses, geometrical construction procedures

INTRODUCTION TO AUTOCAD:

Basics of sheet selection, draw tools, Modify tools, dimensioning

METHOD OF PROJECTIONS: Principles of projection - First angle and third angle projectionof points. Projection of straight lines.Traces of lines.

UNIT II

PROJECTIONS OF PLANES: Projections of plane figures: circle, square, rhombus, rectangle, triangle, pentagon and hexagon.

UNIT – III

PROJECTIONS OF SOLIDS: Projections of Cubes, Prisms, Pyramids, Cylinders and Cones Inclined to one plane. .

UNIT –IV

ISOMETRIC PROJECTIONS: Isometric Projection and conversion of Orthographic views into isometric views. (Treatment is limited to simple objects only).

ORTHOGRAPHIC PROJECTIONS: Conversion of pictorial views into Orthographic views. (Treatment is limited to simple castings).

TEXT BOOK:

1. Dhananjay M. Kulkarni, "Engineering Drawing with AutoCAD", Revised Edition, PHI publication, 2009.
2. N.D. Bhatt & V.M. Panchal,"Engineering Drawing",53rdEdition,Charotar Publishing House, 2014.

REFERENCE BOOKS:

1. Dhananjay AJolhe, "Engineering Drawing with Introduction to AutoCAD"1st Edition,Tata McGraw hill publishers, 2017.
2. Prof.K.L.Narayana& Prof. R.K.Kannaiah, "Engineering Drawing", 23rd Edition, Scitech Pub, 2010.

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PHYSICS LAB

I B.Tech– I Semester (Code: 20EEL102/PHL01)

(COMMON TO ALL BRANCHES)

Lectures	0	Tutorial	0	Problem Solving	0	Practical	3	Credits	1.5
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Course Objectives: To make the students

- Basic experiments such as Magnetic Field Measurements, Hall Effect and LCR resonance give the knowledge to apply them in magnetic applications and circuits design.
- The measurements relating to various physical parameters of materials make the student to understand their utility, design and fabrication of several devices.
- The experiments like CRO, Solar Cell, Photo cell provides the thorough understanding of Opto Electronic devices useful in Engineering and Industrial applications.
- Utilization of the principles of light such as interference and diffraction to measure wavelength and radius of curvature of Lenses.

Course Outcomes: At the end of the course the students should be able to

CO1: Acknowledge the important aspects of earth magnetic field, realize the use of Maxwell's equations in various magnetic applications.

CO2: Realization of material properties and parameters.

CO3: Get hands-on experience in various opto-electronic devices like CRO, Solar Cell, Photo Cell and their applications.

CO4: To apply the phenomenon of interference and LASER principles to find radius of curvature and wavelength respectively by various methods.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	-	-	-	-	2	-	-	-	2	-	-
CO2	3	3	2	2	-	-	-	-	2	2	-	-	2	-	-
CO3	3	3	2	2	2	-	-	-	2	-	-	-	2	-	-
CO4	3	2	-	-	-	-	3	-	-	-	-	2	-	-	-

LIST OF EXPERIMENTS

1. Determination of acceleration due to gravity at a place using compound pendulum.
2. Study the variation of intensity of magnetic field along the axis of a circular coil using
3. Stewart-Gee's apparatus.
4. Determination of thickness of thin wire using air wedge interference bands.
5. Determination of radius of curvature of a Plano convex lens using Newton's rings.
6. Determination of wavelengths of mercury spectrum using grating normal incidencemethod.

7. Determination of dispersive power of a given material of prism using prism minimumdeviation method.
8. Draw the resonant characteristic curves of L.C.R. series circuit and calculate the resonantfrequency.
9. Draw the characteristic curves of a photocell and calculate the maximum velocity ofelectron.
10. Verify the laws of transverse vibration of stretched string using sonometer.
11. Determine the rigidity modulus of the given material of the wire using Torsionalpendulum.
12. Draw the load characteristic curves of a solar cell.
13. Determination of Hall coefficient of a semiconductor.
14. Determination of voltage and frequency of an A.C. signal using C.R.O.
15. Determination of Forbidden energy gap of Si &Ge.
16. Determination of wavelength of laser source using Diode laser.

Any three experiments are virtual

TEXT BOOK:

1. P.Srinivasarao & K.Muralidhar, “Engineering physics laboratory manual”, Himalaya publications.

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ENGLISH COMMUNICATION SKILLS LABORATORY
I B.Tech – I/II Semester (Code:20EEL103/ELL01)

Lectures	0	Tutorial	0	Problem Solving	0	Practical	3	Credits	1.5
Continuous Internal Evaluation			30	Semester End Examination (3 Hours)					70

English Communication Skills (ECS) Lab focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts. To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning

Course Objectives: Students will be able

- To comprehend the importance, barriers and strategies of listening skills in English.
- To illustrate and impart practice Phonemic symbols, stress and intonation.
- To practice oral skills and receive feedback on learners' performance.
- To practice language in various contexts through pair work, role plays, group work and dialogue conversations.

Course Outcomes: At the end of the course the students should be able to

CO1: Better understand the nuances of English language through audio- visual experience and group activities.
CO2: Develop neutralization of accent for intelligibility.
CO3: Build confidence to enhance their speaking skills.
CO4: Use effective vocabulary both in formal and informal situations.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	-	3	2	2	2	-	-	2
CO2	-	-	-	-	-	-	-	-	3	2	2	2	-	-	2
CO3	-	-	-	-	-	-	-	-	3	2	2	2	-	-	2
CO4	-	-	-	-	-	-	-	-	3	2	2	2	-	-	2

UNIT-I
1.1 ListeningSkills;Importance–Purpose-Process-Types
1.2 BarrierstoListening
1.3 StrategiesforEffectiveListening

UNIT-II
2.1 Phonetics;IntroductiontoConsonant,VowelandDiphthongsounds
2.2 Stress
2.3 Rhythm
2.4 Intonation

UNIT-III

3.1 FormalandInformalSituations
3.2 Expressionsusedindifferentsituations
3.3 IntroducingYourself&Others-Greeting&Parting-Congratulating-GivingSuggestions&Advices-ExpressingOpinions-InvitingPeople-Requesting-SeekingPermission-GivingInformation-GivingDirections-Sympathizing-ConvincingPeople-Complaining&Apologizing-ThankingOthers-Shopping-Travelling-ConversationalGambits

UNIT-IV

4.1 JAMSession
4.2 Debates
4.3 Extempore

ReferenceBooks:

1. CommunicationSkills,SanjayKumarandPushpaLata.OxfordUniversityPress.2011
2. BetterEnglishPronunciation,J.D.O'Connor.CambridgeUniversityPress:1984
3. NewInterchange(4rthEdition),JackCRichards.CambridgeUniversityPress:2015
4. EnglishConversationPractice,GrantTaylor.McGrawHill:2001

Software:

1. Buzzersforconversations,NewInterchangeseries
2. EnglishinMindseries,TelephoninginEnglish
3. SpeechSolutions,ACourseinListeningandSpeaking

WORKSHOP PRACTICE LAB

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I B.TECH – I SEMESTER (Code: 20EEL104/MEL02)

Lectures	0	Tutorial	0	Problem Solving	0	Practical	3	Credits	1.5
Continuous Internal Evaluation			30	Semester End Examination (3 Hours)					70

Prerequisites: None

Course Objectives: To make the students

- To impart student knowledge on various hand tools for usage in engineering applications.
- Be able to use analytical skills for the production of components.
- Design and model different prototypes using carpentry, sheet metal and welding.
- Make electrical connections for daily applications.
- To make student aware of safety rules in working environments.

Course Outcomes: At the end of the course the students will be able to

CO1: Make half lap joint, Dovetail joint and Mortise &Tenon joint

CO2: Produce Lap joint, Tee joint and Butt joint using Gas welding

CO3: Prepare trapezoidal tray, Funnel and T-joint using sheet metal tools

CO4: Make connections for controlling one lamp by a single switch, controlling two lamps by a single switch and stair case wiring.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	2	-	2	-	2	-	-	1	-	2	1	2	3
CO2	2	3	2	-	2	-	2	-	-	1	-	2	1	2	3
CO3	2	3	2	-	2	-	2	-	-	1	-	1	1	2	3
CO4	-	-	2	-	2	-	2	-	-	1	-	1	-	-	2

Syllabus:

1. Carpentry
   a. Half Lap joint
   b. Dovetail joint
   c. Mortise &Tenon joint
2. Welding using electric arc welding process/gas welding
   a. Lap joint
   b. Tee joint
   c. Butt joint
3. Sheet metal operations with hand tools
   a. Trapezoidal tray
   b. Funnel
   c. T-joint
4. House wiring

a. To control one lamp by a single switch
b. To control two lamps by a single switch
c. Stair-case wiring

TEXT BOOKS:

1. P.Kannaiah and K.L.Narayana, “Workshop Manual”, SciTech Publishers, 2009.
2. K. Venkata Reddy, “Workshop Practice Manual”, BS Publications, 2008.

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ENVIRONMENTAL STUDIES
I B.TECH – I SEMESTER (Code: 20EE104/MC01)

Lectures	2	Tutorial	0	Problem Solving	0	Practical	0	Credits	0
Continuous Internal Evaluation			30	Semester End Examination (3 Hours)					0

Prerequisites: None

Course Objectives: The course aims

- To develop an awareness, knowledge, and appreciation for the natural environment.
- To understand different types of ecosystems exist in nature.
- To know our biodiversity.
- To understand different types of pollutants present in Environment and to know the global environmental problems.

Course Outcomes: By the end of the course the student will be able to

CO1: Compare various ecosystems such as forest, grassland, desert, and aquatic case studies, relate to the environmental concepts & the levels of energy flow in an ecosystem, Discuss the preventive as well as remedial measures for conservation of biodiversity.

CO2: Integrate and analyse the various natural and manmade factors that affect forests, environment & propose alternative sources of energy to meet the growing energy needs of our population. Identify the importance of sustainable growth and developmental.

CO3: Evaluate the pollution case studies and propose control measures of Urban and industrial wastes. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.

CO4: Understand key concepts from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies, Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	2	2	-	1	1	-	2	-	-	-
CO2	-	-	-	-	-	2	2	-	2	1	-	1	-	-	-
CO3	-	-	-	-	-	3	3	1	2	3	2	1	-	-	-
CO4	-	-	-	-	-	1	2	1	2	1	-	3	-	-	-

UNIT – I

Introduction: Definition, Scope and Importance, Need for public awareness. Ecosystems: Definition, Structure and Functions of Ecosystems, types - Forest, Grassland, Desert, Aquatic (Marine, pond and estuaries).

Biodiversity: Definition and levels of Biodiversity; Values of Biodiversity - Consumptive, Productive, Social, Aesthetic, Ethical and Optional; Threats and Conservation of Biodiversity; Hot Spots of Biodiversity, Bio-geographical Classification of India, India as a mega diversity nation. Chipko movement case study

UNIT – II

Natural resources: Land: Land as a resource, Causes and effects of land degradation - Soil erosion, Desertification. **Forest**: Use of forests, Causes and effects of deforestation, Afforestation, Mining - benefits and problems. **Water**: Uses, floods and drought, Dams - benefits and problems.

Energy: Importance of energy, Environmental Impacts of Renewable and Non-renewable energy resources. Silent Valley Project and Narmada BachaoAndolan case studies8 periods

Sustainability: Definition, Concept and Equitable use of resources for sustainable development; Rain water harvesting and Watershed management. Fieldwork on Rain water harvesting and Watershed management.

UNIT – III

Pollution: Definition; Causes, effects and control of air, water and nuclear pollution; Chernobyl Nuclear Disaster case study; Solid Waste: urban, Industrial and hazardous wastes; Integrated waste management - 3R approach, composting and vermin composting.
Environmental acts: Water and air (Prevention and Control of pollution) acts, Environmental protection act, Forest Conservation act.

UNIT – IV

Environmental issues: Greenhouse effect & Global warming, Ozone layer depletion, Acid rains, Green Revolution, Population Growth and environmental quality, Environmental Impact Assessment.Environmental Standards (ISO 14000, etc.)
Case Studies: Bhopal Tragedy, Mathura Refinery and TajMahal, and Ralegan Siddhi (Anna Hazare).
Field work: Visit to a local area to document environmental assets – Pond/Forest/Grassland. Visit to a local polluted site- Urban and industry/ Rural and Agriculture.

TEXTBOOKS:

1. Benny Joseph, “Environmental Studies”, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. JP Sharma, “Comprehensive environmental studies”, Laxmi Publications.

REFERENCE BOOKS:

1. R.Rajagopalan, “Environmental studies”, Oxford University Press.
2. Anjaneyulu Y, “Introduction to Environmental Science”, B S Publications
3. Jr. G. TylerMiller, “Environmental Science”, 11th Edition – Thomson Series.
4. ErachBharucha, “Textbook of environmental Studies”

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NUMERICAL METHODS AND ADVANCED CALCULUS

I B.Tech – II Semester (Code: 20EE201/MA02)

Lectures	2	Tutorial	1	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: None

Course Objectives: To make the students

- Solve algebraic, transcendental and system of linear equations with the help of numerical methods.
- Apply the techniques of numerical integration whenever and wherever routine methods are not applicable and solve the first order ordinary differential equations numerically with the given initial condition using different methods.
- Evaluate double and triple integrals and apply them to find areas and volumes.
- Evaluate the line, surface and volume integrals and learn their inter-relations and applications.

Course Outcomes:At the end of this course, students will be able to

CO1: Solve non-linear equations and system of linear equations with the help of Numerical techniques.

CO2: Solve the first order ordinary differential equations numerically with the given initial condition.

CO3: Find the area and volume of plane and three-dimensionalfigures using multipleintegrals.

CO4: Apply vector integral theorems to obtain the solutions of engineering problemsinvolving circulation, flux, and divergence in vector fields.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	2	3	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	2	2	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	2	3	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	2	3	-	-

UNIT – I

Numerical Solution of Equations: Introduction; Solution of algebraic and transcendental equations: Bisection method, Method of false position, Newton-Raphson method; Useful deductions from the Newton-Raphson formula; Solution of linear simultaneous equations; Direct methods of solution: Gauss elimination method, Gauss-Jordan method, Factorization method; Iterative methods of solution: Jacobi's iterative method, Gauss-Seidel iterative method.

[Sections:28.1; 28.2; 28.3; 28.5; 28.6; 28.7.1;28.7.2].

UNIT – II

Finite differences and Interpolation: Finite differences: Forward differences, Backward differences; Newton's interpolation formulae: Newton's forward interpolation formula, Newton's backward interpolation formula; Interpolation with unequal intervals; Lagrange's interpolation formula; Divided differences; Newton's divided difference formula; Numerical integration; Trapezoidal rule; Simpson's one-third rule; Simpson's three-eighth rule; Numerical solution of ODE's: Introduction; Picard's method; Euler's method; Runge-Kutta method.

[Sections:29.1; 29.1-1; 29.1.2; 29.6; 29.9; 29.10; 29.11; 29.12; 30.4; 30.6; 30.7; 30.8; 32.1; 32.2; 32.4; 32.7].

UNIT – III

Multiple Integrals: Double integrals; Change of order of integration; Double integrals in polar coordinates; Area enclosed by plane curves; Triple integrals; Volumes of solids: Volume as Triple integral, Change of variables.

[Sections: 7.1; 7.2; 7.3; 7.4; 7.5; 7.6.2; 7.7.2].

UNIT – IV

Vector calculus and its Applications: Scalar and vector point functions; Del applied to scalar point functions-Gradient: Definition, Directional derivative; Del applied to vector point functions: Divergence, Curl; Line integral; Surfaces: Surface integral, Flux across a surface; Green's theorem in the plane (without proof); Stokes theorem (without proof); Gauss divergence theorem(without proof).

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[Sections: 8.4; 8.5; 8.5.1; 8.5.3; 8.6; 8.11.1; 8.12.2; 8.12.3; 8.13; 8.14; 8.16]

TEXT BOOKS:

1.B.S.Grewal, "Higher Engineering Mathematics", 44thedition, Khanna publishers, 2017.

REFERENCE BOOKS:

1.Erwin Kreyszig, "Advanced Engineering Mathematics", 9th edition, John Wiley & Sons.K. J. Ayala, "8051 Microcontroller", Delmar Cengage Learning, 3rd Edition, 2007.
2.N.P.Bali and M.Goyal, "A Text book of Engineering Mathematics" Laxmi Publications, 2010

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SEMICONDUCTOR PHYSICS AND NANO MATERIALS

I B.Tech –II Semester (CODE: 20EE202/PH03)

(Common for CSE, IT, EEE &EIE)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Course Objectives: Students will be able

- To build the foundation and inspires interest of freshmen into electrical and electronics and to focus on fundamental concepts and basic principles regarding electrical conduction.
- To provides various properties of semiconductor materials and their importance in various device fabrications.
- To educate the student on various opto-electronic devices and their applications.
- To provide information about the principles of processing, manufacturing and characterization of nano materials, nanostructures and their applications.

Course Outcomes: At the end of the course the students should be able to

CO1: Understand concepts of band structure of solids, concept of hole and effective mass of electron in semiconductors.

CO2: Know the concept of Fermi level and various semiconductor junctions.

CO3: Familiar with working principles of various opto-electronic devices and their applications.

CO4: Understand importance of nano-materials and their characteristic properties.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	-	2	-	-	-	-	-	-	-	-	2	-	-
CO2	2	2	2	2	-	-	-	-	-	-	-	-	2	-	-
CO3	3	-	-	2	2	-	2	-	-	-	2	2	2	-	-
CO4	3	-	-	2	2	-	-	-	-	-	2	2	2	-	-

UNIT –I

ELECTRONIC MATERILAS: Somerfield free electron theory, Fermi level and energy, density of states, Failure of free electron theory (Qualitative), Energy bands in solids, E-K diagrams, Direct and Indirect band gaps. Types of Electronic materials: Metals, Semi-conductors and Insulators, Occupation Probability, effective mass, Concept of hole.

UNIT – II

SEMICONDUCTORS: Introduction to semiconductors, intrinsic and extrinsic semiconductors, carrier concentrations, Fermi level and temperature dependence, Continuity equation, Diffusion and drift, P-N junction (V-I characteristics), Metal – Semiconductor

junction (Ohmic and Schottky), Semiconductor materials of interest for opto- electronic devices.

UNIT-III

OPTO-ELECTRONIC DEVICES AND DISPLAY DEVICES: Photo voltaic effect, principle and working of LED, Applications of Photo diode, Solar cell, PIN & APD Diode, Liquid crystal display, Opto electric effect: Faraday Effect and Kerr effect.

UNIT-IV

NANO-MATERIALS: Introduction to nano technology, quantum confinement, surface to volume ratio, properties of nano materials, synthesis of nano-materials: CVD, sol-gel methods, laser ablation.Carbon nano tubes: types, properties, applications. Characterization of nano materials: XRD, SEM, applications of nano materials.

TEXT BOOKS:

1. Avadhanulu and Kshirsagar, "A text book of engineering physics", S.Chand& Co. (2013)
2. Dr.*P.Srinivasa Rao*. Dr.K.*Muralidhar, "*Applied physics",
3. Charles Kittel, "Introduction to solid state state physics", 8th edition
4. S.O. Pillai, "Solid state physics",

REFERENCE BOOKS:

1. B.S. Murty, P. Shankar, Baldev Raj, B.B. Rath and J. Murday, "Textbook on Nanoscience and Nanotechnology", Springer Science & Business Media, 2013.
2. Dr.*P.SrinivasaRao*. Dr.K.*Muralidhar. "*Basic Engineering Physics",Himalaya Publications, 2016

NPTEL COURSE LINKS:

1. NPTEL :: Physics - Fundamental concepts of semiconductors
2. NPTEL :: Metallurgy and Material Science - NOC:Fundamentals of electronic materials and devices
3. NPTEL :: Metallurgy and Material Science - Optoelectronic Materials and Devices

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ENGINEERING CHEMISTRY

(Common to all branches)

I B.Tech –II Semester (Code: 20EE203 /CY01)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

PREREQUISITES:None

COURSE OBJECTIVES: The student should be conversant

- With the principles of water characterization and treatment of water for industrial purposes and methods of producing water for potable purposes.
- To understand the thermodynamic concepts, energy changes, concept of corrosion & its control.
- With the conventional energy sources, solid, liquid and gaseous Fuels & knowledge of knocking and anti-knocking characteristics.
- With aim to gain good knowledge of organic reactions, plastics, conducting polymers & biodegradable polymers.

COURSE OUTCOME: By the end of the course the student will be able to

CO1: Develop innovative methods to produce soft water for industrial use and potable water at cheaper cost.

CO2: Apply their knowledge in converting various energies of different systems and protection of different metals from corrosion.

CO3: Have the capacity of applying energy sources efficiently and economically for various needs.

CO4: Design economically and new methods of organic synthesis and substitute metals with conducting polymers and also produce cheaper biodegradable polymers to reduce environmental pollution.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	2	3	-	2	3	-	-	-	-	3	3	-	-
CO2	2	3	2	3	-	2	3	-	-	-	-	3	3	-	-
CO3	2	3	2	3	-	2	3	-	-	-	-	3	3	-	-
CO4	2	3	3	3	-	2	3	-	-	-	-	3	-	-	-

UNIT -I

Water Chemistry

Introduction: water quality parameters

Characteristics: Alkalinity, Hardness **-** Estimation & simple numerical problems,

Boiler Troubles - Sludges, Scales, Caustic embrittlement, boiler corrosion, Priming and foaming.

Internal conditioning- phosphate, Calgon and carbonate methods.
External conditioning - Ion exchange process & Zeolite processWHO Guidelines, Potable water, Sedimentation, Coagulation, Filtration. Disinfection methods: Chlorination, ozonization and UV treatment.Salinity – Treatment of Brackish water by Reverse Osmosis and Electrodialysis.

UNIT- II

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies.Free energy and emf.Cell potentials, the Nernst equation and applications.

Corrosion: Types of corrosion - Chemical or dry corrosion, Electrochemical or wet corrosion; Galvanic, stress, pitting and differential aeration corrosion; Factors effecting corrosion.

Corrosion control – Cathodic protection, and electro plating (Au)&electroless Ni plating.

UNIT- III

Fuels: Classification of fuels; Calorific value of fuels (lower, higher)

Solid fuels: Determination of calorific value (Bomb Calorimeter) & related problems, Coal ranking,
Liquid Fuels: Petroleum refining and fractions, composition and uses. Knocking and anti-knocking Agents, Octane number and Cetane number; Bio fuels- Biodiesel, general methods of preparation and advantages
Gaseous fuels: CNG and LPG, Flue gas analysis – Orsat apparatus.

UNIT- IV

Organic reactions and synthesis of a drug molecule
Introduction to reactions involving substitution (SN^1, SN^2), addition (Markownikoff's and anti-Markwnikoff's rules) , elimination (E_1& E_2), Synthesis of a commonly used drug molecule.(Aspirin and Paracetamol)
Polymers: Conducting polymers: Classification, Intrinsic and Extrinsic conducting polymers and their applications**.** Plastics: Thermoplasts and thermosetting plastics, Bakelite and PVC.
Bio degradable polymers: types, examples-Polyhydroxybuterate (PHB), Polyhydroxybuterate-co-β-hydroxy valerate (PHBV), applications.

TEXT BOOKS:

1. P.C. Jain and Monica Jain, "Engineering Chemistry" DhanpatRai Pub, Co., New Delhi 17th edition (2017).
2. SeshiChawla, "Engineering Chemistry"DhanpatRai Pub, Co LTD, New Delhi 13th edition, 2013.

REFERENCES:

1 Essential Of Physical Chemistry by ArunBahl, B.S. Bahl, G.D.Tuli, by ArunBahl, B.S. Bahl, G.D.Tuli, Published by S Chand Publishers, 12th Edition, 2012.

2 Text Book of Engineering Chemistry by C.P. Murthy, C.V. Agarwal, A. Naidu B.S. Publications, Hyderabad (2006).

3 Engineering Chemistry by K. Maheswaramma, Pearson publishers 2015.

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PROGRAMMING FOR PROBLEM SOLVING

(Common for all branches except Civil Engineering)

I B.Tech –II Semester (Code: 20EE204/CS01)

Lectures	3	Tutorial	0	Problem Solving	1	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: BASIC MATHEMATICS

Course Objectives: To make the students

- Understand basic concepts of C Programming such as: C-tokens, Operators, Input/output, Arithmetic rules.
- Develop problem-solving skills to translate "English" described problems into Programs written using C language.
- Use Conditional Branching, Looping, and Functions.
- Apply pointers for parameter passing, referencing and differencing and linking data structures.
- Manipulate variables and types to change the problem state, including numeric, character, array and pointer types, as well as the use of structures and unions, File.

Course Outcomes: At the end of the course the students should be able to

CO1: Formulate simple algorithms for arithmetic and logical problems and remember the basics of computer fundamentalsof computer history.

CO2: Translate the algorithms to programs also to test and execute the programs and correct syntax and logical errors and implementing conditional branching, iteration and recursion.

CO3: Analyze the problem for its decomposition into functions.

CO4: Understand the file handling and dynamic memory allocation using c programming language.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-

UNIT- I

Overview of C, Constants, Variables and Data Types, Operators and Expressions,Managing I/O Operations.Decision Making and Branching.

Programming Exercises for Unit I: C-expressions for algebraic expressions, evaluation of arithmetic and Boolean expressions. Syntactic and logical errors in a given program, output of a given program, values of variables at the end of execution of a program fragment, Programs using Scientific and Engineering formulae. Finding the largest of the three given

numbers.Computation of discount amount on different types of products with different discount percentages. Finding the class of an input character, finding the type of triangle formed with the given sides, computation of income-tax, finding given year is leap year or not, and conversion of lower case character to its upper case.

UNIT -II

Decision Making and Looping, Arrays, Character Arrays and Strings.

Programming Exercises for Unit II: To print the sum of the digits of a given number and to display the image of a given number. To find whether a given number is prime, printing Fibonacci sequence and to find prime factors of a given number.To print graphic patterns of symbols and numbers.To find the length of a string, compare strings, reverse a string, copy a string and to find whether the given string is palindrome or not with and without using String Handling Functions. Transpose of a matrix and sorting of names using arrays.

UNIT- III

User-defined Functions,Structures and Unions,Pointers

Programming Exercises for Unit - III: Functions - Recursive functions to find factorial & GCD (Greatest Common Divisor), string operations using pointers and pointer arithmetic. Swapping two variable values. Sorting a list of student records on register number using array of pointers

UNIT -IV

File Management in C,Dynamic Memory Allocation,Preprocessor

Programming Exercises for Unit - IV: Operations on complex numbers, and to read an input file of marks and generate a result file, sorting a list of names using command line arguments. Copy the contents of one file to another file. Allocating memory to variables dynamically.

TEXT BOOK:

1. E.Balaguruswamy, “Programming in ANSI C,Fifth Edition,.

REFERENCE BOOKS:

1. Kernighan BW and Dennis Ritchie M, “C programming language”, 2nded, Prentice Hall, .
2. Yashavant P. Kanetkar, “Let us C”, BPB Publications, .
3. Herbert Schildt, “C: The Complete Reference”, 4th edition, Tata Mcgraw-Hill, .
4. Ashok N.Kamthane, “Programming in C”, PEARSON 2nd Edition, .

NPTEL COURSE LINKS:

1. NPTEL :: Computer Science and Engineering - NOC:Problem Solving through Programming in C
2. NPTEL :: Computer Science and Engineering - NOC:Introduction to programming in C

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CIRCUIT THEORY
I B.Tech –II Semester (Code: 20EE205)

Lectures	3	Tutorial	0	Problem Solving	1	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Basic Mathematics, Basic Physics

Course Objectives: To make the students.

- Discuss about basic Laws in circuits, circuit elements and sources and their characteristics.
- Describe fundamental concepts of alternating current and voltages, power triangle and power factor.
- Illustrate the circuits with different DC and AC sources.
- Explain statement and application of various theorems.
- Realize concept of resonance in series and parallel circuits.

Course Outcomes: By the end of the course the student will be able to

CO1: Explain the basic Laws, circuit elements and sources with their characteristics.

CO2: Demonstrate phasor diagrams, phase relations in elements and power triangle.

CO3: Solve problems involving with different AC and DC sources in electrical circuits.

CO4: Apply and analyze the circuits with various theorems.

CO5: Illustrate and analyze the series and parallel resonance circuits.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-

UNIT – I

CIRCUIT ELEMENTS: Basic definition of the unit of Charge, Voltage, Current, Power and Energy, Circuit concept, various circuit elements, Energy stored in Inductors and Capacitors, Kirchhoff's laws,

SOURCES: Ideal, Practical, and dependent sources and their V-I characteristics, Source transformation, Voltage and Current division, series / parallel combination of elements, Star-

Delta transformation, Instantaneous, Peak, Average and RMS values of various waveforms, Crest factor, Form factor. Concept of phase and phase difference in sinusoidal waveforms, Phase relation in pure resistor, Inductor and capacitor, Impedance diagram, phasor diagram, series and parallel circuits, compound Circuits, Computation of active, reactive and complex powers, power triangle, power factor.

UNIT – II

STEADY STATE ANALYSIS: Mesh and Nodal analysis of DC circuitswith and without dependent sources, Mesh and Nodal analysis of AC circuits, Analysis of RL, RC, RLC series and parallel circuits with pulse and impulse excitations.

UNIT – III

NETWORK THEOREMS: Superposition theorem, Thevenin's and Norton's theorems, Reciprocity, Compensation, Maximum power transfer theorems, Tellegen's and Millman's theorems to both DC (with and without dependent) and AC circuits

UNIT – IV

RESONANCE: Series resonance, Impedance and phase angle, voltages and currents, bandwidth and Q factor and its effect on bandwidth, magnification, parallel resonance, resonant frequency, variation of impedance with frequency, Q factor, magnification, reactance curves in parallel resonance, Locus diagrams for series and parallel circuits.

TEXT BOOKS:

1. William H. Hayt, Jack E. Kemmerly and Steven M. Durbin, Engineering Circuit Analysis, 8th Edition,TMH, 2012.
2. C K Alexander and M. N. O. Sadiku, Electric Circuits, McGraw Hill Education, 5th Edition, 2016.

REFERENCE BOOKS:

1. Abhijit chakrabarti, Circuit theory analysis and synthesis, Dhanapatrai & co (p) Ltd, 2018.
2. A Sudhakar and Shyam Mohan SP, Circuits and Networks: Analysis and Synthesis, 4th Edition, TMH, 2010.
3. A Edminister, Electric circuits, Schaum outline series, 7th Edition, McGraw Hill, 2017.
4. M E Vanvalkenburg, Network Analysis, 3rd Edition, PHI, 2006.

5. C L Wadhwa, Network analysis and synthesis, New Age International, 2nd Edition, 2006.

NPTEL COURSE LINKS:

1. NPTEL :: Electrical Engineering - NOC:Network Analysis, https://nptel.ac.in/courses/108/105/108105159
2. NPTEL :: Electrical Engineering - NOC:Basic Electric Circuits, https://nptel.ac.in/courses/108/104/108104139/
3. NPTEL :: Electrical Engineering - NOC:Basic Electrical Circuits, https://nptel.ac.in/courses/108/106/108106172/

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ENGINEERING MECHANICS
I B.Tech –II Semester (Code: 20EE206/CE02)

Lectures	3	Tutorial	0	Problem Solving	1	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Basic Physics

Course Objectives: To learn

- The concepts Force systems, free body diagrams, resultant of forces and equations of equilibrium, Supports and support reactions and calculation of Centroid.
- The Concept of moment of inertia of plane figures, Laws and applications of friction and the Analysis of the truss and determination of axial forces by Method of Joints
- Motion of a body and their relationships and application of D Alembert's principle inrectilinear and curvilinear motions.
- About Mass moment of inertia of material bodies, Plane motion of a body about a fixed axis.

Course Outcomes: By the end of the course the student will be able to

CO1: Analyze the forces developed at the contact of the bodies by constructing the free body diagram and location of centroid

CO2: Analyze the systems with friction, and M.I of composite figures

CO3: Analyze the axial forces in the members of truss and understanding of the principles of dynamics

CO4: Analyze of moment of inertia of material bodies and Rotation of rigid body about fixed axis.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3		
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3		
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3		
CO4	3	2	-	-	-	-	-	-	--	-	-	-	3		

UNIT – I

Concurrent Forces in a Plane

Principles of statics – composition and resolution of forces – equilibrium of concurrent forces in a plane –Method of moments.

Parallel Forces in a Plane

Two parallel forces – general case of parallel forces in a plane – center of parallel forces – Centroids of composite plane figures and curves.

UNIT – II

Moments of Inertia of Plane Figures

Moment of inertia of a plane figure with respect to an axis in its plane – Moment of Inertia with respect to an axis perpendicular to the plane of the figure – Parallel axis theorem.

Friction

Characteristics of friction – problems involving dry friction, ladder friction and wedge friction.

UNIT – III

Rectilinear Translation

Kinematics of rectilinear motion – principles of dynamics – Differential equations of rectilinear motion D'Alembert principle.

Curvilinear Translation

Kinematics of curvilinear motion – Differential equations of curvilinear motion – D'Alembert's principle.

UNIT – IV

Moments of Inertia of Material Bodies

Moment of inertia of rigid body – Moment of inertia of a lamina – Moments of inertia of three – dimensionalbodies.

Rotation of a Rigid Body about a Fixed Axis

Kinematics of rotation – Equation of motion for a rigid body rotating about a fixed axis – D'Alembert's principle.

TEXT BOOKS:

1. S. Timoshenko and D. H. Young, "Engineering mechanics" Mc Graw-Hill International edition (For concepts and symbolic problems)
2. R. C. Hibbeler and Ashok Gupta, "Engineering mechanics statics and dynamics", Pearson (For numerical problems using S.I. system ofunits)

REFERENCE BOOKS:

1. Beer and Johnston, "Vector mechanics for engineers statics and dynamics" Tata Mc Graw-Hill publishing company, NewDelhi
2. A. K. Tayal, "Engineering mechanics statics and dynamics" Umesh publication, Delhi (For numerical problems using S.I. system ofunits)

NPTEL COURSE LINKS:

1. NPTEL :: Mechanical Engineering - NOC:Engineering Mechanics
2. NPTEL :: Basic courses-Sem 1 and 2 - Engineering Mechanics

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ENGINEERING CHEMISTRY LAB
(Common to all branches)
I B.Tech –II Semester (Code:20EEL201/CYL01)

Lectures	0	Tutorial	0	Problem Solving	0	Practical	3	Credits	1.5
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Nil

Course Objectives: To make the students

- The basics of chemistry lab to carry out the qualitative and quantitative analysis ofany given sample.
- To determine the percentage purity of washing soda bleaching powder and given salt. The measurement of quality parameters of water to check its suitability for domesticand industrial purpose
- To estimate the characteristic properties of oil for its use at various level.
- To synthesize the Soap, Resin and Aromatic Ester followed by their applications.The use and utility of some instruments like P^H meter, Conductometer andPotentiometer for various applications.

Course Outcomes: By the end of the course the student will be able to

CO1: Familiar with fundamental basics of Chemistry lab.

CO2: Estimate purity of estimate purity of washing soda, bleaching powder and quantity of Iron andother salts.

CO3: Gain the knowledge regarding the quality parameters of water like salinity, hardness,alkalinity, oil for saponification and iodine value.

CO4: Prepare high polymers and soap and instrumentationtechnics.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	2	2	-	2	-	-	-	-	-	2	-	-	-
CO3	2	2	2	2	-	2	-	-	-	-	-	2	-	-	-
CO4	2	2	2	2	-	-	-	-	-	-	-	2	-	-	-

LIST OF EXPERIMENTS

1. **Introduction to Chemistry Lab** (the teachers are expected to teach fundamentals likeCalibration of Volumetric Apparatus, Primary, Secondary Solutions, Normality, Molarity, Molality etc. anderror, accuracy, precision, theory of indicators, use of volumetric titrations).

2. **Volumetric Analysis:**
   a. Estimation of Washing Soda.
   b. Estimation of Active Chlorine Content in Bleaching Powder
   c. Estimation of Mohr's salt by permanganometry.

3. **Analysis of Water:**
    a. Determination of Alkalinity of Tap water.
    b. Determination of Total Hardness of ground water sample by EDTA method
    c. Determination of Salinity of water sample
4. **Estimation of properties of oil**:
    a. Estimation of Acid Value
    b. Estimation of Saponification value
5. **Preparations:**
    a. Preparation of Soap
    b. Preparation of Urea-formaldehyde resin
    c. Preparation of Phenyl benzoate
6. **Demonstration Experiments (Any two of the following):**
    a. Determination of $p^H$of given sample.
    b. Determination of conductivity of given sample by conduct meter.
    c. Potentiometric Determination of Iron.

TEXT BOOKS (for Chemistry 1 and 2):

1. K.Mukkanti, Etal, "Practical Engineering Chemistry" B.S. Publications, Hyderabad, 2009.
2. Vogel, "Inorganic quantitative analysis", 5^{th} edition, Longman group Ltd. London, 1979.

REFERENCE BOOKS:

1. Text Book of engineering chemistry by R.n. Goyal and HarrmendraGoel.
2. A text book on experiments and calculations- Engineering Chemistry. S.S. Dara.
3. Instrumental methods of chemical analysis, Chatwal, Anand, Himalaya Publications.

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CIRCUIT THEORY LAB

I B.Tech –II Semester (Code: 20EEL202)

Lectures	0	Tutorial	0	Problem Solving	0	Practical	3	Credits	1.5
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Pre-requisites: Circuit theory, Mathematics

Course Objectives: To make the students

- State and verify basic Kirchhoff's laws in circuits.
- Explain and verify fundamental theorems of circuit theory.
- Study the parameters of a given choke coil.
- Solve and plot the locus diagrams of series RL, RC circuits.
- Describe and verify fundamental theorems of circuit theory using software.

Course Outcomes: At the end of the course the students should be able to

CO1: Provebasic Kirchhoff's laws for the given circuits.

CO2: Verify fundamental theorems of circuit theory.

CO3: Find the parameters of a given choke coil.

CO4: Draw the locus diagrams of series RL, RC circuits.

CO5: Verify fundamental theorems of circuit theory using software.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	1	-	-	-	-	3	2	-	-	3	-	-
CO2	3	3	2	1	-	-	-	-	3	2	-	-	3	2	-
CO3	3	2	1	2	-	-	-	-	3	2	-	-	2	3	-
CO4	3	3	2	3	-	-	-	-	3	2	-	-	2	2	-
CO5	3	2	3	3	-	-	-	-	3	2	-	-	3	2	-

LIST OF EXPERIMENTS

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Verification of Thevenin's theorem
4. Verification of Norton's theorem
5. Verification of Reciprocity theorem
6. Verification of Maximum Power Transfer theorem
7. Parameters of Choke coil
8. Measurement of low and medium resistance using volt ampere method
9. Locus diagram of RL series circuit
10. Locus diagram of RC series circuit
11. Steady state analysis of RL, RC and RLC series circuits using software
12. Verification of Superposition theorem using software
13. Verification of Thevenin's and Norton's theorem using software
14. Verification of Maximum Power Transfer theorem DC and AC circuits using software
15. Locus diagram of RL and RC series circuit using software

Note: Minimum 10 experiments should be carried out.

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PROGRAMMING FOR PROBLEM SOLVING LAB

I B.Tech –II Semester (Code: 20EEL203/CSL01)

Lectures	0	Tutorial	0	Problem Solving	0	Practical	3	Credits	1.5
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Basic Mathematics

Course Objectives: To make the students

- Understand basic concepts of C Programming such as: C-tokens, Operators, Input/output, Arithmetic rules.
- Develop problem-solving skills to translate "English" described problems into Programs written using C language.
- Use Conditional Branching, Looping, and Functions.
- Apply pointers for parameter passing, referencing and differencing and linking data structures.
- Manipulate variables and types to change the problem state, including numeric, character, array and pointer types, as well as the use of structures and unions, File.

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Course Outcomes: By the end of the course the student will be able to

CO1: Address the challenge, pick and analyze the appropriate data representation formats and algorithms.

CO2: Choose the best programming construct for the job at hand by comparing it to other structures and considering their constraints.

CO3: Develop the program on a computer, edit, compile, debug, correct, recompile and run it.

CO4: Identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	3	-	-	-	2	2	-	3	3	3	3
CO2	3	3	3	-	3	-	-	-	2	2	-	3	3	3	3
CO3	3	3	3	-	3	-	-	-	2	2	-	3	3	3	3
CO4	3	3	3	-	3	-	-	-	2	2	-	3	3	3	3

LIST OF PROGRAMMES:

1. A program for electricity bill taking different categories of users, different slabs in each category. (Using nested if-elsestatement).

Domestic Customer:		
Consumption Units	**Rate of Charges(Rs.)**	
0 – 200	0.50 per unit	
201 – 400	100 plus	0.65 per unit
401 – 600	230 plus	0.80 per unit
601 and above	390 plus	1.00 per unit

Commercial Customer:		
Consumption Units	**Rate of Charges (Rs.)**	
0 – 100	0.50 per unit	
101 – 200	50 plus	0.6 per unit
201 – 300	100 plus	0.70 per unit
301 and above	200 plus	1.00 per unit

2. Write a C program to evaluate the following (usingloops):
   a) $1 + x^2/2! + x^4/4!+ \ldots$uptotenterms
   b) $x + x^3/3! + x^5/5!+ \ldots$ upto ten terms
3. Write a C program to check whether the given number is
   a) Prime ornot.
   b) Perfect or Abundant orDeficient.
4. Write a C program to display statistical parameters (using one – dimensionalarray).
   a) Mean
   b) Mode
   c) Median
   d) Variance.
5. WriteaCprogramtoreadalistofnumbersandperformthefollowingoperations
   a) Print thelist.
   b) Delete duplicates from thelist.
   c) Reverse thelist.
6. Write a C program to read a list of numbers and search for a given number using Binary search algorithm and if found display its index otherwise display the message "Element not found in theList".

7. Write a C program to read two matrices and compute their sum andproduct.

8.Write a C program to read list of student names and perform the following operations
   a) To print the list of names.
   b) To sort them in ascending order.
   c) To print the list after sorting.

9. Write a C program that consists of recursive functions to

   a) Find factorial of a given number
   b) Solve towers of Hanoi with three towers (A, B & C) and three disks initially on tower A.

10. A Bookshop maintains the inventory of books that are being sold at the shop. The list includes details such as author, title, price, publisher and stock position. Whenever a customer wants a book the salesperson inputs the title and the author, and the system searches the list and displays whether it is available or not. If it is not, an appropriate message is displayed, if it is, then the system displays the book details and request for the number of copies required, if the requested copies are available the total cost of the requested copies is displayed otherwise the message "required copies not in stock" is displayed. Write a program for the above in structures with suitable functions.

11. Write a C program to read a data file of students' records with fields (Regno,Name, M1,M2,M3,M4,M5) and write the successful students data (percentage > 40%) to a data file.

12. Write a C program to read a file as command line argument and count the given word frequencyin a file.

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PROBABILITY AND STATISTICS

II B.Tech – III Semester (Code: 20EE301/MA03)

Lectures	2	Tutorial	1	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: None

Course Objectives: To make the students

- Apply the continuous probability densities to various problems in science and engineering.
- Estimate the point and interval estimators of the mean, variance and proportion for the given Sample data and apply Z-test, t-test to various real-life problems.
- Apply various sample tests like F-test and $\chi 2$ -test for decision making regarding the population based on sample data.
- Compute the level of correlation, the best fit curve to the given data by the method of least squares and also perform ANOVA arising in the field of engineering.

Course Outcomes:At the end of this course, students will be able to

CO1: Apply discrete and continuous probability distributions to various problems arising inengineering applications.

CO2: Perform Test of Hypothesis for a population parameter for single sample.

CO3: Perform Test of Hypothesis for population parameters for multiple samples.

CO4: Interpret the results of correlation, regression and one way ANOVA for the given data.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	-	-	-	-	-	-	2	3	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	2	2	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	2	2	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	2	2	-	-

UNIT – I

Continuous Random Variables, Normal Distribution, Normal Approximation to the Binomial Distribution, Uniform Distribution, Gamma Distribution and its applications, Beta Distribution and its applications, Weibull distribution, Joint Distributions (Discrete), Joint Distributions (Continuous).

[Sections 5.1, 5.2, 5.3, 5.5,5.7, 5.8, 5.9, 5.10]

UNIT – II

Populations and Samples, the sampling distribution of the mean (σ known), The sampling distribution of the mean (σ unknown), The sampling distribution of the variance, point estimation, Interval estimation, Tests of Hypotheses, Null Hypothesis and Tests of hypotheses, Hypothesis concerning one mean.

[Sections 6.1, 6.2, 6.3, 6.4, 7.1, 7.2, 7.4, 7.5, 7.6]

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UNIT – III

Comparisons-Two independent large samples, Comparisons-Two independent small samples, matched pairs comparisons, the estimation of variances, Hypotheses concerning one variance, Hypotheses concerning two variances.

[Sections 8.2, 8.3, 8.4, 9.1, 9.2, 9.3]

UNIT – IV

Estimation of proportions, Hypotheses concerning one proportion, Hypotheses concerning several proportions.The method of least squares, curvilinear regression, multiple regression, correlation, Completely Randomized Designs**.**

[Sections 10.1, 10.2, 10.3, 11.1, 11.3, 11.4, 11.6, 12.1, 12.2]

TEXT BOOKS:

1. Miller & Freund's "Probability and Statistics for Engineers", Richard A. Johnson, 8th Edition, PHI. .

REFERENCE BOOKS:

1. R.E Walpole, R.H. Myers & S.L. Myers 'Probability & Statistics for Engineers and Scientists', 6th Edition, PHI.
2. Murray R Spiegel, John J.Schiller, R. AluSrinivasa, 'Probability &Satistics',Schaum's outline series.

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NETWORK ANALYSIS

II B. Tech – III Semester (Code: 20EE302)

Lectures	2	Tutorial	0	Problem Solving	1	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: BasicMathematics

CourseObjectives: Tomake thestudents.

- Inferandevaluatetransientresponse,Steadystateresponse forsingle phasesystems.
- Interpret the circuits usingLaplaceTransforms.
- Understandtheconceptsofthree-phasesystemsandtheiranalysis.
- Evaluatetwo-port networkparametersandnetworkfunctions.
- Formulate the equations of coupled circuitsandtheirbehavior.
- ConstructpassivefiltersusingconstantKandMderivedmethods.

CourseOutcomes: After completion of this course, Studentswillbeable to

CO1: Solve transient response, steady state response for single phase systems.

CO2: Apply Laplace Transforms to electrical circuit and its analysis.

CO3: Determine the voltages, currents, and powers in three-phase circuits with balanced and unbalanced loads.

CO4: Evaluate two-port network parameters, network functions.

CO5: Demonstrate the coupled circuits and theirbehavior.

CO6: Illustrate passive filters using constant K and M derived methods.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	2	3	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	2	3	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	2	3	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	2	3	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	2	3	-	-
CO6	3	3	2	-	-	-	-	-	-	-	-	2	3	-	-

UNIT – I

SolutionofFirstandSecondordernetworks: Solutionoffirstandsecondorderdifferentialequationsfor Seriesandparallel R-L, R-C, RLC circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state responsefor DC and AC excitations.

Electrical Circuit Analysis Using Laplace Transforms: Review of Laplace Transform,Analysisofelectricalcircuitsusing LaplaceTransformforstandardinputs,convolutionintegral,inverse Laplace transform, Frequencyresponse(magnitudeandphaseplots).

UNIT – II

Poly Phase Systems: Advantages of 3-phase systems, generation of 3-phase voltages, phasesequence, star & delta connections, interconnection of 3-phase sources and loads, voltage,current&powerinstar&deltaconnectedsystems,analysisof3-phasebalancedcircuit, measurement of3-phasepower,2wattmetermethod.Analysisof3-phaseunbalancedsystems,star/deltatransformation method,applicationofKVLandMillman'smethod.

UNIT-III

TwoPortNetworkandNetworkFunctions: TwoPortNetworks,terminalpairs,relationshipoftwoportvariables,impedanceparameters,admittanceparameters,transmissionparametersandhybridparameters,interrelationoftwoportnetwork,interconnections of two port networks, image parameters, Two-Port bridged – T, Ladder andLatticenetworks.transformednetworkwithinitialconditions.Transferfunctionrepresentation. Poles and Zeros - Network functions for the one port and two port - Poles andZerosofnetwork functions -Restrictions onpoleandzerolocations fordriving pointfunctionsand transfer functions-Timedomain behavior from the polezeroplot..

UNIT-IV

Coupled Circuits: Defining self and mutual inductance, coefficient of coupling, dotconvention, Development of circuit equations in time domain and frequency domain, solutionofcoupledcircuits,series, andparallel connections oftwocoupledcoils,tunedcircuitanalysis(single and double tuned)

Filters:Lowpass,high pass,bandpass&bandrejectfilters-frequencyresponse, constantK–andMderived–filters.

TEXTBOOKS:

1. WilliamH. Hayt,Jack E. KemmerlyandStevenM. Durbin,"EngineeringCircuitAnalysis", 8th Edition,TMH,2013.
2. ASudhakarandShyamMohanSP,"CircuitsandNetworks:AnalysisandSynthesis",5th Edition, TMH, 2017.

REFERENCEBOOKS:

1. M.E.Vanvalkenburg,"Network Analysis",3rd Edition,PHI,2006.
2. C.K.AlexanderandM.N.O.Sadiku,"ElectricCircuits",McGrawHillEducation, 5th Edition, 2016.
3. AbhijitChakrabarti,"Circuit theoryanalysisandsynthesis"Dhanapatrai&co(p)Ltd,2018.

4. C. L Wadhwa, "Network analysis and synthesis", New Age International, 2nd Edition,2006.
5. J.A.Edminister,"Electriccircuits",Schaumoutlineseries,.

NPTEL COURSE LINKS:

1. NPTEL :: Electrical Engineering - NOC:Network Analysis
2. NPTEL :: Electrical Engineering - NOC:Basic Electrical Circuits
3. NPTEL :: Electrical Engineering - NOC:Basic Electric Circuits
4. https://onlinecourses.nptel.ac.in/noc22_ee07/preview
5. https://archive.nptel.ac.in/courses/108/105/108105159/

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ELECTROMAGNETIC FIELDS

II B.Tech – IV Semester (Code: 20EE303)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Basic Physics, Basic Mathematics

Course Objectives: To make the students

- Acquire knowledge in Electromagnetic field theory.
- Provide a solid foundation in Electrostatics such as Dipole, Capacitance
- Attain familiarity in Boundary conditions and Magnetic field.
- Illustrate the relation between field theory and circuit theory.
- Identify the electromagnetic wave propagation in medium.

Course Outcomes: After completion of this course,Students will be able to

CO1: Describethe fundamentals in Electromagnetic field theory.

CO2: Explain basics in Electrostatics such as Dipole, Capacitance

CO3: Distinguish electric and magnetic properties of material media and Familiarity in boundary conditions and Magnetic field.

CO4: Explainthree-dimensional vector differential and integral concepts to solve real life electromagnetic field problems.

CO5: Describe the electromagnetic wave propagation in medium.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	-	-	-	2	3	2	-
CO2	3	3	2	-	-	-	-	-	-	-	-	2	3	2	-
CO3	3	3	2	-	-	-	-	-	-	-	-	2	3	2	-
CO4	2	2	2	-	-	-	-	-	-	-	-	2	3	2	-
CO5	3	3	3	-	-	-	-	-	-	-	-	2	3	2	-

UNIT – I

Electrostatics I: Introduction to Rectangular, Cylindrical and Spherical Coordinate systems. The experimental law of coulomb, Electric field intensity, Field due to a continuous volume charge distribution, Field of a line charge, sheet of charge. Electric Flux Density, Gauss's law, Applications of Gauss law, Divergence, Maxwell's First equation (Electrostatics), Energy expended in moving a point charge in an electric field, Definition of potential and potential difference. The potential field of a point charge, system of charges, potential gradient.

UNIT – II

Electrostatics II: Electric field intensity due to dipole and Energy density in electrostatic field. The nature of dielectric materials, boundary conditions for perfect dielectric materials.Capacitance.Several capacitance examples.Capacitance of a two-wire line.Derivations

of Poisson's and Lap lace's equations, Examples of the solution of Laplace's equation. Current and current density, continuity of current, conductor properties and boundary conditions

UNIT – III

Steady Magnetic Field: Biot- Savart Law, Ampere's Circuital Law, Magnetic Flux and Magnetic Flux Density, The scalar and vector magnetic potentials. Magnetic Forces and Materials: Force on a moving charge, Force on a differential current element, Force between differential current elements, Force and torque on a closed circuit, The nature of magnetic materials, Magnetization and Permeability. Magnetic boundary conditions.Potential energy in magnetic fields.

UNIT – IV

Time Varying Fields and Maxwell's Equations: Faraday's law, Displacement current, Maxwell's equations in point form, integral form.

Concept of Uniform Plane Wave: Wave propagation in free space, dielectrics. Poynting theorem and wave power. Propagation in good conductors: skin effect. Reflection of uniform plane waves at normal incidence.

TEXT BOOKS:

1. W H Hayt, J A Buck , "Engineering Electromagnetics", 9th Edition TMH, 2020.
2. G S N Raju, "Electromagnetic Field Theory and transmission lines", 1st Edition, Pearson Education India, 2005.

REFERENCE BOOKS:

1. Joseph A Edminister, "Theory and Problems of Electromagnetics", 2nd Edition, Schaum's Outline Series, Mc-Graw Hill International, 1993
2. EC Jordan and KG Balmain, "Electromagnetic Waves and Radiating Systems", PHI, 2003.
3. Mathew NO Sadiku, "Elements of Electromagnetics", Oxford University Press, 2003.

NPTEL COURSE LINKS:

1. Electrical Engineering - NOC:Electromagnetic theory - NPTEL
   https://nptel.ac.in/courses/108/104/108104087/
2. Electrical Engineering - Electromagnetic Fields - NPTEL
   https://nptel.ac.in/courses/108/106/108106073/

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DC MACHINES AND TRANSFORMERS

II B.Tech – III Semester (Code: 20EE304)

Lectures	3	Tutorial	0	Problem Solving	1	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Basic Physics, Basic Mathematics

Course objectives: To make the students

- Demonstrate the concept of magnetic circuits and electromagnetic force and torque.
- Explain the construction of dc generators and its characteristics.
- Study the various speed control techniques and testing methods of dc motor.
- Explain the construction and operation of single and three phase Transformers.

Course Outcomes: At the end of this course, students will be able to

CO1: Illustrate the concepts of magnetic circuits.
CO2: Describe the operation of dc generators and its characteristics.
CO3: Demonstrate the speed control techniques and various testing methods of dc motors.
CO4: Assess the construction and operation of single phase and three phase Transformers.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	2	3	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	2	3	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	2	3	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	2	3	-	-

UNIT-I

Magnetic Fields and Magnetic circuits: Review of magnetic circuits-MMF, flux, reluctance, inductance; review of Ampere law and Biot- Savarts law. Visualization of magnetic fields produced by a bar magnet and a current carrying coil-through air and through a combination of iron and air.

Electromagnetic force and torque: B-H curve of magnetic materials; energy stored in magnetic circuit; Field energy and mechanical force-mechanical energy-Multiple excited magnetic field systems-Forces /Torques in systems with permanent magnets. Examples of galvanometer coil-relay contact-lifting magnet-rotating element with eccentricity or saliency.

UNIT-II

DC Generators: Basic construction of a DC machine-Principle and operation of DC Generator-Types of windings- Types of field excitations-EMF equation-Armature reaction- commutation-Characteristics of all types of DC Generators-Applications of DC Generators- Parallel operation of DC Generators.

UNIT-III

DC Motors: Principle and operation of DC motor-Torque equation of DC motor-characteristics of all types of DC motors-starters and their design-speed control-Losses-Swinburne's test, load testing and back-to-back testing of DC machines.

UNIT-IV

Single phase Transformers: Principle, Construction and operation of single-phase transformer, equivalent circuit, phasor diagrams. Voltage Regulation, losses and efficiency.Testing's-OC and SC test, back-to back test, Separation of hysteresis and eddy current losses.**Three phase transformers:** Construction, types of connection and their comparative features. Parallel operation.Auto- transformers.Magnetizing current, effect of non-linear B- H curve of magnetic core material.Scott connection, tap changing transformers.Cooling of transformers.

TEXT BOOKS:

1. P.S.Bhimbra, Electric Machinery, Khanna Publications, 7th Edition, 2011.
2. I.J.Nagrath & D.P.Kotari, Electric Machines, Tata Mc Graw-Hill Publication, 3rd Edition, 2017.

REFERENCES BOOKS:

1. A.E. Fritzgerald, C. Kingsley & S. Umans –Electric Machinary, McGraw-Hill Companies, 6th Edition 2017
2. Samarjit Ghosh, Electrical Machines, Pearson 2nd Edition, 2012.
3. J. B. Gupta, Theory & performance of Electric Machines, S.K. Kataria&Sons,15th Edition, 2015
4. M.G.Say, Performance and design of AC machines, CBS Publishers, 5th Edition, 2005.

NPTELCOURSE LINKS:

1. NPTEL :: Electrical Engineering - NOC:Electrical Machines - I, https://nptel.ac.in/courses/108/105/108105155/
2. NPTEL :: Electrical Engineering - Electrical Machines -I, https://nptel.ac.in/courses/108/105/108105017/

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TECHNICAL ENGLISH

II B.Tech – III Semester (Code: 20EE305/EL02)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: NIL

Course Objectives: Students will be able

- To enhance the vocabulary competency of the students
- To enhance the understanding of the elements of grammar
- To enable the students to use proper spelling, grammar in constructing the sentences
- To enhance the learner's ability to communicate accurately

CourseOutcomesBytheendofthecoursethestudentwouldbeableto

CO1: Makeuseofcontextualcluestoinfermeaningsofunfamiliarwordsfromcontext

CO2: Understandhowtoapplytechnicalinformationandknowledgeinpracticaldocumentsfora varietyofpurposes

CO3: Analyse the content of the text in writing use grammatical, stylistic, andmechanical formats and conventions appropriate to various audiences and disciplines

CO4: Buildconfidencetoparticipateactivelyinwritingactivities(individuallyandincollaborat ion)thatmodeleffectivetechnicalcommunicationin theworkplace

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	2	2	3	2	2	-	-	2
CO2	-	-	-	-	-	-	-	2	2	3	2	2	-	-	2
CO3	-	-	-	-	-	-	-	2	2	3	2	2	-	-	2
CO4	-	-	-	-	-	-	-	2	2	3	2	2	-	-	2

UNIT-I

1.1 VocabularyDevelopment:FamiliarisingIdioms&Phrases
1.2 GrammarforAcademicWriting:MakingRequests
1.3 LanguageDevelopment:UsingTransition&Linkwords
1.4 TechnicalWriting:LetterWriting&EmailWriting

UNIT-II

2.1 VocabularyDevelopment:Analogouswords,GenderSensitivelanguage
2.2 GrammarforAcademicWriting:Tenses:SimplePast/PresentPerfect,TheFuture:Pre dicting&Proposing

2.3 LanguageDevelopment:Clozetests
2.4 TechnicalWriting:TechnicalReports

UNIT-III

3.1 VocabularyDevelopment:Abbreviations&Acronyms
3.2 Grammar for Academic Writing:Describing(People/Things/Circumstances): Adjectival&Adverbialgroups
3.3 LanguageDevelopment:Transcoding(Channelconversionfromcharttotext)
3.4 TechnicalWriting:Circular,Memos,MinutesofMeeting

UNIT-IV

4.1 VocabularyDevelopment:Corporatevocabulary
4.2 GrammarforAcademicWriting:Inversions&Emphasis
4.3 LanguageDevelopment:ReadingComprehension
4.4 TechnicalWriting:ResumeRefe

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rence Books

1. CommunicationSkills,SanjayKumar&PushpaLatha.OxfordUniversityPress:2011.
2. TechnicalCommunicationPrinciplesandPractice.OxfordUniversityPress:2014.
3. AdvancedLanguagePractice,MichaelVince.MacMilanPublishers:2003.
4. ObjectiveEnglish(ThirdEdition),EdgarThorpe&Showick.PearsonEducation:2009
5. EnglishGrammar:AUniversityCourse(SecondEdition),AngelaDowning&Philip Locke,Routledge Taylor &FrancisGroup:2016

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SOFTWARE TOOL TO ELECTRICAL ENGINEERING

II B.Tech – III Semester (Code: 20EEL301/SOC1)

Lectures	1	Tutorial	0	Problem Solving	0	Practical	2	Credits	2
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Course Objectives: This course enables the students to

- CreateawarenessaboutMATLABsoftwareandbasicmathematicalfunctionandMATRIX operations representation
- Learn the fundamental of M-file script and Simulink writing concepts and Plot function
- Explain the basics of SCILAB Software with programming
- Develop the Input and Output Functions with graphic applications using SCILAB

Course Outcomes(COs): By the end of the course the student would be able to

CO1: Develop awarenessaboutMATLABandbasicmathematicalfunction,matrixoperations representation.

CO2: Execute the code in MATLAB Script files for differential, linear,non –linear equations for solving the problems.

CO3: Write the code for matrixoperations,differential, linear, non-linearEquations using SCILAB.

CO4: Develop the Input and Output Functions with graphical representation Using SCILAB.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	3	3	-	-	-	3	3	-	2	3	-	-
CO2	3	3	2	3	3	-	-	-	3	3	-	2	3	-	-
CO3	3	3	2	3	3	-	-	-	3	3	-	2	3	-	-
CO4	3	3	2	3	3	-	-	-	3	3	-	2	3	-	-

UNIT-I

Introduction to MATLAB software:Over view of MATLAB Environment, Basic commands, Assigning variables, Operations with variables, Data files and Data Types-Character and string, Arrays and vectors, Column vectors, Row vectors,

Basic Mathematics: Arithmetic operations, Operators and special characters, logical operators, solving arithmetic equations, Matrix Operations-Finding transpose, determinant and inverse Solving matrix; Other operations -Trigonometric functions, Complex numbers, fractions Real numbers, Complex numbers.

UNIT-II

M files: Working with script tools, Writing Script file, executing script files, The MATLAB Editor,savingmfiles;LoopsandConditionalStatements-ControlFlowconditionalControlif, else, switch Loop Control for, while, continue, break Program Termination return; Functions-Writinguserdefinedfunctions,builtinFunction,Functioncalling,ReturnValue.

MATLAB Simulink: Introduction of Simulink, Simulink Environment & Interface, Study of Library,CircuitOrientedDesign,EquationOrientedDesign,Model,SubsystemDesign.

UNIT-III

Introduction to SCILAB software: Scilab Objects -Matrix Construction and Manipulation, Strings, Boolean Matrices, Polynomial Matrices, Sparse Matrices, Lists, Functions.

SCILAB Programming :Branching, Iterations, Scilab Functions, Debugging Programs.

UNIT-IV

Input and Output Functions: Display of Variables, Formatted Input and Output, Input Output in Binary Mode

SCILAB Graphics:Basic Graphing, Graphics Objects, Graphic Tour, Basic Graphics Functions, Mathematical functions-continuous linear system.

List of Experiments:

1. Tapping some Array Operations on Marks earned bystudents
2. Find first 10 terms of Fibonacciseries.
3. Find factorial of a numbern
4. Find the Rank, transpose, inverse of the givenmatrix.
5. Create a script file for two or more polynomial functions.
6. Solving System of Equations in MATLAB and scilab.
7. Compute the solution of differential equations.
7. FindthesolutionoflinearequationsusingGauss andGaussSeidel.
8. FindthesolutionofnonlinearequationsusingBisectionmethodandNewton–Raphson
9. Implements bisection method for finding a root f(x) = 0 using SCILAB
10. Findthesolutionofnonlinearequationsusing Newton–Raphson method.
11. Find a least-squares fit of the model of given quadratic equation using SCILAB.
12. Find Numerical Integration using trapezoidal rule using Scilab.
13. Draw the plot for Eleven data samples in the interval $0 \leq x \leq 1$ of the function y=2cos(6

x+0.5) using SCILAB.

14. Find the solution of Ordinary differential equations using SCILAB.
15. Draw the 3D plots using basic techniques using SCILAB

TEXT BOOKS:

1. StephenJ. Chapman ,MATLAB Programming for Engineers,Cengage Learning, 4th Edition,2014.
2. S. Nagar, Introduction to Scilab For Engineers and Scientists,Apress, 1stEdition, 2017.

REFENCE BOOKS:

1. Shawna Lockhart, Eric Tilleson, Introduction to Programming with MATLAB, SDC publications, 1st Edition 2019.
2. Stephen L. Campbell, Jean-Philippe Chancelier and Ramine Nikoukha "Modeling and Simulation in Scilab/Scicos, Springer, 4thedition ,2010.

ONLINE COURSE LINKS:

1. https://nptel.ac.in/courses/103/106/103106118/
2. https://nptel.ac.in/courses/111102137
3. https://www.scilab.org/numerical-computing-for-engineers

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MEASUREMENT AND INSTRUMENTATION LAB

II B.Tech – III Semester (Code: 20EEL302)

Lectures	2	Tutorial	0	Problem Solving	0	Practical	2	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Basic Mathematics, Basic Electrical Engineering.

Course Objectives: To make the students

- To learn about characteristics of measuring instruments.
- To have an adequate knowledge in Calibration of measuring instruments.
- To have an adequate knowledge in errors in Bridges.
- To have an adequate knowledge in Sensors and Transducers.

Course Outcomes(COs): By the end of the course the student would be able to

CO1: Demonstrate various measurement devices, characteristics, operation and their limitations.

CO2: Illustrate the dynamic response and the calibration of few instruments.

CO3: Calibration and validation of DC and AC bridges.

CO4: Demonstrate the Function of Various types of Transducers.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	3	-	-	-	-	3	3	-	-	3	2	-
CO2	3	3	-	3	-	-	-	-	3	3	-	-	3	2	-
CO3	3	3	-	3	-	-	-	-	3	3	-	-	3	2	-
CO4	3	3	-	3	-	-	-	-	3	3	-	-	3	2	-

UNIT-I

INTRODUCTION TO MEASUREMENT Elements of Generalized measurement system- Methods of measurement- Classification of instruments–Static & Dynamic characteristics of instruments-Mean, Standard deviation- Probability of errors-Types of error Accuracy, Precision, Sensitivity, Linearity, Resolution.

UNIT-II

ELECTRICAL MEASURING INSTRUMENT: Basic effects of electromechanical instruments– Ammeter and voltmeter–Moving coil–Moving Iron–Electro dynamo meter and induction type– Extension of range. Wattmeter–Dynamometer and induction type energy meter.

UNIT-III

BRIDGES**:** Measurement of resistance-Low Medium and High- AC bridges- Anderson's for L, Schering Bridge for C.

UNIT-IV

TRANSDUCERS: Temperature transducers-RTD, Thermistor, Thermocouple-Displacement transducer- LVDT, Pressure transducer- Strain gauge.

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List of Experiments

1) Measurement of a batch of resistors and estimating statistical parameters.
2) Measurement of Medium resistance using Wheatstone bridge.
3) Measurement of Inductance using an Anderson's bridge technique as well as LCR meter.
4) Measurement of Capacitance using Schering bridge technique as well as LCR meter.
5) Measurement of Low Resistance using Kelvin's double bridge.
6) Measurement of High resistance and Insulation resistance using Megger.
7) Measurement of dielectric strength of Transformer oil using oil testing kit.
8) Calibration of 1-phase energy meter using direct loading/ Phantom loading method.
9) Current Measurement using CT.
10) Study a Linear Variable Differential Transformer (LVDT) and use it in a simple experimental set up to measure a small displacement.
11) Study the characteristics of Resistance Temperature Detector (RTD)
12) Study the characteristics of a Thermistor.
13) Study the characteristics of a Thermocouple.
14) Study the characteristics of a Photo reflective sensor for Speed Measurement.
15) Measure the stress & strain using strain gauges mounted on cantilever beam.

Note: Minimum 10 experiments should be carried.

TEXT BOOKS:

1. K. Sawhney, Puneet Sawhney , A course in electrical and electronic measurements and instrumentation, Dhanpat rai &Co, 19th Revised 2014.
2. R.K. Rajput, Electrical & Electronics Measurements & Instrumentation, S. Chand and Company Ltd.

REFERENCE BOOKS:

1. 1.J.B. Gupta, A Course in Electrical & Electronics Measurement & Instrumentation, Kataria and Sons,Reprint 2013.
2. 2.D.V.S. Moorthy, Transducers & Instrumentation, Prentice Hall of India, 2nd Edition,2008.
3. 3.B.C. Nakra and K.K.Choudhry ,Instrumentation Measurement and Analysis,,Mc Graw Hill Education (India) Pvt.Ltd, 3rd Edition 2009.

NPTEL COURSE LINKS:

1. http://nptel.ac.in/courses/108105064/
2. http://nptel.ac.in/courses/112103174/10
3. https://swayam.gov.in/courses/4523-mechanical-measurement-system
4. https://swayam.gov.in/course/3764-industrial-instrumentation

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DATA STRUCTURES AND ALGORITHMS LAB

II B.Tech – III Semester (Code: 20EEL303/IT01)

Lectures	1	Tutorial	0	Problem Solving	0	Practical	2	Credits	2
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Programming for Problem Solving

Course Objectives: Students will be able

- To impart the basic concepts of data structures and algorithms.
- To understand concepts about searching and sorting techniques
- To understand basic concepts about stacks, queues, lists, trees and graphs.
- To enable them to write algorithms for solving problems with the help of fundamentaldata structures.

Course Outcomes(COs): By the end of the course the student would be able to

CO1: Implement a linked lists.

CO2: Implement stack and queue ADT's using arrays.

CO3: Construct and implement different tree algorithms.

CO4: Implement various hashing techniques and Graph traversal methods.

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	2	2	-	-	-	-	3	2	-	3	3	2	-
CO2	3	3	3	2	-	-	-	-	3	2	-	3	3	2	-
CO3	1	3	2	2	-	-	-	-	3	2	-	3	2	1	-
CO4	1	2	3	2	-	-	-	-	3	2	-	3	2	1	-

UNIT - I

Introduction: Importance of Data Structures, Classification of Data Structures.

Stacks and Queues: Stack ADT and its operations, Stack Applications: Evaluation of Postfix. Queue ADT, Operations on Queue ADT.

UNIT - II

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion, Deletion from linked list. Double Linked List-Operations.

Sorting Techniques: Quick sort, Merge Sort.

UNIT - III

Trees: Preliminaries, Binary Trees, Expression trees, The Search Tree ADT-implementations.

UNIT - IV

Graphs: Basic Terminologies and Representations, Graph search and traversal algorithms: BFS and DFS.

LIST OF EXPERIMENTS:

1. Write a program to perform the following operations on Array List.

a) Creation b) Insertion c) Deletion d) Search e) Display.

2. Write a program to implement the following

   a) stack using array b) queue using array

3. Write a program to implement the following using stack.

   a) infix to postfix conversion b) postfix evaluation

4. Write a program to implement circular queue and perform the following

   a) enqueue b) dequeue

5. Write a program to perform the following operations on Single Linked List.

   a) Creation b) Insertion c) Deletion d) Search e) Display

6. Write a program to perform the following operations on Circular Single Linked List.

   a) Creation b) Insertion c) Deletion d) Search e) Display

7. Write a program to perform the following operations on Doubly Linked List.

   a) Creation b) Insertion c) Deletion d) Search e) Display

8. Write a program to implement the following sorting techniques

   a) Quick Sort b) Merge Sort c) Shell Sort

9. Write a program to demonstrate Binary Expression tree.

10. Write a program to create Binary tree and display their traversals.

TEXT BOOKS:

1. Mark Allen Weiss. Data Structures and Algorithm Analysis in C. Pearson Education, 2 edition, 2013. ISBN 978-81-7758-358-8

REFERENCES:

1. M.J.Augeustein Y.Langsam and A.M.Tenenbaum. Data Structures Using C. Pearson Education Asia, 2 edition, 2006. ISBN 81-203-1177-9.
2. Behrouz A. Forouzan Richard F.Gilberg. Data Structures – A Pseudocode Approach with C.ThomsonBrooks / COLE, 2 edition, 1998. ISBN 978-0-534-39080-8.
3. J.E. Hopcroft Alfred Aho and J.D. Ullman. *Data Structures and Algorithms*. Pearson Education Asia,1 edition, 1983. ISBN 978-0201000238

NPTEL COURSE LINKS:

1. Naveen Garg. NPTEL Course on Data Structures And Algorithms. IIT Delhi. URL https://nptel.ac.in/courses/106102064
2. NPTEL :: Computer Science and Engineering - NOC:Programming, Data Structures and Algorithms
3. NPTEL :: Computer Science and Engineering - Data Structures And Algorithms

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PROFFSSIONAL ETHICS AND HUMAN VALUES

II B.Tech –III Semester (Code: 20EE306/MC02)

Lectures	2	Tutorial	0	Problem Solving	0	Practical	0	Credits	0
Continuous Internal Evaluation			30	Semester End Examination (3 Hours)					0

Course Objectives (COs): To make the student

- Illustrate the importance of ethics and human values in life and society, moral awareness.
- Build ethics to engineering profession,Explain moral development, and importance of ethical theories.
- Demonstrate the Engineers as responsible experimenters, assessment of safety and risk, employee rights and professional rights.
- Shape themselves into valuable professionals, follow ethics and are able to solve their ethical dilemmas.

Course Outcomes: At the end of this course, students will be able to

CO1: Explain objectives of ethics and human values that ought toguide the engineering. profession.

CO2: Develop work ethics in the profession and in society andresolves the moral issues in the profession and moral development.

CO3: Demonstrate the Engineers asresponsible experimenters, assessment of safety and risk, employee rights and professional rights.

CO4: Describe Shape themselves into valuable professionals, follow ethics and are able to solve their ethical dilemmas.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	3	3	2	-	2	-	-	-
CO2	-	-	-	-	-	-	-	3	3	2	-	2	-	-	-
CO3	-	-	-	-	-	-	-	3	3	2	-	2	-	-	-
CO4	-	-	-	-	-	-	-	3	3	2	-	2	-	-	-

UNIT – 1

Morals, values and Ethics: Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT -II

Senses of Engineering Ethics: Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan"s theory – Consensus and Controversy – Models of

professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT – III

Engineering as Social Experimentation: Engineering as Experimentation, Engineers as Responsible Experimenters, Codes of Ethics, Safety, Responsibility and Rights: Safety and Risk– Assessment of Safety and Risk, Risk Benefit Analysis and Reducing Risk. Collegiality and Loyalty, Respect For Authority, Collective Bargaining Confidentiality, Conflicts Of Interest, Occupational Crime, Professional Rights Employee Rights,

UNIT – IV

Global Issues: Multinational Corporations, Environmental Ethics, Computer Ethics, Engineers as Managers, Consulting Engineering, Engineering as Expert Witnesses and Advisors. Intellectual Property Rights (IPR) – Discrimination.

TEXT BOOKS:

1. Mike Martin and Roland Schinzinger, Introduction to Engineering Ethics, Mc Graw Hill, 2nd Edition, 2010.
2. M. Govindarajan, S. Natarajan, V. S. Senthil kumar, "Professional Ethics and Human Values", PHI Learning Pvt Ltd., 2013.
3. Charles E Harris, Michael S Pritchard and Michael J Robins, "Engineering Ethics", 6th edition, 2017.

REFERENCE BOOKS:

1. Charles D Fleddermann, "Engineering Ethics", Pearson Prentice Hall, 2008.
2. John R Boatright, "Ethics and The Conduct of Business", Pearson, 8th Edition, 2016.
3. Edmund G Seebauer And Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2000

NPTEL VIDEO LINKS:

1.https://nptel.ac.in/courses/109/106/109106117/
2.https://nptel.ac.in/courses/110/105/110105097/

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ANALOG ELECTRONICS

II B.Tech – IV Semester (Code: 20EE401)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Basic Physics

Course Objectives: To make the students

- Describe formation of PN junction Diode and applications of diode like Rectifiers, clippers and clampers.
- Explain and design the working concepts of BJT / FET amplifiers.
- Examine the fundamental concepts of differential, multi-stage and operational amplifiers.
- Study about basics of Differential, Multi-stage and operational amplifiers**.**
- Gain knowledge about Linear and Nonlinear applications of Op-amp.

Course Outcomes: After completion of this course, **s**tudents will be able to

CO1: Demonstrate the fabrication a PN junction diode while delving into its diverse applications including rectification, clipping and clamping.

CO2: Infer and outline the functioning principles and devise the operational mechanism of BJT/FET Amplifiers.

CO3: Investigate and analyse a variety of feedback and oscillating circuits.

CO4: Classify and discuss the core concepts of differential, multi-stage and operational amplifiers in detail.

CO5: Illustrate the linear and nonlinear applications of operational amplifiers.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	2	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	2	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	2	-
CO4	3	3	2	-	-	-	-	-	-	-	-	2	3	2	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	2	-

UNIT – I

Diode circuits: Open-circuited P-N Junction, Current Components in a p-n diode, I-V characteristics, temperature Dependence of the I-V characteristic, Zener Diode.

Rectifiers: Half wave, full wave and Bridge Rectifiers without filter and with inductor filter, capacitor filter, L section &Π- section filters.

Clippers, Clampers: Positive and negative clippers - Positive and negative clampers.

UNIT – II

BJT circuits: NPN & PNP junction transistors, Transistor current components, CB Configuration, CE Configurations, CC configuration, BJT as a switch, BJT as an amplifier, BJT biasing circuits, Small signal equivalent circuits.

FET circuits: JFET, Pinch-off voltage , volt-ampere characteristics, MOSFET structure and I-V characteristics, MOSFET as a switch, MOSFET as an amplifier, FET small signal model, CS / CD / CG configurations at low frequencies.

UNIT – III

Feedback Amplifiers: Feedback concept, Transfer Gain with Feedback, Negative feedback amplifiers and their characteristics.

Oscillators: Barkhausen criterion for sinusoidal oscillators, RC phase shift oscillator using BJT, General Form of Oscillator, Wien Bridge, Hartley, Colpitt's oscillators using BJT. **Differential, Multi-stage and operational amplifiers:** Differential amplifier, multi-stage amplifiers, internal structure of an operational amplifier, deal op-amp, non-idealities in an op- amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

UNIT – IV

Linear applications of Op-amp: Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, instrumentation amplifier, integrator, differentiator, Voltage to current and current to voltage conversion.

Nonlinear applications of Op-amp: Basic comparator, Zero-crossing detector , Schmitt Trigger, Square-wave and triangular-wave generators, Absolute value output circuit, Peak detector, Sample and hold circuit, Precision rectifier.

TEXT BOOKS:

1. Jacob Millman and Christos C Halkias, Integrated Electronics Analog and Digital Circuits and Systems,Tata McGraw Hill, 2nd Edition,2017.
2. Rama Kant A. Gayakwad, Op-Amps and Linear Integrated Circuits, Pearson education,4th Edition, 2015.

REFERENCE BOOKS:

1. Theodore F Bogart Jr., Jeffrey S Beasley and Guillermo Rico, Electronic Devices and Circuits, Pearson Education, 6th Edition, 2004.
2. David A Bell, Electronic Devices and Circuits, Prentice Hall India, 5th Edition, 2018.
3. D.Roy and Choudhury, ShailB.Jain, Linear Integrated Circuits,New Age International, 4th Edition,2017.
4. Robert L Boylested and Louis Nashelsky , Electronic Devices and Circuit Theory, Prentice Hall India,11thEdition, 2015.

NPTEL COURSE LINKS:

1. NPTEL::Electrical Engineering: Analog Electronic Circuits,https://nptel.ac.in/courses/108102112

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DIGITAL ELECTRONICS
II B.Tech – IV Semester (Code: 20EE402)

Lectures	3	Tutorial	0	Problem Solving	1	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Basic Physics, Basic Mathematics

Course Objectives: To make the students at the end of the course

- Explain the fundamental concepts and techniques used in digital electronics, and Number conversions.
- Apply Boolean Algebra and able to minimize Boolean expressions by applying boolean algebra, K-Map method and Tabulation Method with "don't care" conditions.
- Develop and design various combinational logic circuits.
- Use basic flip-flops SR, JK, D and T to design sequential circuits.
- Describe the fundamental concepts about various terms and circuits of A/D and D/A converters
- Classify different Programmable Logic Devices.

Course Outcomes: After the completion of this course, the students are able to:

CO1: Describe fundamental concepts and techniques used in digital electronics, and able to perform Number conversions, Complements.

CO2: Simplify Boolean function using Boolean algebraic rules and laws, K-Map and Tabulation Method.

CO3: Deduce of various Combinational logic circuits.

CO4: Illustrate functionalities of Latches and Flip-Flops and design of Sequential logic circuits.

CO5: Explain about various terms of A/D and D/A converters.

CO6: Classification of memories and PLD's.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	2	2
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	2	2
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	2	2
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	2	2
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	2	2
CO6	3	3	2	-	-	-	-	-	-	-	-	-	3	2	2

UNIT-I

Fundamentals of Digital Systems and Logic families: Digital signals, digital Circuits, AND , OR, NOT, NAND, NOR a n d Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, Octal, hexa decimal number, binary arithmetic, one's and two's complements arithmetic, codes: Excess-3 and gray code, error detecting and

correcting codes, characteristics of digital ICs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

UNIT-II

Combinational Digital Circuits: Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, don't care conditions, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, Multiplexer, De-Multiplexer, digital comparator, parity checker/ generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

UNIT-III

Sequential circuits and systems :A1-bitmemory,thecircuit properties of Bi stable latch, the clocked SR flip flop, J-K, T and D- type flip flops, applications of flip flops, shift registers, applications of shift registers, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, applications of counters.

UNIT-IV

A/D and D/A Converters: Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, sample and Hold Circuit, a n a l o g t o digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage of frequency and voltage to time conversion, specifications of A/D converters.

Semi-conductor memories and Programmable logic devices: Memory organization and operation, expanding memory size, classification and characteristics of memories, read only memory (ROM), read and write memory (RAM), ROM as a PLD, Programmable logic array, Programmable array logic.

TEXT BOOKS:

1. R.P. Jain, Kishor Sara"Modern Digital Electronics", Mc Graw Hill India, 5th edition, July 2022.
2. M. Morris Mano, "Digital logic and Computer design", Pearson India, 6th edition, 2018.

REFERENCE BOOKS:

1. Anil K. Maini, "Digital Electronics: Principles and Integrated Circuits", Wiley, 2007.
2. S.S. Bhatti Rahul Malhotra, "A Textbook of Digital Electronics", I K International Publishing House, 2011.
3. A.Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

NPTEL COURSE LINKS:

1. NPTEL :: Electrical Engineering - NOC:Digital Electronic Circuits, https://nptel.ac.in/courses/108/105/108105132/
2. NPTEL :: Electrical Engineering - NOC:Digital Circuits, https://nptel.ac.in/courses/108/105/108105113/

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INDUCTION MOTORS AND SYNCHRONOUS MACHINES

II B.Tech – IV Semester (Code: 20EE403)

Lectures	3	Tutorial	0	Problem Solving	1	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Basic Physics, Basic Mathematics

Course objectives: To make the students

- Understand the construction, operation and performance of three phase induction machines.
- Gain knowledge about construction, operation and application of single-phase induction machines.
- Understand the construction, operation and performance of Alternators.
- Gain knowledge about construction, operation and performance of synchronous motors.

Course Outcomes: At the end of this course, students will be able to

CO1: Demonstrate construction, operation and performance of three phase induction machines.

CO2: Describe the construction, operation and application of single-phase induction machines.

CO3: Assess operation and performance of Alternators.

CO4: Assess operation and performance of synchronous motors.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	-	-	-	-	-	-	-	2	3	3	3
CO2	3	3	3	2	-	-	-	-	-	-	-	2	3	3	3
CO3	3	3	3	2	-	-	-	-	-	-	-	2	3	3	3
CO4	3	3	2	3	-	-	-	-	-	-	-	2	3	3	3

UNIT-I

Induction machines: Construction-Types (squirrel cage and slip ring)-rotating magnetic field in two phase & three phase systems-Torque equation-torque slip characteristics-

equivalent circuit-phasor diagram-losses and efficiency- circle diagrams-starting methods and speed control-Induction generator.

UNIT-II

Single- phase Induction motors: Constructional features-double revolving field theory-equivalent circuit-determination of parameters-split phase-capacitor start and run-shaded pole motors-characteristics and their applications.

UNIT-III

Synchronous generators: Construction-EMF equation with winding factors-equivalent circuit and phasor diagram-armature reaction-synchronous impedance-voltage regulation-methods of determining regulation –EMF and ZPF methods-salient pole machine-two reaction theory-power angle characteristics-parallel operation of alternators-synchronization of alternators.

UNIT-IV

Synchronous motors: Theory of operation-starting methods-phasor diagrams-variation of current and power factor with excitation-Power circles-V and inverted V curves-hunting and its prevention-synchronous condenser and its applications.

TEXT BOOKS:

3. P.S.Bhimbra, Electric Machinery, Khanna Publications, 7th Edition, 2011.
4. I.J.Nagrath & D.P.Kotari, Electric Machines, Tata Mc Graw-Hill Publication, 3rd Edition, 2017.

REFERENCES BOOKS:

5. A.E. Fritzgerald, C. Kingsley & S. Umans, Electric Machinary, McGraw-Hill Companies, 6th Edition, 2017.
6. Samarjit Ghosh, Electrical Machines, Pearson, 2nd Edition, 2012.
7. J. B. Gupta, Theory & performance of Electric Machines, S.K. Kataria&Sons,15th Edition, 2013.
8. M.G.Say, Performance and design of AC machines, CBS Publishers, 5th Edition,2005.
9. P.S. Bimbhra, Generalized Theory of Electrical Machines, Khanna Publication,7th Edition, 2021.

NPTEL COURSE LINKS:

1. NPTEL :: Electrical Engineering - Electrical Machines II, https://nptel.ac.in/courses/108/106/108106072/
2. NPTEL :: Electrical Engineering - NOC:Electrical Machines - II, https://nptel.ac.in/courses/108/105/108105131/

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SIGNALS AND SYSTEMS

II B.Tech – IV Semester (Code: 20EE404)

Lectures	3	Tutorial	0	Problem Solving	1	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Basic Physics, Basic Mathematics

Course objectives: To make the students

- Explain the concepts of continuous time and discrete time systems.
- Gain knowledge about LTI systems
- Learn about the concepts of systems in frequency domain.
- Describe sampling theorem and its implications.

Course Outcomes: At the end of this course, students will be able to

CO1: Explain the concepts of continuous time and discrete time systems.

CO2: Demonstrate and analyze continuous and discrete LTI systems, develop state space model.

CO3: Determine the frequency response of continuous and discrete time systems.

CO4: Illustrate sampling theorem and reconstruct of signals

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	1	3	2	2
CO2	3	3	2	-	-	-	-	-	-	-	-	1	3	2	2
CO3	3	3	2	-	-	-	-	-	-	-	-	1	3	2	2
CO4	3	3	2	-	-	-	-	-	-	-	-	1	3	2	2

UNIT-I

INTRODUCTION TO SIGNALS AND SYSTEMS: Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.

UNIT-II

BEHAVIOR OF CONTINUOUS AND DISCRETE-TIME LTI SYSTEMS: Impulse response and step response, convolution, input-output behavior with a periodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems.System representation through differential equations and difference equations .State-

space Representation of systems.State-Space Analysis, Multi-input, multi-output representation.State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

UNIT-III

FOURIER AND Z - TRANSFORMS: Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete- Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem.The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

UNIT-IV

SAMPLING AND RECONSTRUCTION: The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects.Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

TEXT BOOKS:

1. V. Oppenheim, A. S. Willsky and S. H. Nawab, Signals and Systems, Prentice Hall India, 2007.
2. Anand Kumar, Signals and Systems, Prentice Hall India Learning Private Limited, 3rd edition, 2016.

REFERENCE BOOKS:

1. J. G. Proakis and D. G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, Pearson, 2007.
2. H. P. Hsu, Signals and Systems , Schaum's Series, McGraw Hill Education, 3rd Edition 2013.
3. S. Haykin and B. V. Veen, Signals and Systems, John Wiley and Sons, 2nd Edition, 2007.
4. M. J. Robert, Fundamentals of Signals and Systems, McGraw Hill Education, 2007.
5. B. P. Lathi, Linear Systems and Signals, Oxford University Press, 3rd Edition, 2017.

NPTEL COURSE LINKS:

1. NPTEL :: Electrical Engineering - NOC:Signals and Systems, https://nptel.ac.in/courses/1-8/1-6/1-81-6163/
2. NPTEL :: Electronics & Communication Engineering - Signals and Systems, https://nptel.ac.in/courses/117/1-1/1171-1-55/

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GENERATION AND TRANSMISSION
II B.Tech-IV Semester (20EE405)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Course Objectives: To make the students

- Discuss the economical aspects and choice of power stations and units.
- Infer the significance of conventional and non-conventional energy resources and their operation.
- Calculate transmission line parameters.
- Discuss the theory and mechanical design of transmission lines and introduce various types of insulators and their testing.

Course Outcomes: After completion of this course, Students will be able to

CO1: Explain the economical aspects and choice of power stations and units.
CO2: Examine the significance of conventional and non-conventional energy resources and their operation.
CO3: Calculate the parameters of Transmission line and describe the performance of different types of transmission line.
CO4:Demonstrate the types of insulators and their efficiency calculation.
CO5: illustrate the travelling wave's phenomenon with different case studies.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	3	-

UNIT-I

Economical Aspects: Economics of generation - factors affecting cost of generation - Definitions: load factor – diversity factor – plant use factor - reduction of cost by inter connected stations. Power factor considerations – causes of low power factor – methods of improving power factor – phase advancing and generation of reactive KVAR – most economical power factor for constant KW load and constant KVA type loads. Tariff: Characteristics of Tariff – types of Tariffs.

Choice of power stations and units: Types of power stations – choice of generation - size of generator units – load duration curve – effect of variable load on plant operation and design.

UNIT-II

Thermal Power: Block Diagram of Thermal Power Station (TPS), Brief Description of Thermal Power system Components

Hydro Power: Selection of Site, Classification, Layout, Description of Main Components.

Nuclear Power: Nuclear Fission and Chain Reaction-Principle of Operation of Nuclear Reactor. - Description of Main Components.

Solar Power Generation: Role and Potential of Solar Energy Options, Principles of Solar Radiation, Solar Energy Collectors, Different Methods of Energy Storage – PV Cell- V-I Characteristics.

Wind Power Generation: Role and potential of Wind Energy Options, Horizontal and Vertical Axis Wind Mills- Performance Characteristics-Pitch & Yaw Controls – Economic Aspects.

UNIT-III

Transmission Line Parameters: 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. 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.

Modelling 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. Mathematical Solutions to estimate regulation and efficiency of all types of lines- 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, Numerical Problems. – Surge Impedance and surge Impedance loading - wavelengths and Velocity of propagation – Ferranti effect, charging current, Need of Shunt Compensation.

UNIT-IV

Insulators, Corona: Types of Insulators- String efficiency and Methods for improvement– Voltage Distribution, Calculation of string efficiency- Capacitance grading and Static shielding. Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference.

Mechanical Design of Lines: Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor - Stringing chart and sag template and its applications.

Travelling waves on Transmission lines and over voltages: Wave equation, Surge impedance and wave velocity, Reflection and Refraction of waves, Typical cases of line terminations, forked line, successive Reflection, Bewley Lattice diagram, Attenuation and Distortion, Arcing grounds, Capacitance switching and Current chopping. **Over Voltages**: Lightning Phenomenon, over voltages due to lightning, Switching Over voltages, Protection of systems against surges and Surge Arresters.

TEXT BOOKS:

1.Non-Conventional Energy Sources, G.D. Rai, Khanna Publishers,6th Edition 2009.
2.C.L. Wadhwa, Electrical power systems, New Academic Science Publication, 7th Edition, 2017.

REFERENCE BOOKS:

1.John Twidell and Tony Weir, Renewable Energy Resources, Taylor and Francis Group, 3rdEdition, 2019.
2.S.N.Singh., Electrical Power Generation, Transmission and Distribution, PHI, 2nd Edition, 2008.
3.V.K Mehta and Rohit Mehta, Principles of Power Systems, S.CHAND & COMPANY LTD, 3rdEdition, 2006
4. N. Bhadra, D. Kastha & S. Banerjee, Wind Electrical Systems, Oxford University Press, ISBN-13: 97800019056709306, 2013.
5.D. P. Kothari and I. J. Nagrath, Power System Engineering, Mc Graw Hill Education (India) Pvt. Ltd., 3rd Edition, 2019.

NPTEL COURSE LINKS:

1. **NPTEL :: Electrical Engineering - Power System Generation, Transmission and Distribution (Encapsulated from earlier Video), https://nptel.ac.in/courses/108/102/108102047/**
2. **NPTEL :: Electrical Engineering - NOC:Power System Engineering, https://nptel.ac.in/courses/108/105/108105104/**
3. **NPTEL :: Introduction to power system analysis, https://nptel.ac.in/courses/108/105/108105067/**

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PYTHON

II B.Tech – IV Semester (Code: 20EEL401/SOC2/IT02)

Lectures	1	Tutorial	0	Problem Solving	0	Practical	2	Credits	2
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Course Objectives: The course aims

- To enable the students to identify the syntax and semantics of Python.
- To enable students to write python scripts for solving real time problems.
- To enhance the object-oriented programming skills of the students.

Course Outcomes: After completing the course the students would be able to

CO1: Write programs using basic Python constructs

CO2: Write programs using sequences in Python

CO3: Write programs using object oriented programming concepts

CO4: Write programs that handle exceptional conditions

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	2	3	-	-	-	3	2	-	3	3	3	1
CO2	2	2	2	2	2	-	-	-	3	2	-	2	2	3	1
CO3	3	3	3	3	3	-	-	-	3	2	-	3	2	3	2
CO4	2	2	1	2	2	-	-	-	3	2	-	2	2	3	2

UNIT I

Introduction: Overview, History of Python, Python Features, Environment Setup. Variables, expressions,and statements: values and types, variables, names and keywords, statements, operators and operands,expressions, order of operations, modulus operator, string operations, asking the user for input, comments,choosing mnemonic variable names.
Conditional execution: Boolean expressions, logical operators, conditional execution, alternativeexecution, chained conditionals, nested conditionals, catching exceptions using try and except,shortcircuit evaluation of logical expressions.
Iteration: updating variables, the while statement, infinite loops and break, finishing iterations withcontinue, definite loops using for, loop patterns.
Functions: function calls, builtin functions, type conversion functions, random numbers, math functions,adding new functions, definitions and uses, flow of execution, parameters and arguments, fruitfulfunctions and void functions.

UNIT II

Strings:A string is a sequence, getting the length of a string using len, traversal through a string with aloop, string slices, strings are immutable, looping and counting, the in operator, string comparison, stringmethods, parsing strings, format operator.
Files I/O: persistence, opening files, text files and lines, reading files, searching through a file, letting theuser choose the file name, using try except and open, writing files.
Lists: a list is a sequence, lists are mutable, traversing, operations, slices, methods, deleting elements,functions, strings, parsing lines, objects and values, aliasing, arguments.
Dictionaries: dictionary as a set of counters, dictionaries and files, looping and dictionaries, advancedtext parsing.
Tuples: tuples are immutable, comparing tuples, tuple assignment, dictionaries and tuples, multipleassignment with dictionaries, the most common words, using tuples as keys in dictionaries, sequences.

UNIT III

Object Oriented Programming: Managing Larger Programs, Using Objects, starting with Programs,Subdividing a Problem: Encapsulation, First Python Object, Classes as Types, Object Lifecycle,ManyInstances, Inheritance.

UNIT IV

Exception Handling: Errors and Exceptions(From Web References text 1).

LIST OF EXPERIMENTS

1. Write a script to print some Pythagorean triples.
2. Write a script that demonstrates string handling capabilities of Python.
3. Write a script that demonstrates associated arrays support in Python.
4. Write a script to print Fibonacci numbers up to and including the first command line argument.
5. Write a simple script that reads from a file detail of students in a section and finds top ten meritorious students in the section.
6. Write a script to Implement Stack.
7. Write a script to Implement Queue.

TEXTBOOKS:

1. Charles R Severance. Python for Everybody: Exploring Data in Python 3. 4 2016. ISBN 978 1530051120. doi: https://www.py4e.com/book.
2. Ljubomir Perkovic. Introduction to Computing Using Python: An Application Development Focus. Wiley, 2 edition, 8 2015. ISBN 9781118890943.

3. Guido van Rossum and Jr Fred L. Drake. Python Tutorial. Python Software Foundation. doi: https: //docs.python.org/3/.

REFERENCES BOOKS:

1. Kenneth A. Lambert. Fundamentals of Python: First Programs. Cengage, 2nd edition, 2019. ISBN 9781337560092.

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ANALOG AND DIGITAL ELECTRONICS LAB

II B.Tech – IV Semester (Code: 20EEL402)

Lectures	0	Tutorial	0	Problem Solving	0	Practical		3	Credits	1.5
Continuous Internal Evaluation				30		Semester End Examination (3 Hours)				70

Course Objectives: To make the students

- To analyse the characteristics of Diodes, Transistors and FET in different biasing conditions.
- To design feedback amplifiers, oscillators using transistors and wave form generating using op-amp.
- To design and verify different types of logic gates using universal gates, combinational logic circuits and code converters.
- To design multiplexers, demultiplexers and counter circuits using logic gates.
- To design and test applications of 555 timer circuits and D/A converters.

Course Outcomes: After the completion of this course, Students will be able to

CO1: Illustrate the characteristics of Diodes, Transistors and FET in different biasing conditions

CO2: Construct feedback amplifiers, oscillators using transistors and wave form generation using op-amp.

CO3: Verify different types of logic gates using universal gates, combinational logic circuits and code converters.

CO4: Examine multiplexers, demultiplexers and counter circuits using logic gates.

CO5: Design and test applications of 555 timer circuits and D/A converters

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	3	-	-	-	-	3	2	-	2	3	2	2
CO2	3	3	3	3	-	-	-	-	3	2	-	2	3	2	2
CO3	3	3	3	3	-	-	-	-	3	2	-	2	3	2	2
CO4	3	3	3	3	-	-	-	-	3	2	-	2	3	2	2
CO5	3	3	3	3	-	-	-	-	3	2	-	2	3	2	2

LIST OF EXPERIMENTS

1. Characteristics of PN Junction and Zener diode
2. Characteristics of Transistor in Common Emitter configuration
3. Verification of Transistor Self Bias Circuit

4. Characteristics of Junction Field Effect Transistor
5. Design of voltage shunt feedback amplifier.
6. Design of RC phase shift oscillator.
7. Waveform generation using OP-AMP
8. Realization of Logic Gates using Discrete Components & Universal Building Blocks.
9. Design of Combinational Logic Circuits like half-adder, Full adder, Half-subtractor and Full-subtractor
10. Design of Code converters.
11. Design of 4X1 Multiplexer and 1x4 Demultiplexer.
12. Realization of RS-JK & D flip-flop using logic gates.
13. Design of Synchronous Counter, Mod Counter, Up counter, Down counter and Up/Down counter using Flip Flops.
14. Design and testing of mono stable and astable Multivibrators using 555 timers.
15. Design a 4-bit R-2R ladder type of digital to analog converter.

Note: Minimum 10 experiments should be conducted.

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DC MACHINES & TRANSFORMERS LAB

II B.Tech – IV Semester (Code: 20EEL403)

Lectures	0	Tutorial	0	Problem Solving	0	Practical	3	Credits	1.5
Continuous Internal Evaluation			30	Semester End Examination (3 Hours)					70

Course Objectives: To make the students

- To develop experimental setups for studying the performance and operation of DC Generators and DC motors.
- To perform Direct and Indirect tests of various DC motors.
- Acquire hands on experience of conducting various tests on Transformers and obtaining their Performance indices using standard analytical as well as graphical methods.
- To develop experimental setups for studying the performance and operation of Transformers.

Course Outcomes: After completion of this course,Students will be able to

CO1: Compare the performance characteristics of DC Generators.

CO2: Examine the performance of the given DC motors.

CO3: Estimate the performance of single-phase transformer.

CO4: Evaluate the performance of transformers under various conditions.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	3	-	-	-	-	3	2	-	2	3	3	-
CO2	3	3	2	3	-	-	-	-	3	2	-	2	3	3	-
CO3	3	3	2	3	-	-	-	-	3	2	-	2	3	3	-
CO4	3	3	2	3	-	-	-	-	3	2	-	2	3	3	-

LIST OF EXPERIMENTS

1. Open circuit characteristics of separately excited / self-excited D.C shunt generator
2. Load test on D.C Shunt Generator
3. Load test on D.C series generator
4. Load test on D.C Compound Generator
5. Brake test on D.C Shunt Motor

6. Speed control of DC Shunt motor
7. Swinburne's Test on a D.C Shunt Machine.
8. Retardation test on D.C. Machine.
9. Field test on two identical DC series machine
10. Hopkinson's test on Two Identical D.C Machines
11. OC & SC tests on single - phase transformer
12. Load test on single - phase transformer
13. Scott Connection of Transformers
14. Parallel Operation of Two Single - Phase Transformers
15. Sumpner's test on two single-phase Transformers
16. Separation of losses in single – phase transformer

Note: Minimum 10 experiments should be carried out.

LERARNING RESOURCES:

1. P.S. Bhimbra, Electric Machinery, Khanna Publications, 7th edition,2011.
2.I.J. Nagrath & D.P. Kothari,Electric Machines,Tata McGraw Hill,5th edition,2017.

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SOFT SKILLS LAB

II B.Tech – IV Semester (Code: 20EEL404/ELL02)

Lectures	0	Tutorial	0	Problem Solving	0	Practical	2	Credits	1
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

CourseObjectives: Student will be able

- Tomaketheengineeringstudentsawareoftheimportance,theroleandtheconte ntofsoftskills throughinstruction,knowledgeacquisition,demonstrationandpractice.
- Toknowtheimportanceofinterpersonalandintrapersonalskillsinanemployabilitysettin g
- To activelyparticipateingroupdiscussions/interviewsandprepare&deliverpresentations
- To functioneffectivelyinmulti-disciplinaryandheterogeneousteamsthroughtheknowledgeofteamwork,Inte r-personalrelationships,stressmanagementandleadershipquality

CourseOutcomes: Bytheendofthecoursethestudentswouldbeableto

CO1: Useappropriatebodylanguageinsocialandprofessionalcontexts
CO2: Demonstratedifferentstrategiesinpresentingthemselvesinprofessionalcontexts
CO3: Analyzeanddeveloptheirownstrategiesoffacingtheinterviewssuccessfully
CO4: Developteamcoordinatingskillsaswellleadershipqualities

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	2	3	3	2	2	-	-	2
CO2	-	-	-	-	-	-	-	2	3	3	2	2	-	-	2
CO3	-	-	-	-	-	-	-	2	3	3	2	2	-	-	2
CO4	-	-	-	-	-	-	-	2	3	3	2	2	-	-	2

UNIT-I

1. BodyLanguage&IdentityManagement

a. FacialExpressions–Kinesics-Occulesics
b. Haptics-Proxemics
c. ParaLinguistics
d. Appearance
e. IdentityManagementCommunication

UNIT-II

2. EmotionalIntelligence&LifeSkills

a. SelfAwarenessthroughJohariWindowandSWOCanalysis
b. SelfMotivation
c. Empathy
d. Assertiveness&ManagingStress
e. PositiveAttitude
f. TimeManagement
g. GoalSetting:Shortterm,LongTerm,Vision,Mission.

UNIT-III

3. BusinessPresentations

a. PreparingeffectivePresentationsPowerPointPresentations
b. PowerPointPresentations
c. UsingVisualAids
d. MockPresentations

UNIT-IV

4. EmployabilitySkills

a. GroupDiscussion
b. TeamBuildingandLeadershipQualities
c. InterviewSkills

ReferenceBooks:

1. PersonalityDevelopmentandSoftskills(SecondEdition),BarunK.Mithra.Oxford UniversityPress:2016
2. TheDefinitiveBookofBodyLanguage,Allan&Barbara.PeaseInternational:2004
3. WorkingwithEmotionalIntelligence,DanielGoleman.Bloomsbury:1998
4. EnglishforJobseekers,LinaMukhopadhyay.CambridgeUniversityPress:2013
5. The7HabitsofHighlyEffectivePeople,StephenR. Covey.St.Martin'sPress:2014

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MICROPROCESSORS AND MICROCONTROLLER

III B.Tech – V Semester (Code: 20EE501)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Digital Electronics

Course Objectives: To make the students

- Learn the Architecture of 8085 and 8086microprocessor.
- Explain the detail aspects of I/O and Interfacing circuits.
- Study the Architecture of 8051microcontroller.
- Study about 8051 micro controller interfacing with various applications.

Course Outcomes:At the end of this course, students will be able to

CO1: Execute the programs in 8086 microprocessor using assembly language Programming.

CO2: Illustrate various applications by interfacing programmable I/O devices.

CO3: Demonstrate the architecture of 8051 microcontroller and develop assembly languageprograms.

CO4: Illustrate various applications using 8051 microcontrollers.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	1	1	-	-	-	-	-	-	2	2	2	-
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2	-
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	2	-
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	2	-

UNIT – I

8086 Microprocessor: Introduction to 8085 Microprocessor and its Architecture, 8086Microprocessor Family, 8086 Internal Architecture, Pins and Signals, Instruction set and Assembler directives. Introduction to Programming: 8086Assembly Language Programming, Implementing standard Program Structures, Strings, Procedures and Macros.

UNIT – II

Interfacing Devices & Applications: 8255 Programmable Peripheral Interface, keyboard interfacing and 7-segment display interfacing, 8279 Programmable Keyboard Display Interface 8253 Programmable Interval Timer, 8259 Programmable Interrupt

Controller, Direct Memory Access (DMA) and 8257DMA Controller, 8251 and serial I/O and Data Communication.

UNIT – III

8051 Microcontroller: Architecture of 8051, Special Function Registers, I/O Ports, Memory Organization, Addressing modes, Instruction set, Assembly Language Programming, Assembly Code for Arithmetic and Logic Operations.

UNIT – IV

Microcontroller Interfacing & Applications: Programming 8051 Timers, Timer programming, Serial Port Programming, Interrupts Programming, LCD and Keyboard Interfacing, ADC, DAC and Sensor Interfacing, External Memory Interface, Stepper Motor and Waveform generation.

TEXT BOOKS:

1. Ramesh Goankar, "Microprocessor Architecture, Programming, and Applications with the 8085",Penram International Publishing, 6th Edition, 2013.
2. D. V. Hall, "Microprocessors & Interfacing", McGraw Hill Higher Education, 3rd Edition, 2017.

REFERENCE BOOKS:

1. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088Family - Architecture, Programming and Design", 2nd Edition, Prentice Hallof India, 2007.
2. K. J. Ayala, "8051 Microcontroller", Delmar Cengage Learning, 3rd Edition, 2007.
3. K. M. Bhurchandi and A K Ray, "Advanced Microprocessors and Peripherals", McGraw Hill, 3rd edition, 2017.
4. M. A.Mazidi, J. G. Mazidi and R. D. McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", 2nd Edition, Pearson Education, 2011.

NPTEL COUIRSE LINKS:

1. NPTEL :: Electrical Engineering - NOC:Microprocessors And Microcontrollers
2. NPTEL :: Electronics & Communication Engineering - Microcontrollers and Applications
3. NPTEL :: Computer Science and Engineering - Microprocessors and Microcontrollers

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POWER SYSTEMS ANALYSIS

III B.Tech – V Semester (Code: 20EE502)

Lectures	3	Tutorial	0	Problem Solving	1	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Linear algebra and differential equations, Circuit Theory, Network Analysis, Generation and Transmission

Course Objectives: To make the students

- Describe types of underground cables and explains the representation of power system components.
- Explain power flow control and various Symmetrical faults in the power system networks.
- Learn the symmetrical components and networksand analysis of Unsymmetrical faults.
- Explain distribution of various supply systems and substation practice.

Course Outcomes: At the end of this course, students will be able to

CO1: Explain performance of underground cables and solve all power system problemsusing per unit system.

CO2: Assess Power flow control of a synchronous machine and analyze the power system networks by using Symmetrical faults.

CO3: Solve the unsymmetrical faults using symmetrical components.

CO4: Determine the symmetrical components and analyze the asymmetrical faults using symmetrical components.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	2	2
CO2	3	3	2	1	-	-	-	-	-	-	-	-	3	2	2
CO3	3	3	2	3	-	-	2	-	-	-	-	-	3	2	2
CO4	3	3	2	2	-	-	1	-	-	-	-	-	3	2	2

UNIT – I

Underground Cables: Types of cables, laying of cables, insulation resistance, electric stress and capacitance of single core cable, use of inter sheath, capacitance grading, capacitance of three core belted type cable, stress in a three-core cable,

sheath effects, currents in bonded sheaths, electrical equivalent of sheath circuit, thermal characteristics of cables.

Representation of power system Components: Modeling of power system components for system studies: transmission lines, two-winding transformers with nominal & off-nominal ratio tap settings, three-winding transformers, phase shifting transformers. One line diagram, Impedance and Reactance diagrams, advantages of Per Unit Computations, per unit quantities, changing the base, selection of base, per-unit impedances of three winding transformers. Formation of Y-Bus.

UNIT – II

Power flow control: Power angle equation of a synchronous machine- effect of synchronous machine excitation - power angle equation for power system with single and multi-machines.

Symmetrical Faults: Transients in RL series circuit, –short-circuit currents and reactance's of synchronous machines, internal voltages of loaded machines under transient conditions, selection of circuit breakers. Formation of Bus Impedance matrix by using Z-Bus building algorithm.Analysis of symmetrical faults using bus impedance matrix.

UNIT-III

Symmetrical components and Networks: Introduction – operator 'a', resolution of three unbalanced phasor into symmetrical components, power in terms of symmetrical components. Unsymmetrical series impedance - sequence impedances and sequence networks of unloaded generators, circuit elements. Positive, negative and zero sequence networks.

Unsymmetrical Faults: Single line to ground, line to line and double line to ground faults on an unloaded alternator and on power systems.

UNIT-IV

Distribution: Comparison of copper efficiencies between DC, AC Single phase, 3-phase, 3- wire & 4-wire systems, calculation of voltage regulation in case of non-uniform and uniformly distributed loads on feeders, feeders fed at one end and both ends, ring feeders without and with interconnections, choice of voltage and frequency, Kelvin's law for most economical cross section and most economical current density and its limitations.

Substation Practice: Classification of substations, indoor and outdoor substations, bus-bar arrangements – single bus-bar, sectionalized single bus-bar, main and transfer bus-bar system, sectionalized double bus-bar system, ring mains, group switching.

TEXT BOOKS:

1. John J. Grainer, W D Stevenson Jr, Power System Analysis, McGraw Hill Education, 1st edition, 2017
2. D P Kothari, I J Nagrath, Power System Engineering, McGraw-Hill Education, 3rd Edition, 2019

REFERENCE BOOKS:

1. S. Ramar, S. Kuruseelan, Power System Analysis, PHI Learning Pvt. Ltd., 2013
2. William D. Stevenson Jr., Elements of power System Analysis, Mc Graw Hill Education (India) private limited, New Delhi, 2014.
3. C.L. Wadhwa, Electrical Power Systems, New age International (P) Limited, 7th edition,2016.
4. Hadi Sadat, Power System Analysis, Tata Mc Graw Hill Publishing Company, New Delhi 2002

NPTEL COURSE LINKS:

1. https://nptel.ac.in/courses/108105067
2. https://nptel.ac.in/courses/117105140

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CONTROL SYSTEMS

III B.Tech-V Semester (Code: 20EE503)

Lectures	3	Tutorial	0	Problem Solving	1	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Mathematics, Physics, Network Theory

Course Objectives: To make the students

- To make the students interpret different physical systems, construct mathematical models and reduce a block diagram of multiple subsystems to a signal block.
- To make the students employ time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions.
- To make the students analyze the system stability using complex domain.
- To make the students formulate different types of analysis in time and frequency domain.
- To make the students Identify the needs of different types of controllers and compensator to ascertain the required dynamic response from the system.
- To make the students assess controllability and observability of control systems.

Course Outcomes: After completion of this course, Students will be able to

CO1: Illustrate the concepts of classification of control systems, develop of mathematical models from schematics of physical system and reduce a block diagram of multiple subsystems to a signal block

CO2: Describe time domain analysis and predict the performance parameters of the system for standard input functions.

CO3: Compute stability of the system in complex domain.

CO4: Demonstrate stability of the system in time and frequency domain.

CO5: Identify the needs of different types of controllers and compensator to ascertain the required dynamic response from the system.

CO6: Assess controllability and observability of control systems.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	-	-	-	-	-	-	-	2	3	-	-
CO2	3	3	2	2	-	-	-	-	-	-	-	2	3	-	-
CO3	3	3	2	2	-	-	-	-	-	-	-	2	3	3	3
CO4	3	3	2	2	-	-	2	-	-	-	-	2	3	3	3
CO5	3	3	2	2	-	-	2	-	-	-	-	2	3	3	3
CO6	3	3	2	2	-	-	-	-	-	-	-	2	2	-	-

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Course Syllabus:

UNIT – I

Introduction: Basic concept of control system. Types of feedback control systems and itseffect on overall gain – Liner time invariant, time variant systems and nonlinear control systems

Modeling of LTI Systems: Mathematical models and Transfer functions of Physical systems. Block diagram representation of control systems – signal flow graph.

UNIT – II

Time Domain Analysis: Standard test signals – step, ramp, parabolic and impulse response function –Time response offirst order and second order systems to standard test signals - steady state response – errorConstants.Effect of adding poles and zeros on overshoot, rise time, band width.

Stability Analysis in the Complex Plane: Absolute, relative, conditional, bounded input – bounded output, zero input stability, conditions for stability, Routh –Hurwitz criterion.

UNIT – III

Root Locus Technique: Introduction - Construction of Root Locus, Introduction to Controller Design using Root-loci method of feedback controller design.

Frequency Domain Analysis: Introduction – correlation between time and frequency responses– Polar plots – Bode plots – Nyquist plots.

UNIT – IV

Design of controllers and compensator: Introduction to Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs.

State space analysis: Concepts of state variables and state models – diagonalization – solutionof state equations – Concepts of controllability and Observability.

TEXT BOOKS:

1. I. J. Nagrath and M. Gopal, Control Systems Engineering, New Age International Pvt Ltd, 6th Edition 2018.
2. Control Systems Engineering by SK Bhattacharya, Pearson Education India,3rdEdition, 2013.

REFERENCE BOOKS:

1. A. Anand Kumar, “Control Systems”, Prentice Hall India Learning Private Limited, 2nd Edition, 2014.
2. Katsuhiko Ogata, “Modern Control Engineering”, Prentice Hall of India Pvt. Ltd., 5th Edition, 2015.

3. A. NagoorKani, "Control Systems", RBA publications, 1st Edition, 2014.
4. Joseph Distefano, Allen Stubberud, Ivan Williams & Sanjoy Mandal, "Control Systems (Schaum's Outline Series)", McGraw Hill Education, 3rd Edition, 2017.

NPTEL COURSE LINKS:

1. NPTEL: Electrical Engineering - NOC: Control, engineeringhttps://nptel.ac.in/courses/108/ 106/ 108106098/
2. NPTEL :: Electrical Engineering - Control Engineeringhttps://nptel.ac.in/courses/108/102/108102043/
3. NPTEL :: Electrical Engineering - Control Engineeringhttps://nptel.ac.in/courses/108/102/108102044/
4. NPTEL :: Engineering Design - NOC: Control systemshttps://nptel.ac.in/courses/107/106/107106081/

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POWER ELECTRONICS

III B.Tech-V Semester (Code: 20EE504)

Lectures	3	Tutorial	0	Problem Solving	1	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Semiconductor Physics and Nano Materials (20EE202/PH03)

Course Objectives: To make the students

- Discuss the thyristor and its family devices, ratings and protection.
- Explain AC to DC Conversion circuits with various loads
- Outline the operation of inverters PWM techniques.
- Study the operation of DC-DC choppers and AC Voltage controllers.

Course outcomes: At the end of this course, students will be able to

CO1: Demonstrate the basic operation and compare performance of various power semiconductor devices, passive components and switching circuits.

CO2: Categorise the performance of AC to DC Conversion circuits with different loads.

CO3: Outline the operation of inverters and PWM techniques.

CO4: Illustrate the operation of DC-DC choppers and AC Voltage controllers.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	-	-	-	-	-	-	-	3	3	2	-
CO2	3	3	3	2	-	-	-	-	-	-	-	3	3	3	3
CO3	3	3	3	2	-	-	-	-	-	-	-	3	3	3	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3	3	3	3

UNIT-I

Introduction to Power Electronics devices and protection: Thyristor family devices, principle of operation, Snubber designs, selection and protection,Firing circuits, Commutation, MOSFET, IGBT operation, principles and ratings.

UNIT-II

AC to DC conversion: Uncontrolled, semi-controlled, fully controlled and dual converters in single-phase and three phase configurations operation with R, R-L, back emf load, Issues of line current harmonics, Power factor, Distortion factor of ac to dc converters and effect of source inductance.

UNIT-III

Inverters: Basics of dc to ac conversion, inverter circuit configurations and principle of operation,VSI and CSI, single and three-phaseconfigurations, Single, Multiple,Square wave and sinusoidal PWM control methods and harmonic control.

UNIT-IV

DC-DC Converters and AC-AC Converters: Introduction to dc-dc conversion, various topologies, buck, boost, buck-boost converters. Introduction to ac to ac conversion, single- phase and three-phase ac voltage controller circuit configuration with R load Analysis. Cyclo-converters: single-phase, three-phase to single-phase circuit configuration.

TEXT BOOKS:

1. M. H. Rashid, Pearson, Power electronics: circuits, devices, and applications, Pearson India Education Services Pvt.Ltd, 4th Edition, 2017.
2. M.D.Singh and Khanchandani, Power Electronics, Mc Graw Hill, 2nd Edition, 2017.

REFERENCE BOOKS:

1. R.W.Erickson and D.Maksimovic, Fundamentals of Power Electronics,Springer; 3rd Edition, 2020.
2. L. Umanand, Power Electronics: Essentials and Applications, Wiley India, 1st Edition, 2009.
3. P.S. Bhimbra, Power Electronics,Khanna Publications, 6th Edition, 2008.
4. N. Mohan and T. M. Undeland, Power Electronics: Converters, Applications and Design, John Wiley & Sons, 3rd Edition, 2007.

NPTEL COURSE LINKS:

1. NPTEL :: Electrical Engineering - Power Electronics
2. NPTEL :: Electrical Engineering - NOC:Power Electronics

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ELECTRICALPOWER DISTRIBUTION SYSTEM
III B.Tech-V Semester (Code: 20EE505/PE1A)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

CourseObjectives:Tomakethestudents

- Describe the distributionsystemplanningmodelsandstudydifferentloadcharacteristics.
- Illustrate the different typesofdistributiontransformersandsub-transmissionsystems.
- Learn about theprimary distribution system,secondarydistributionsystems and about protection devices.
- Determinevoltagedropandpowerlossfornon-threephaseprimarylines.

Courseoutcomes: Atthe endofthiscourse,studentswillbeableto

CO1: Explain thevariousfactorsaffectingthe distributionsystemandalsoaboutdistributionsystemplanning.
CO2: Illustratethe DistributionTransformers,voltageregulation, Efficiencycalculationsand design considerations ofsub-transmissionlines.
CO3: Classify the substation, feeders, primary and secondary distribution systems, also the protective devices.
CO4: Determine the voltagedrop, linelosscalculationandthe effect ofcompensationonpowerfactorimprovement.

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	-	-	-	-	-	-	-	-	2	3	2	2
CO2	3	2	1	-	-	-	-	-	-	-	-	2	3	2	2
CO3	3	2	2	-	-	-	-	-	-	-	-	2	3	2	2
CO4	3	2	2	-	-	-	-	-	-	-	-	2	3	2	2

UNIT–I

Distribution systemplanning and automation: Planning and forecast techniques - Presentandfutureroleofcomputersindistributionsystemplanning–automation-Methods ofimprovement-Loadcharacteristics– Definitionsloadgrowth–tariffs-Diversified demandmethod.

UNIT–II

Distributiontransformers: Types-RegulationandEfficiency-distributionfactors–KW KVAMethodofdeterminingregulation.Designofsubtransmissionlinesanddistribution substations:Introduction–subtransmissionsystems-distributionsubstation–Substation busschemes-descriptionandcomparisonofswitchingschemes–substationlocationand rating-

Applicationofnetworkflowtechniquesinruraldistributionnetworkstodetermine optimumlocationofsub-station.

UNIT–III

Designconsiderationsonprimarysystems:Introduction,typesoffeeders, -voltagelevels Radialtypefeeders,feederswithuniformlydistributedloadandnon-uniformlydistributedloads.Designconsiderationsofsecondarysystems:Introduction, secondaryvoltagelevels, -Secondarybanking, existingsystemsimprovement.DistributionsystemProtection:Basicdefinitions,overcurrentprotectiondevices,fuses,automaticcircuitreclosures,automatic line sectionalizers,objectivesofdistributionsystemprotection, coordinationof protective devices, Fuseto Fuse co-ordination, Fuseto circuit breakercoordination, Reclosuretocircuitbreakerco-ordination.

UNIT-IV

Voltage dropand power loss calculations: Three phaseprimarylines, non3phaseprimarylines,4wiremultigroundedprimarylines,copperloss,Distributionfeedercosts,lossreductionandvoltageimprovementin ruraldistributionnetworks.Applicationsof Capacitorstodistributionsystems:Effectofseriesandshuntcapacitors,Power factor correction, economicjustificationforcapacitors, acomputerizedmethodtodeterminethe economicpowerfactor,Procedureto determinethe bestandoptimumcapacitorlocation DistributionSystemVoltage Regulation:Basicdefinitions, Qualityofservice,voltage control,linedropcompensation.

TEXT BOOKS:

1. Turan Gonen, Electric Power Distribution System Engineering, CRC Press, 3rdEdition,2014.
2. Dr. V. Kamaraju,Electrical distribution systems McGraw hill, 2017.

REFERENCE BOOK:

1. A.S. Pabla, Electric Power Distribution TMH, 7thEdition. 2019.
2. G. Ramamurthy, Hand Book of Electric Power Distribution, 2nd Edition, Universitie Press,2009.

NPTEL COURSE LINKS:

1.NPTEL :: Electrical Engineering - NOC:Electrical distribution system analysis, https://archive.nptel.ac.in/courses/108/107/108107112/

2.NPTEL :: Electrical Engineering - NOC:operation and planning of power distributionSystems, https://onlinecourses.nptel.ac.in/noc22_ee35/preview

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RENEWABLE ENERGY SOURCES

III B.Tech-V Semester (Code: 20EE505/PE1B)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation			30	Semester End Examination (3 Hours)					70

Pre-requisite: Basic Physics

Course Objectives: To make the students at the end of the course

- Discuss concepts of different solar thermal generation techniques.
- Explore concept of solar PV systems
- Gain knowledge about wind energy conversion.
- Explain concept of grid connectivity

Course Outcomes: At the end of this course, Students will be able to

CO1:classify different solar thermal techniques.

CO2: Construct PV plant design for off grid and on grid systems.

CO3: Distinguish between different wind plants and their working.

CO4: List out the technologies to integrate the RES to grid connectivity.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	-	-	-	2	3	2	2
CO2	3	3	3	-	-	-	-	-	-	-	-	2	3	2	2
CO3	3	3	3	-	-	-	-	-	-	-	-	2	3	2	2
CO4	2	1	3	-	-	-	-	-	-	-	-	2	3	2	2

UNIT – I

Principles of Solar Radiation: Comparison of renewable and conventional energy sources – Role and potential of new and renewable source – Environmental impact of solar power – extraterrestrial and terrestrial solar radiation – The solar constant – solar radiation on tilted surface – instruments for measuring solar radiation.

Solar energy collection: Flat plate and concentrating collectors and classification - Operation of solar thermal power plant – Applications of solar power – solar pond.

UNIT – II

Solar PV systems: Fundamentals of solar cell, semiconductors as basis for solar cells, P-N junction, sources of losses and prevention, types of solar cells, **PV plant design** - estimating power and energy demand, site selection, land requirements, choice of modules, Array

design, balance of systems, off grid systems, grid interface, supporting structures, mounting and installation.

UNIT – III

Wind Energy Basics: Status, Advantages and disadvantages of wind energy systems, Types of wind energy converters, local Effects on wind, site selection: roughness length, wind shear, Wind Speed Variability, Obstacles to wind flow.

Components of a wind energy converter: Rotor Blades, Gearboxes, Synchronous or Asynchronous Generators, Towers, Miscellaneous components, Turbine Selection.

Working principles of wind energy: Energy content in wind, Energy Conversion at the Blade, Wind variations: Weibull distribution.

UNIT – IV

Grid connectivity and Smart grid: Introduction to grid connectivity of RE systems, smart grid and energy technologies, operating principles and models of smart grid components, key technologies for generation and their control capabilities.

TEXT BOOKS:

1. B H Khan, Non-Conventional Energy Resources, McGraw Hill Education, 2nd edition, 2009.
2. Chetan Singh Solanki Solar Photovoltaic: Fundamentals, Technologies and applications, PHI Learning, 3rd edition, 2015.

REFERENCE BOOKS:

1. John Twidell & Toney Weir: Renewable Energy Resources 3rd Edition, 2015.
2. G D Rai: Non-Conventional Energy Resources,Khanna Pub, 6th edition, 1988.
3. Krzysztof (Kris) Iniewski, Smart Grid Infrastructure & Networking, McGraw-Hill Companies, 1st edition,2013.

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ELECTRICAL MACHINE DESIGN
III B.Tech-V Semester (Code: 20EE505/PE1C)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

CourseObjectives:Tomakethestudents

- Developknowledgeonprinciplesofdesignofrotatingmachines
- Designmaindimensions&coolingsystemsoftransformers
- Gainknowledgeonmaindimensionsofinductionmotoranditsclassification
- Learnabout design of salient pole and cylindrical rotor Alternators.

Course Outcomes:Afterthecompletionofthiscourse,thestudentswillbeableto

CO1: Compute the various parameters of a dc machine and provide the information required for the fabrication of the same along with an estimate of various performance indices.

CO2: Demonstrate about all transformer details with mathematical expressions and provide the information required for the fabrication of the same.

CO3: Calculate and estimate the performance of an Induction motor in the design of stator and rotor.

CO4: Illustrate about design of stator and rotor of synchronous machines and study their behaviour.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	2
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	-	2
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	-	2
CO4	3	3	3	-	3	-	-	-	-	-	-	-	3	-	2

UNIT-I

D.C.MACHINES:E.M.Fgeneratedfromfullpitch- fractionalpitchwithandwithout distributedwindings- distributionfactor.Designofmaindimensionsfromoutputequation-DesignofArmaturewindings-Designoffieldsystem- Designofinterspoleand commentator.

UNIT-II

TRANSFORMERS: Derivation ofoutput equation - volt per turn importance andcalculationofmain dimensionsforthreephaseandsinglephasetransformers- window dimensions-Yokedesignandcoildesign-Designoftankwithtubes.Basicdesignaspects ofdry transformerandhighfrequencytransformers.

UNIT-III

INDUCTIONMOTOR: Derivationofoutputequation- calculationofmaindimensions– Statordesign-numberofslots- shapeandareaofslots- Rotordesign forsquirrelcageand slipringtypes.

UNIT-IV

SYNCHRONOUSMACHINES: Derivationofoutputequation- CalculationsofMain Dimensionsforsalientpoleandcylindricalrotoralternators-Statordesign-numberof statorslotsandslotdimensions- Poledesignforsalientpolegenerators- polewinding calculations.Designofrotorfor cylindricalrotoralternator- Designofrotorwindings.

COMPUTERAIDEDDESIGN: Advantageofcomputeraideddesign- Flowchartfor computeraideddesign.

TEXTBOOKS:

1. A.K.Sawhney, Dhanpatrai&Sons,"ACourseinElectricalmachineDesign", 2016.
2. M.G.Say,PB,"PerformanceandDesignofACMachines", CBS Publishers, ISBN-13- 978-812391-277, 2002.

REFERENCEBOOKS:

1. V S Nagarajan, V Rajini, Electrical Machine Design, Pearson Publications, 1st edition, 2018.
2. V.N.Mittle, Arvind Mittal,DesignofElectricalMachines, StandardPublishersDistributors, ISBN-13-978-818-141263, 2009.
3. A.E. Clayton, N.N Hancock, PerformanceandDesignofACMachines,CBS Publishers ISBN-13-978-81239-9271, 2004.
4. M. Ramamurthy, E. Horwood, Computer aided design of electrical equipment, BS Publications, 2008.

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DIGITAL SIGNAL PROCESSING

IIIB.Tech–VSemester(Code:20EE505/PE1D)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				0

Prerequisites: Signals and Systems

CourseObjectives: To make the students

- AcquireknowledgeinLTIsignalsandsystemsandtheconceptofZ-transform.
- DemonstrateDFTandIDFTusingdifferentalgorithms.
- Model DigitalIIRfiltersfrom Analogfiltersusingvarioustechniques.
- ModelDigitalFIRfiltersusing various windowtechniques.

Course Outcomes: Afterthecompletionofthiscourse,studentswillbeableto

CO1: DemonstratetheLTIsignalsandsystemsandconceptofZ-transform.

CO2: IllustrateDFTandIDFTusingDIT-FFTandDIF-FFTalgorithms.

CO3: Construct theButterworthandChebyshevdigitalIIRfiltersandtheirrealization.

CO4: Implementtheappropriatetypeofdesignmethodfor FIRfiltersand theirrealization.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3	-	-	-	2	2	-	2	3	2	2
CO2	3	3	3	3	3	-	-	-	2	2	-	2	3	2	2
CO3	3	3	3	3	3	-	-	-	2	2	-	2	3	2	2
CO4	3	3	3	3	3	-	-	-	2	2	-	2	3	2	2

UNIT–I

DiscreteSignalsandSystems: Introductionto digitalsignalprocessing,advantagesand applications,discretetime signals, LTIsystem, stability andcausality.Frequencydomain representationofdiscretetimesignalsandsystems.

Z-Transforms: IntroductiontoZ-transform,Z-transformtheoremsandproperties,InverseZtransform,causalityandstability,solutionofdifference equations.MATLABprogrammingtogeneratediscretetimesequence,plotthefrequencyresponseofsystemandtofindpartialfractionofH(Z).

UNIT–II

DiscreteFourierTransform(DFT): Introduction,PropertiesofDFT,Linearconvolution using DFT,computationsforevaluatingDFTandIDFT.
FastFourierTransform(FFT): Introduction,advantagesofFFT,DecimationintimeFFT algorithms-
DecimationinfrequencyFFTalgorithm,IDFTusingFFTalgorithm.MATLABprogrammingtocomputetheDFTofsequencex(n)andcomparisonofcircular andlinearconvolutionoftwosequences.

UNIT–III

IIRFilterDesignTechniques: Introduction, PropertiesofIIRfilters,Designofanalog prototypeof digitalfilters,Digital ButterworthandChebyshevfiltersusingbilinear transformation,Impulseinvariancetransformationmethods.

RealizationofIIRFilters: Directform,Canonicform,Cascadeform,Parallelformand Lattice-
Ladderformofrealizations.MATLABprogrammingondesignofButterworthandChebyshevfilters

UNIT–IV

FIRFilterDesignTechniques: IntroductiontocharacteristicsoflinearphaseFIRfilters, Frequencyresponse.ComparisonofIIRandFIRfilters.Designingof FIRfiltersusing windowingtechniques.

Realization o f F I R Filters: Transversal structure, cascade realization, Linear phase realization,Latticestructure.
MATLABprogrammingtodesigndigitalFIRfiltersusingwindowingmethod.

TEXTBOOK:

1. JohnG.Proakis,DimitrisGManolakis,digitalSignalProcessing:Principles, Algorithmsand Applications,PearsonNw International Education, 4th Edition,2014.
2. P. RameshBabu, Digital Signal Processing, SciTech Publications (India)Pvt Ltd, 6th Edition,2015.

REFERENCEBOOKS:

1. LonnieCLudeman,FundamentalsofDigitalSignalProcessing,WileyIndia Pvt. Ltd., ISBN-10 : 8126522224,2012.
2. SKMitra,DigitalSignalProcessing:AComputerBasedApproach,McGraw Hill Education4th Edition,2013.
3. JohnnyR.Johnson,IntroductiontoDigitalSignalProcessing,Pearson Education India, 1st Edition,2015.
4. AlanVOppenheimandRonaldWSchafer,Discrete TmeSignalProcessing,PearsonEducation India, 3rdEdition,2014.

NPTELCOURSE LINKS:

1. Digital Signal Processing and its Applications - Course (nptel.ac.in)
2. Digital Signal Processing - Course (nptel.ac.in)
3. NPTEL :: Electrical Engineering - Digital Signal Processing

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APPLICATIONS OF IOT IN ELECTRICAL ENGINEERING

III B.Tech-V Semester (Code: 20EEL501/SOC3)

Lectures	1	Tutorial	0	Problem Solving	0	Practical	2	Credits	2
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Course Objective: The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-life IOT based projects. To make the students

- Explore the concepts of Internet of Things and its hardware and software components.
- Interface Sensor and Actuators with Arduino/Raspberry Pi.
- Construct the Basic Networking with ESP8266 WIFI module.
- Analyze basic IOT applications using Cloud Platforms.

Course Outcomes: After the completion of this course, the students will be able to

CO1: Demonstrate internet of things and its hardware and software components.

CO2: Illustrate device interfacing with Arduino Board/Raspberry Pi and implement small application.

CO3: Measure and monitor the sensing data remotely

CO4: Develop IOT applications using Cloud platforms.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	-	-	-	3	2	-	-	3	2	-	2	3	-	-
CO2	2	3	3	3	3	2	-	-	3	2	-	2	3	2	2
CO3	2	3	3	3	3	3	-	-	3	3	-	2	3	2	2
CO4	2	3	3	3	3	3	-	-	3	3	-	2	3	2	2

UNIT I

Introduction to IOT, Arduino and Raspberry Pi Simulation Environment: Understanding IoT fundamentals, IOT Architecture and protocols, Difference between IOT & M2M, Various Platforms for IOT, Real time Examples of IOT, Overview of IoT components and IOT Communication Technologies, Challenges in IOT. Arduino and Raspberry Pi Architecture, hardware setup and software installation for Arduino and Raspberry Pi, Basics of Embedded C programming for Arduino, Interfacing LED and push button with Arduino and Raspberry Pi

UNIT II

Sensor and Actuators with Arduino/ Raspberry Pi: Overview of Sensors working, Analog and Digital Sensors, Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with Arduino/Raspberry Pi, Interfacing of Actuators with Arduino/Raspberry Pi, Interfacing of Relay Switch and Servo Motor with Arduino/RaspberryPi.

UNIT III

Basic Networking with ESP8266 WiFi module: Basics of Wireless Networking, Introduction to ESP8266 Wi-Fi Module, Various Wi-Fi library, Web server-introduction, installation, configuration, Posting sensor(s) data to web server.

UNIT IV

Cloud Platforms for IOT: Virtualization concepts and Cloud Architecture, Cloud computing, benefits, Cloud services -- SaaS, PaaS, IaaS, Cloud providers & offerings, Study of IOT Cloud platforms, Thing Speak API and MQTT, Interfacing ESP8266 with Web services

List of Experiments

Mandatory Experiments:

1. a)FamiliarizationwithArduino/RaspberryPiandperformnecessarysoftwareinstallation.
   b) Study the fundamental IOT Software &Components.
2. a) Interface LED & Buzzer with Arduino and write a program to turn ON LED for 1 sec with a delay of2seec.
   b) Interface LED & Buzzer with Raspberry Pi and write a program to turn ON LED for 1 sec with a delay of2seec.
3. a) Implement two-way traffic control usingArduino.
   b) Implement two-way traffic control using RaspberryPi
4. a) To interface DHT11 sensor with Arduino and write a program to print temperature and humidityreadings.
   b) To interface PIR sensor with Arduino and write a program to turn ON LED at sensor detection.
5. Interface Stepper motor with Arduino and write a programto control stepper motor.
6. Interface OLED with Arduino and write a program to print temperature and humidity

readings onit.

Application Oriented Experiments:

7. Interface servo motor using with Raspberry Pi and write a program to control servomotor.
8. Servo Motor control WithEsp32.
9. Design of digital dc voltmeter and ammeter using Arduinouno.
10. Measurement of Power and Energy usingArduino.
11. Over/UnderVoltageProtectionofHomeAppliancesusingArduinouno&NODEMCU.
12. Write a program for weather monitoring station and handling temperature & humidity values on cloudplatform.
13. Design home automation using mobileapp.
14. Design smart irrigation system and analyse data using cloudplatform.
15. Detection of induction motor fault usingIOT.

TEXT BOOK:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos,DavidBoyle,InternetofThings:TechnologiesandApplicationsforaNewAge of Intelligence, Academic Press, 2nd Edition,2018.
2. Raj Kamal, Internet of Things: Architecture and Design , McGraw Hill Education; 1st Edition,2017.

REFERENCE BOOKS:

1. Jeeva Jose, Internet of Things, Khanna Publishing, 1st edition,2018.
2. Vijay Madisetti and Arshdeep Bahga, Internet of Things (A Hands-on-approach), Orient Blackswan Private Limited , 1st Edition,2015.
3. OlivierHersent,DavidBoswarthick,OmarElloumi,TheInternetofThings:keyapplications and Protocols, Wiley, 1st Edition,2015.
4. Michael Miller,The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities are Changing the World , Que Publishing, 1st Edition,2015.

Swayam Portal link:

https://onlinecourses.nptel.ac.in/noc19_cs65/preview

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MICROPROCESSOR & MICROCONTROLLER LAB
III B.Tech-V Semester (Code: 20EEL502)

Lectures	0	Tutorial	0	Problem Solving	0	Practical	2	Credits	1
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Course Objectives: To make the students

- Understand the working of TASM to write assembly language programs for 8086 microprocessors
- Understand the operation of 8086 development board
- Understand the operation of 8051 development board
- Understand the working of different programmable i/o devices

Course Outcomes: At the end of this course, students will showcase the ability to

CO1: Write basic programs in assembly language for 8086 microprocessors using TASM

CO2: Test complex programs in assembly language for 8086 microprocessors using TASM

CO3: Develop various applications by interfacing programmable i/o devices to 8086 development board

CO4: Develop various applications by interfacing programmable i/o devices to 8051 development board.

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2	2	3	-	-	-	3	2	-	2	2	2	-
CO2	2	2	2	2	3	-	-	-	3	2	-	2	2	2	-
CO3	2	2	2	2	3	-	-	-	3	2	-	2	2	2	-
CO4	2	2	2	2	3	-	-	-	3	2	-	2	2	2	-

Program execution with Assembler

1. Programs on 16-bit arithmetic and logical operations for 8086 microprocessors. (using various addressing modes)
2. Programs on conditional and unconditional branching instructions for 8086 microprocessors
3. Programs to implement procedures for 8086 microprocessors.
4. Programs to sort given data using 8086 microprocessors.
5. Programs to implement string manipulations using 8086 microprocessors.

6. Programs to implement interrupt handling using 8086 microprocessors.

Program execution with 8086 Development boards

7. Study of Programmable peripheral interface 8255.
8. Study of Programmable interval timer 8254.
9. Study of Programmable Keyboard Display Interface 8279
10. Elevator Simulator interfacing with 8086 microprocessors.
11. Traffic light controller interfacing with 8086 microprocessors.
12. Stepper motor control using 8086 microprocessors.

Program execution with 8051 Development boards

13. Programming arithmetic, logical and bit manipulation instructions using 8051 microcontrollers.
14. Program and verify timer/counter in 8051 microcontrollers.
15. Program and verify interrupt handling in 8051 microcontrollers.
16. UART operation in 8051 microcontrollers.
17. Interfacing DAC and ADC to 805l microcontroller.
18. Interfacing stepper motor using 8051 microcontrollers.

Note: Minimum 10 experiments should be conducted

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INDUCTION MOTORS AND SYNCHRONOUS MACHINES LAB

III B.Tech – V Semester (Code: 20EEL503)

Lectures	0	Tutorial	0	Problem Solving	0	Practical	3	Credits	1.5
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Course Objective: To make the students.

- Develop experimental setups for studying the performance and operation of squirrel cage and slip ring induction motors.
- Perform Direct and Indirect tests of various induction motors.
- Acquire hands on experience of conducting various tests on alternators and obtaining their performance indices using standard analytical as well as graphical methods.
- Develop experimental setups for studying the performance and operation of synchronous Motors.

Course Outcomes: After completion of this lab course, the student is able to

CO1: Compare the performance characteristics of Induction motors.

CO2: Distinguish the performance of the given Induction motors.

CO3: Test the performance of synchronous generators.

CO4: Evaluate the performance of synchronous motors.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	3	-	-	-	-	3	2	-	2	3	2	2
CO2	3	3	2	3	-	-	-	-	3	2	-	2	3	2	2
CO3	3	3	2	3	-	-	-	-	3	2	-	2	3	2	2
CO4	3	3	2	3	-	-	-	-	3	2	-	2	3	2	2

List of Experiments:

1. Load test on Squirrel-Cage Induction motor.
2. Load test on Slip-Ring Induction motor.
3. No-load and Blocked rotor test on 3-phase induction motor.
4. Separation of losses of 3-phase Induction motor.
5. Brake test on single - phase induction motor.
6. Determination of Equivalent circuit of single - phase induction motor.

8. Regulation of alternator by EMF &MMF method.

9. Regulation of alternator by ZPF method.

1-.Synchronization of alternator with infinite bus with P & Q control.

11. Load test on Alternator.

12. Measurement of Xd and Xq of a three phase alternator.

13. V and inverted V curves of synchronous motor.

14. Synchronous Motor performance with constant excitation.

15. Load test on Universal Motor.

Note: Minimum 10 experiments should be conducted.

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CONTROL SYSTEMS LAB
III B.Tech – V Semester (Code: 20EEL504)

Lectures	0	Tutorial	0	Problem Solving	0	Practical	3	Credits	1.5
Continuous Internal Evaluation			30	Semester End Examination (3 Hours)					70

Prerequisites: Mathematics, Network Theory

Course Objectives: To make the students

- Able to analyze characteristics of various types of systems.
- Familiarize with the modelling of dynamical systems.
- Able to design Lag, Lead, Lead-Lag compensators theoretically & experimentally.
- Familiarize to observe the effect of P, PI, PD and PID controllers on system.
- Able to find the closed loop stability of the system with different approaches.

Course Outcomes: After completion of this course**,** Students will be able

CO1: Deduce characteristics of various types of systems.
CO2: Derive a Mathematical model for Various Systems with various methods.
CO3: Design and verify Lag, Lead, Lead-Lag compensators experimentally.
CO4: Illustrate the effect of P, PI, PD and PID controllers on a control system.
CO5: Interpret stability of the system through Frequency Response Method.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	-	-	-	-	3	2	-	2	2	3	-
CO2	3	3	2	2	-	-	-	-	3	2	-	2	2	3	-
CO3	2	2	3	2	-	-	-	-	3	2	-	2	2	3	-
CO4	3	3	2	2	-	-	-	-	3	2	-	2	2	3	-
CO5	3	3	2	2	-	-	-	-	3	2	-	2	2	3	-

LIST OF EXPERIMENTS:

1. Characteristics of magnetic amplifier.
2. Characteristics of A.C servo motor
3. Characteristics of Synchros.
4. Effect of feedback on D.C servomotor.
5. Transfer function of D.C motor
6. Transfer function of D.C generator.
7. Time response of second order systems
8. Simulation of transfer functions using operational amplifier
9. Stepper motor control.
10. D.C. position control System

12. Temperature controller using PID
13. Effect of P, PD, PID controller on a second order system
14. P, PI, PD, PID control using Op-Amps.
15. Frequency response of first and second order systems.

Note:Minimum 10 experiments should be conducted.

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Summer Internship

III B.Tech – V Semester (Code: 20EEL505/INT01)

Lectures	0	Tutorial	0	Problem Solving	0	Practical	0	Credits	1.5
Continuous Internal Evaluation				0	Semester End Examination (3 Hours)				100

Course Objectives: To make the students

- Equip students with a comprehensive understanding of key environmental regulations and standards relevant to electrical engineering projects.
- Develop students' ability to tackle complex engineering problems by considering environmental impacts and sustainability.
- Foster innovation by integrating environmental sustainability into the design and development of electrical engineering projects.
- Promote teamwork and collaboration across different disciplines to address environmental and engineering challenges.

Course Outcomes: After completion of this course student will be able to

CO1: Identify and apply appropriate environmental laws and guidelines in their engineering designs and projects.

CO2: Demonstrate improved problem-solving skills by incorporating environmental considerations into their engineering solutions.

CO3: Create project designs that are both innovative and aligned with current industry trends in sustainability.

CO4: Effectively work in interdisciplinary teams, gaining exposure to diverse perspectives and enhancing their collaborative skills.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	2	-	2	2	3	3	-	3	3	2	2
CO2	3	3	2	2	2	-	2	2	3	3	-	3	3	2	2
CO3	3	3	2	2	2	-	2	2	3	3	-	3	3	2	2
CO4	3	3	2	2	2	-	2	2	3	3	-	3	3	2	2

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GUIDELINES AND EVALUATION OF INTERNSHIP PROGRAM

As per R20 guidelines, every student has to undergo internship twice, once between IV and V semester, the other between VI and VII Semester. The first internship is for a duration of 4 weeks and the second internship is for a duration of 6 weeks.

There shall be a departmental internship committee consisting of the Head of the Department and two faculty members nominated by the HOD. The committee shall identify the potential organizations which can provide internship opportunity to the students. The department shall enter into an MOU with the concerned organization and the details will be shared with the students.

The students shall be informed to apply for undergoing internship in the specified proforma. The details and consent of the organization in which he/she is seeking for internship are to be furnished. Further, the student along with the parent must submit an undertaking form. The committee shall scrutinize the applications and approve the same. If a student fails to acquire internship, he/she may be permitted to undergo equivalent work (mini project, research project, fabrication work, field work, research paper, etc.,) in the department under the guidance of a faculty member.

After the completion of the internship, the student mustsubmit the report and attend a departmental internal assessment for award of grade and credits.

- **Weightage for Evaluation:**
  The various stages of evaluation and weightage at each stage are given below:

Stage	Marks	Remarks
Internship Certificate	20M	Company Supervisor will assess the interns in the internship company premises. Company supervisor assesses the intern and provide certificate.
Report Submission	30M	After the completion of the internship, the student mustsubmit the report along with certificate.
Final Assessment- in the college premises	50 M	The HOD of the concern department acts as convener of the committee and two faulty members are members to assess the intern's performance.

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INDIAN CONSTITUTION

III B.Tech – V Semester (Code: 20EE506/MC03)

Lectures	2	Tutorial	0	Problem Solving	0	Practical	0	Credits	0
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				0

Course Objectives: To make the students

- Study the importance of constitution
- Discuss philosophy of fundamental rights and duties
  Describe the central and state relation, financial and administrative.
- Explain the autonomous nature of constitutional bodies like Supreme Court and high
- court, controller and auditor general of India and election commission of India.

Course Outcomes: After completion of this course, Students will be able to

CO1: Explain the Fundamental rights.

CO2: Describe the Fundamental duties and its importance.

CO3: Explain about the uses of Panchayath Raj system in India and its duties.

CO4: Demonstrate the System of Election Commission and its functions.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	2	2	1	-	-	-	1	-	-	-
CO2	-	-	-	-	-	2	2	1	-	-	-	1	-	-	-
CO3	-	-	-	-	-	2	2	1	-	-	-	1	-	-	-
CO4	-	-	-	-	-	2	2	1	-	-	-	1	-	-	-

UNIT-I

1. Meaning of the constitutional law and constitutionalism.
2. Historical perceptive of the constitution of India
3. Salient features and characteristics of the constitution of India.
4. Preamble, union and its territory and citizenship.

UNIT – II

5. Fundamental rights principles.
6. Directive principles of state policy.
7. Fundamental Duties.
8. The government of the union, the president, The Prime Minister, and the council of ministers, The parliament of India, The supreme court, the union judiciary

UNIT – III

9. The Machinery of Government in the states, The Governor, The Chief Minister and council of

1-.Union territories.

11.The Federal System, Division of powers between centre and states, Legislative Administration and Financial relation.

12. Emergency Provisions, President Rule, National Emergency, Financial Emerging

13. Local self-Government, Panchayat Raj, Municipalities and municipal Corporation.

UNIT IV

14. Miscellaneous Provisions, The comptroller and Auditor general of India, The Public Service Commission, Special Provisions relating to certain classes, Elections – Political parties.

15. Amendment of the Constitution.

TEXT BOOKS:

1. Bakshi P M — The Constitution of India , Universal Law Publishers
2. Ramnarain Yadav – Legelect's the constitution of India, K K Legelest Publication

REFERENCE BOOKS:

1. M V Pylee – Constitutional Government in India – Asia Publishing House
2. D C Dasgupta – Indian Government and Politics. Vikas Publishing house
4. Sujit Chowdary, Madhav Khosla, Pratapabhem Mehla. The Oxford Hand Book of the Indian Constitution
5. Noorani A G Constitutional question in India ; The President , Parliament and the States — Oxford.
6. Astoush – Kumar Indian Constitution and its features, Anmol Publishers

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POWER SYSTEM PROTECTION
III B.Tech-VI Semester (Code: 20EE601)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Power systems, Basics of circuit theory.

Course Objectives: To make the students

- Develop adequate knowledge of requirement of protective relaying and about all types of protective relays.
- Provide the knowledge of static relays and Microprocessor based numerical relays.
- Explain Protection of alternators, transformers and transmission lines.
- Develop basic knowledge of switch gear and principles of operations of various types of circuit breakers

Course Outcomes: After completion of this course, students will be able to

CO1: Explain requirement of protective relaying and all types of relays.

CO2: Demonstrate basic components of static relays, types of comparators, types of over current relays and types of Microprocessors based numerical relays.

CO3: Describe differential and distance protection for generators, transformers and transmission lines and feeders.

CO4: Identify, differentiate and working of various types of circuit breakers.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	1	1	-	-	-	-	-	-	1	2	3	2
CO2	3	2	2	3	3	-	-	-	-	-	-	3	3	3	3
CO3	3	2	2	2	2	-	-	-	-	-	-	3	3	3	3
CO4	3	2	2	2	2	-	-	-	-	-	-	3	3	3	3

UNIT – I

Protective Relays: Introduction, basic requirement of protective relaying, zones of protection, primary and backup protection, classification of relays, attracted armature, balanced beam, induction disc, thermal relays, Buchholz's relay, Over

current, under voltage, directional and non-directional relays. Distance relays, impedance, reactance, mho and off set mho relays. Differential relays, circulating current and opposite voltage differential scheme. Negative sequence relays.

UNIT – II

Static Relays andMicroprocessorRelays: Introduction, basic component of static relays. Comparators-amplitude and phase comparators. Over current relays, instantaneous over current relay, inverse time over current relays, differential relays. Introduction to Microprocessor relays- Architecture of Microprocessor Relays- over current relays- distance and differential relays.

UNIT – III

Protection of Alternators, Transformers and Transmission Lines Stator and Rotor protection of alternators-Stator protection against inter turn faults-Rotor earth fault protection-Protection against loss of excitation-field suppression of alternator. Differential protection of transformers-Frame leakage protection- Differential protection of transmission line- Three stepped zone of distance protection of transmission line-- over current, distance and differential protection for feeders – carrier current protection – phase comparison – carrier aided distance protection.

UNIT – IV

Switchgear: Elementary principles of arc phenomenon, arc quenching, interruption of capacitive currents and low current chopping, resistance switching, recovery and restriking voltages. Principles of operations of various types of circuit breakers, air break, oil filled, air blast, vacuum and SF6 circuit breakers. Rating and specifications of circuit breaker.

TEXT BOOKS:

1. Badri Ram, D. N. Vishwakarma, “Power System Protection and Switchgear”, Tata Mc-Graw Hill, 2nd Edition, 2-17.
2. U. A. Bakshi , Dr. M. V. Bakshi , “switchgear And Protection”,Technical publications,2-21
3. Y.G. Paithankar & S.R.Bhide, “Fundamentals of Power System Protection”, PHI, 2nd Edition, 2-13.
4. Bhuvanesh Oza, Nirmal-Kumar Nair, Rashesh Mehta and Vijay Makwana, “Power system protection & switchgear” Mc-Graw Hill, 1st Edition, 2-17.

REFERENCE BOOKS:

1. T.S. Madhava Rao, "Power system protection Static relays", Tata Mc-Graw Hill, 2nd Edition, 2-17
2. Sunil S Rao,"Switchgear Protection and Power Systems (Theory, Practice & Solved Problems)", Khanna Publishers, 14th Edition, 2-19.
3. Ravindranath B and M Chander, "Power system protection and switchgear" ,New Age International,2nd Edition, 2-18.

NPTEL COURSE LINKS:

1. NPTEL :: Electrical Engineering - Power System Protection
2. NPTEL :: Electrical Engineering - NOC:Power System Protection
3. https://nptel.ac.in/courses/1-81-7167

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SWITCHED MODE POWER SUPPLY

IIIB.Tech–VISemester(Code:20EE602/PE2A)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Power Electronics (20EE504).

Course Objectives: To make the students

- Classify of various Switched Mode Power Supply components
- Outline the Modelling and control aspects of converter.
- Illustrate various Soft-switching DC - DC Converters
- Assess the Nonlinear phenomena of Pulse Width Modulated Rectifiers

Course Outcomes: At the end of this course, the students will be able to

CO1: Illustrate various reactive elements in Power Electronic Systems.

CO2: Classify different controllers for converter.

CO3: Illustratevarious modes of operation of DC-DC converters.

CO4: Assess the Pulse Width Modulated Rectifiers.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	-	-	-	-	-	-	-	2	3	3	2
CO2	3	3	3	2	-	-	-	-	-	-	-	2	3	3	3
CO3	3	3	3	2	-	-	-	-	-	-	-	2	3	3	3
CO4	3	3	3	2	-	-	-	-	-	-	-	2	3	3	3

UNIT-I

Design constraints of reactive elements in Power Electronic Systems: Design of inductor, transformer and capacitors for power electronic applications, Input filter design. Basic concepts and steady-state analysis of second and higher order Switched Mode power converters.

UNIT – II

Dynamic Modelling and control of second and higher order switched Mode power converters: Analysis of converter transfer functions, Design of feedback compensators, current programmed, frequency programmed and critical conduction mode control.

UNIT – III

Soft-switching DC - DC Converters: Zero-Voltage-switching converters, Zero-Current switching converters, Multi resonant converters and Load resonant converters.

UNIT – IV

Pulse Width Modulated Rectifiers: Properties of ideal rectifier, realization of near ideal rectifier, control of the current waveform, single phase and three-phase converter systems incorporating ideal rectifiers and design examples. Nonlinear phenomena in switched mode power converters.

TEXT BOOKS:

1. H.W.Whittington, B. W. Flynn and D. E. MacPherson, Switched Mode Power Supplies Design and Construction,Universities Press (India) Pvt. Ltd., 2nd Edition, 2009.
2. Mohan N. Undeland . T & Robbins W, Power Electronics Converters, Application and Design, John Wiley, 3rd Edition, 2007.

REFERENCE BOOKS:

1. Krein P.T, Elements of Power Electronics, Oxford University Press,2nd Edition, 2014.
2. M. H. Rashid, Pearson, Power electronics: circuits, devices, and applications, Pearson India Education Services Pvt.Ltd, 4th Edition, 2017.
3. Umanand L, Bhat S.R, Design of magnetic components for switched Mode Power Converters,New Age International (P) Ltd, 1st Edition, 2009.
4. R.W.Erickson and D.Maksimovic, Fundamentals of Power Electronics, Springer; 3rd Edition, 2020

Web Source Links:

1. L.Umanand, "Fundamental of Power Electronics" NPTEL Course ; https://onlinecourses.nptel.ac.in/noc22_ee-3/preview.
2. Dr. Robert Erickson," Power Electronics Specialization", COURSERA, https://www.coursera.org/specializations/power-electronics.

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ELECTRICALDRIVES

IIIB.Tech –VISemester(Code:20EE602/PE2B)

Lectures	3	Tutorial	0	ProblemSolving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	SemesterEndExamination(3Hours)				70

Prerequisites:PowerElectronics.

CourseObjectives:Tomakethestudents

- DescribethestructureofElectricDrivesystemsandtheirroleinvariousapplications such as flexible production systems, energy conservation, renewableenergy,transportationetc.,makingElectricdrivesanenablingtechnology
- Describetheoperationofdc motor drives to satisfy four-quadrantoperation tomeetMechanicalloadrequirements.
- Describetheoperationofinductionmachinesinanenergyefficientmannerusing Powerelectronics.
- Learnthebasicoperationofsteppermotorsandswitched-reluctancemotordrives.

CourseOutcomes: Aftercompletionofthiscourse,thestudentwillbeableto

CO1: Classify different types of drives, Characteristics and applications in various industries & to know the characteristics of various motors and loads.

CO2: Describeaboutoperationofdcmotorspeedcontrolusingconvertersandchoppers

CO3: Illustratedifferentspeedcontrolmethodsininductionmotorsusing thyristorsbasedControlschemes.

CO4: Demonstratethebasicoperationofsteppermotorsandswitched-reluctancemotordrives.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	1	-	-	-	-	-	-	-	-	3	3	2	-
CO2	3	3	2	-	-	-	-	-	-	-	-	3	3	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	3	3	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	3	-

UNIT–I

Introduction: Electric drives - advantages of electric drive - Type of electric drives - componentsofelectricdrives-Statusofdcandacdrives.**DynamicsofElectricDrives:** Speedtorque conventions and multi quadrant operation - Equivalent values ofdrive parameters. **Control of Electric Drives:** Modes of operation - Speed control anddriveclassification-closed-loopcontrolofdrives.

UNIT– II

DCmotorDrives:DCmotorsandtheirperformance–Starting-methodsofbraking-speedcontrol-Methodsofarmaturevoltagecontrol-Transformeranduncontrolledrectifierontrol.**ControlledRectifierfedDCDrives:**Singlephase

fullyandhalf controlled rectifiercontrolofseparatelyexciteddc motor - Threephasefully andhalfcontrolledrectifier control of separatelyexciteddc motor - Dual converter controlofseparatelyexciteddcmotor - comparisonof conventional and**Chopperfed DCDrives:**Controlofseparatelyexciteddcmotors-Choppercontrolofseriesmotor.

UNIT– III

Inductionmotordrives: Threephase induction motors - Operation with unbalancedsource voltagesandsingle phasing- Operationwith unbalancedrotorimpedances–Starting– braking-transientanalysis - Speedcontrol - pole amplitude modulation -statorvoltage control - Variable frequencycontrol from voltage andcurrentsources -Eddy current drives - rotorresistancecontrol - slip power recovery - Variablespeedconstantfrequencygeneration.

UNIT– IV

Synchronousmotordrives: Synchronousmotors-Operationandfixedfrequencysupply

-Synchronousvariablespeeddrives-brakingofsynchronousmotor.Switchedreluctance motordrives - brushless dc motors - stepper motors – variable reluctancemotor.Vectorcontrols-Spacevectormodulation.

TEXTBOOKS:

1. G.K.Dubey,FundamentalsofElectricdrives,Narosa , 2ndEdition, 2010.

REFERENCEBOOKS:

1. G.K.Dubey,PowerSemiconductorcontrolleddrives,Prentice Hall India, 2ndEdition2010.
2. S.B.Dewan,G.R.Selmon&Straughen,Powersemiconductordrives, JohnWiley, 2009.
3. G.K.Dubey, SRDoradla,Thyristorisedpowercontrollers,NewAge International, 2nd edition, 2012.

E-resourcesandotherdigitalmaterial

https://nptel.ac.in/courses/1-81-8-77

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HVDC &FACTS
IIIB.Tech–VISemester(Code:20EE602/PE2C)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites:PowerElectronics,Transmission & Distribution system

CourseObjectives: Tomakethestudents

- Study comparison of AC and DC Transmission systems and components of HVDC.
- Discuss the control aspects of HVDC System and harmonics introduction.
- Explain the fundamentals of FACTS Controllers and basic types of FACTS Controllers.
- Study objectives of shunt, series and combined compensators and their control Structure

Course Outcomes:Aftercompletionofthecoursethestudentwillbeableto

CO1: CompareHVACandHVDCsystemandtodescribevarioustypesofDClinks in HVDCconverterandinverteroperation.

CO2: Describevariousmethodsfor thecontrol ofHVDCsystemsandtoperformpower flowanalysisinAC/DCsystems.

CO3: Explain conceptofFACTScontrollerforthespecificapplicationbasedon systemrequirementsandtypesoffactscontrollers.

CO4: Illustrate the objectivesofShuntControllers,Seriescontrollers&combinedcontrollersforvarious functionssuch as TransientstabilityEnhancement,voltageinstability preventionandpoweroscillationdamping.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	1	1	1	-	-	-	-	-	-	1	3	2	2
CO2	3	3	3	2	2	-	-	-	-	-	-	1	3	2	2
CO3	3	3	3	2	2	-	-	-	-	-	-	2	3	2	2
CO4	3	2	3	2	2	-	-	-	-	-	-	2	3	2	2

UNIT–I

HVDCtransmission:HVDCTransmissionsystem:Introduction,comparisonofACand DC systems, applications of DC transmission, types of DC links, Layout of HVDC Converter

station and components of HVDC system. Line commutated converterand voltagesourceconverterbasedsystems.

UNIT–II

ControlofHVDCsystem: Principles ofcontrol, desiredfeaturesofcontrol,converter control characteristics,powerreversal,Ignition anglecontrol,current and extinctionangle control.Harmonicsintroduction,generation,acfiltersanddcfilters.Introductiontomulti terminalDCsystemsandapplications,comparisonofseriesandparallelMTDCsystems.

UNIT–III

FACTSconcepts:Reactivepowercontrolinelectricalpowertransmission,principlesofconventionalreactivepowercompensators. IntroductiontoFACTS, flow ofpowerinAC parallelpaths andmeshed systems,basic types ofFACTScontrollers,definitionsofFACTS controllers,briefdescriptionofFACTScontrollers.

UNIT–IV

StaticShunt,SeriesandCombinedCompensators: **Shunt**compensation–objectivesof shuntcompensation,staticVARcompensators–SVC, STATCOM,SVCand STATCOM comparison.Seriescompensation–objectivesofseriescompensation, thyristorswitchedseries capacitors(TCSC), staticseries synchronouscompensator (SSSC),powerangle characteristics. Unifiedpowerflowcontroller (UPFC)–Introduction,operatingprinciple, independentrealandreactivepowerflowcontrollerandcontrolstructure.Interlinepower flowcontroller (IPFC)–Introduction,operatingprinciple.

TEXT BOOKS:

1. NarainG.Hingorani ,LaszloGyugyi,UnderstandingFacts: Concepts and Technologyof Flexible AC Transmission Systems, Wiley India Pvt Ltd (2011).
2. KR Padiyar, “Hvdc Power Transmission Systems New Age Publishers; Thirdedition (2017)

REFERENCES:

1 . K.R. Padiyar , Facts Controllers In Power Transmission And Distribution, New Age International Pvt Ltd; Second edition (2016).
2 S Kamakshaiah , V Kamaraju , HVDC Transmission | by McGraw Hill; Second edition (2020)

NPTEL LINKS:

1.HTTPS://NPTEL.AC.IN/COURSES/1-81-7114
2.HTTPS://NPTEL.AC.IN/COURSES/1-81-4-13
3. HTTPS://ARCHIVE.NPTEL.AC.IN/COURSES/1-8/1-7/1-81-7114/
4. HTTPS://NPTEL.AC.IN/COURSES/1-81-616-

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MACHINE MODELLING AND ANALYSIS

IIIB.Tech–VISemester(Code:20EE603/PE3A)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: NIL

CourseObjectives(COs):

After completionofthiscourse, studentswillbe ableto

- Understandthe conceptsof2-axisrepresentationofan electricmachine
- Knowtheconceptsofrepresentingtransferfunctionmodelof Dcmachine
- Acknowledgetheimportanceof Voltageand currentEquationsinstatorreference frame
- Developthemodelling Voltageand currentEquationsin state–spacevariableform of 3-ph synchronousmotor

Course Outcomes(COs): After completionofthiscourse, studentswillbe ableto

CO1: Describe thebasicmethodsandassumptions in modellingoftwo-polemachines.

CO2: Categorise thedifferentframesformodellingofACmachinesandphase transformations.

CO3: Deducevoltage,currentandtorqueequationsfordifferentmachines.

CO4: Illustrate Circuitsmodelofa3phSynchronousmotorandVoltageand currentEquationsin state–spacevariableform.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	2	-	-	-	-	-	-	1	3	1	-
CO2	3	3	2	2	2	-	-	-	-	-	-	1	3	1	-
CO3	3	3	2	2	2	-	-	-	-	-	-	1	3	1	-
CO4	3	2	2	2	2	-	-	-	-	-	-	1	3	1	-

UNIT-I

BasicTwo-poleDCmachine–primitive2-axismachine–VoltageandCurrentrelationship–Torqueequation.MathematicalmodelofseparatelyexcitedDCmotorandDCSeriesmotorin statevariableform–Transferfunctionofthemotor–Numericalproblems.MathematicalmodelofD.C. shuntmotorD.C.Compoundmotorinstatevariableform–Transfer functionofthemotor–NumericalProblems

UNIT-II

Linertransformation–Phasetransformation(a,b,ctoα,β,o)–Active transformation(α.β,otod,q).Circuitmodelofa3phaseInductionmotor–Lineartransformation–Phase Transformation–TransformationtoaReferenceframe–Twoaxismodelsforinductionmotor.dqmodelbasedDOLstartingofInductionMotors.

UNIT-III

VoltageandcurrentEquationsinstatorreferenceframe–equationinRotorreferenceframe–equationsin asynchronouslyrotatingframe–Torqueequation–EquationsIstate–spaceform.

UNIT-IV

Circuitsmodelofa3phSynchronousmotor–TwoaxisrepresentationofSyn.Motor.Voltageand currentEquations instate–spacevariableform–Torqueequation.dqmodelbasedshortcircuit fault analysis-emphasison voltage,frequencyandrecoverytime.

TEXTBOOKS:

1. AnalysisofelectricmachineryandDrivesystems-PaulC.Krause,OlegWasynezuk,ScottD.Sudhoff,thirdedition,IEEE press,2013
2. GeneralizedMachinetheoryP.S.Bimbhra,KhannaPublishers,2002

REFERENCEBOOKS:

1. Thyristor control of Electric Drives – Vedam Subramanyam, Tata McGraw-Hill Education,1988
2. PowerSystemStabilityand Control–PrabhaKundur,EPRI.2006.

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DIGITAL CONTROL SYSTEMS

B.Tech II–IV Semester (Code: 20EE603/PE3B)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Mathematics, Physics, Linear Control Systems

Course Objectives: To make the students

- To understand the concepts of digital control systems and to apply the knowledge state variable analysis in the design of discrete systems
- To provide elaborate discussion about analysis of discrete time control systems.
- To explain the concept of stability analysis of discrete time control systems.
- To have an adequate knowledge to design of discrete time systems.

Course Outcomes: After completion of this course, Students will be able to

CO1: Illustrate z–transformations and their role in the mathematical analysis of different Systems (like Laplace transforms in analog systems).

CO2: Describe state space models of discrete time systems and the controllability and Observability of discrete time systems

CO3: Demonstrate the concepts of stability analysis and analyze of discrete time systems.

CO4: Computecontrollers for discrete systems in state variable analysis.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	-	-	1	-	-	-	-	1	3	-	-
CO2	3	3	3	2	-	-	1	-	-	-	-	1	3	-	-
CO3	3	3	3	2	-	-	1	-	-	-	-	1	3	3	3
CO4	3	3	3	2	-	-	2	-	-	-	-	1	3	3	3

UNIT – I

Introduction to Sampling and Reconstruction: Introduction, Examples of Data Control Systems – Digital to Analog conversion and Analog to Digital conversion, sample and hold operations.

Z – Transforms: Introduction,Theory of Z-Transform,Inverse Z-Transforms, Modified Z-Transforms, Solutions of linear difference equations.

Z-Plane Analysis of Discrete-Time Control System: Z-Transform method for solving difference equations; Pulse transforms function, block diagram analysis of sampled – data systems, mapping between s-plane and z-plane.

UNIT – II

State Space Analysis State Space Representation of discrete time systems, Pulse Transfer Function Matrix solving discrete time state space equations, State transition matrix and it's Properties, Methods for Computation of State Transition Matrix, Discretization of continuous time state – space equations.

Controllability and Observability: Concepts of Controllability and Observability, Tests for controllability and Observability. Duality between Controllability and Observability, Controllability and Observability conditions for Pulse Transfer Function.

UNIT – III

Stability Analysis: Mapping between the S-Plane and the Z-Plane – Primary strips and Complementary Strips – Constant frequency loci, Constant damping ratio loci, Stability Analysis of closed loop systems in the Z-Plane. Jury stability test – Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion.

UNIT – IV

Design of Discrete Time Control System by Conventional Methods: Transient and steady – State response Analysis – Design based on the frequency response method – Bilinear Transformation and Design procedure in the w-plane, Lead, Lag and Lead-Lag compensators and digital PID controllers.

State Feedback Controllers and Observers: Design of state feedback controller through pole placement – Necessary and sufficient conditions, Ackerman's formula. State Observers – Full order and Reduced order observers.

TEXT BOOKS:

1. K. Ogata,Discrete-Time Control systems, Pearson Education/PHI, 2nd Edition.2003.
2. V. I. George&C. P. Kurian, Digital Control Systems, Cengage India Pvt. Ltd,2015.

REFERENCE BOOKS:

1. Kuo, Digital Control Systems Oxford University Press, 2003, 2nd Edition.
2. M. Gopal Digital Control and State Variable Methods, Tata McGraw Hill Education Pvt. Limited, 2012, 4th Edition.
3. M. Gopal, Digital Control Engineering, New Age Int. Pvt. Ltd., 2014, 2nd Edition.
4. M. Sami Fadali Antonio Visioli Digital Control Engineering Analysis and Design,
5. Academic Press.

NPTEL COURSE LINKS:

1. NPTEL: Electrical Engineering - NOC: https://nptel.ac.in/courses/108103008

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OPTIMIZATION TECHNIQUES

IIIB.Tech–VISemester(Code:20EE603/PE3C)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

CourseObjectives: Tomakethe students

- Explainthe Conceptstosolvelinearprogrammingproblemsariseinreallife situationsinvolvingseveralparametersusingvariousmethodsandtheiradvantages.
- Discusstheapplicationsoflinearprogrammingnamelytransportation,assignment and travelling salesman problem which arise i n different situations in all engineeringbranches.
- Explainthenon-linearityinoptimizationproblems,directsearch techniquesand iterativemethods.
- Discuss the applications of optimization techniques in the problem Dynamic programming in optimization and solve certain integer linear programming problems.

Course Outcomes: Aftercompletionof thiscourse,studentswillbeable to

CO1:Developthemathematicalmodelofanoptimizationproblemand s o l v e a givenlinear programmingproblemusingsuitablemethod.

CO2:Obtain solutionforaspecialtype linearprogramming problemnamelytransportation,assignment&travellingsalesmanproblem.

CO3: Describethecharacteristicsofnon-linearityinoptimizationandsolvecertainNLPPusingsearchinganditerativetechniq ues.

CO4:DescribethecharacteristicsofDynamicprogramminginoptimization andsolve certainintegerlinearprogrammingproblems.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	3	-	2	-	-	-	3	2	2	2	1
CO2	3	3	3	2	2	-	2	-	-	-	3	2	2	2	1
CO3	3	3	3	2	3	-	2	-	-	-	3	2	2	2	1
CO4	3	3	3	2	3	-	2	-	-	-	3	2	2	2	1

UNIT-I

LinearProgrammingProblems(LPP): Mathematicalmodelsand basicconceptsof linear programmingproblem;Solutionoflinearprogrammingproblems- Graphicalmethod,

Analyticalmethod, Simplexmethod,Artificialvariabletechnique(Big-Mand Two-phase methods),Dualityprincipleanddualsimplexmethod.

UNIT-II

SpecialtypeofLPPs: Mathematicalmodeloftransportationproblem,Methodsoffinding initialbasicfeasiblesolutionto find theoptimalsolutionoftransportationproblem, Exceptionalcasesintransportationproblem,Degeneratesolutionof transportationproblem, Assignmentproblemasaspecialcaseoftransportationproblem,Hungarianalgorithmtosolvean assignmentproblem,Specialcases in assignmentproblem.Thesalesman problem,Formulationoftravellingsalesmanproblemas anassignmentproblem.

UNIT-III

Non-linearProgrammingProblems (NLPP): Classicalmethod of optimizationusing Hessianmatrix,Iterativemethods- Randomsearchmethods,Steepestdecentmethodand Conjugategradientmethod;Directmethods- Lagrange'smethod,Kuhn-Tuckerconditions, Penaltyfunctionapproach.

UNIT–IV

DynamicProgramming:

Principleofoptimality– recursiverelations– solutionofLPP–simpleexamples.
IntegerLinearProgramming: Gomory'scuttingplanemethod–Branchandboundalgorithm– Knapsackproblem– linear-–1problem.

TEXTBOOKS:

1. Kantiswarp,P.K.Gupta,ManMohan,—OperationsResearch‖,S.Chand&Sons,NewDelhi. 16/e.,2013.(UnitI,II)
2. S.S.Rao,—OptimizationTechniques‖,NewAgeInternational,NewDelhi,3/e.,2013.

REFERENCEBOOKS:

1. Hamdy.A.Taha,OperationsResearch,PrenticeHallofIndiaLtd,NewDelhi,7/e.,2002.
2. J.C.Pant,—IntroductiontoOptimization‖,JainBrothers,NewDelhi,7/e.,2012.
3. K.V.Mittal:OptimizationMethods,WileyEasternLtd.2005

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POWER QUALITY

IIIB.Tech–VISemester(Code:20EE603/PE3D)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Generation and Transmission (20EE405),Power Electronics (20EE504)

Course Objectives: To make the students

- Classify the power quality problems.
- Categorize voltage sag and voltage swell problems and suggest preventive techniques.
- Identify the harmonic sources and the effects of harmonic distortion.
- DistinguishthePower Quality Conditioners.

Course Outcomes: After completion of this course students will be able to

CO1: Summarize different types of power quality problems with their source of generation.

CO2: Examine different methodologies for detection, classification and mitigation of power quality problems.

CO3: Illustrate the active & passive filters for harmonic elimination.

CO4: Demonstrate thePower Quality Conditioners.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	2	-	-	1	-	-	-	-	2	3	2	2
CO2	3	3	3	2	-	-	1	-	-	-	-	2	3	2	2
CO3	3	3	3	2	-	-	1	-	-	-	-	2	3	2	2
CO4	3	3	3	2	-	-	1	-	-	-	-	2	3	2	2

UNIT – I

INTRODUCTION: Electric power quality phenomena - IEC and IEEE definitions - power quality disturbances - voltage fluctuations-transients-unbalance-waveform distortion-power frequency variations. Voltage variations - Voltage sags and short interruptions – flicker - longer duration variations.

UNIT – II

VOLTAGE SAGS AND INTERRUPTIONS: Sources of sagas and interruptions, Estimating voltage sag performance, fundamental principlesof protection, solutions at the end-use level, Motor-starting sags, utility system fault-clearing Issues.

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.

UNIT – III

FUNDAMENTALS OF HARMONICS: Harmonics – sources – definitions & standards – impacts - calculation and simulation –harmonic power flow - mitigation and control techniques – filtering – passive and active

UNIT – IV

POWER QUALITY CONDITIONERS: Power Quality conditioners – shunt and series compensators – DStatcom - Dynamic voltage restorer - unified power quality conditioners - case studies

TEXT BOOKS:

1. Roger C. Dugan, Mark F.McGranaghan, Surya Santoso, H.Wayne Beaty, Electrical Power Systems Quality, TMH Education Pvt. 3rd Edition, Ptd.2017
2. C. Sankaran, Power quality CRC Press, 1st Edition, 2019

REFERENCE BOOKS:

1. J. Arrillaga, N.R. Watson,S. Chen, Electrical systems quality Assessment, John Wiley & Sons. ISBN-13 97808126531745, Reprint 2018.
2. Math H. J. Bollen Understanding Power quality problems ,IEEE Press. ISBN-1397808126530397, Reprint 2016.
3. Bhim Singh, Ambrish Chandra and Kamal Al-Haddad Power Quality: Problems andMitigation Techniques, John Wiley & Sons Ltd., U.K,ISBN-13 97801118922057, 2015.

NPTEL Links

1.https://nptel.ac.in/courses/1-8/1-2/1-81-2179/

2.https://nptel.ac.in/courses/1-8/1-7/1-81-7157/

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DATA ANALYTICS

IIIB.Tech–VISemester(Code:20EE604/JO1A)

Lectures	2	Tutorial	0	Problem Solving	0	Practical	2	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites:NIL

Course Objectives: To make the students

- Reproduce Big data, characteristics of Big Data, sources and applications of Big Data, Industry examples and Big Data technologies.
- Describes basic concepts of Hadoop, architecture and design of Hadoop Distributed File System (HDFS), commands of HDFS.
- Demonstrate how classic Map Reduce works (v1) and anatomy of Map Reduce (v2) along with their failures. Deploying map reduce programs on to HDFS.YARN (Yet Another Resource Node) and its failures, scheduling in YARN.
- Describes different Big Data tools like PIG, HIVE, & SQOOP.

Course Outcomes: By the end of the course the student will be able to

CO1: Summarize the different methodologies of Big data tools and characteristics.

CO2: Describes the Hadoop distributed file system with respect to Hadoop.

CO3: Recognizes the Map Reduce mechanism is effective than YARN in Hadoop.

CO4: Describe the configuration of HIVE component and meta-store, SQL on Hadoop alternatives transactions.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	2	2	-	-	-	-	-	-	2	3	2	2
CO2	2	2	2	3	2	-	-	-	-	-	-	2	2	3	2
CO3	3	2	3	2	2	-	-	-	-	-	-	2	3	3	2
CO4	2	2	3	3	2	-	-	-	-	-	-	2	3	2	2

Course Syllabus:

UNIT-I **(15 Periods)**

UNDERSTANDING BIG DATA: What is big data? Why big data? Data!, Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System, Grid Computing, Volunteer Computing, convergence of key trends, Unstructured Data.

INDUSTRY EXAMPLES OF BIG DATA: Web Analytics, Big Data and Marketing, Fraud and Big Data, Risk and Big Data – Credit risk management, Big Data and Algorithmic Trading, Big Data and Healthcare – Big data in medicine, Advertising and big data

BIG DATA TECHNOLOGIES: Introduction to Hadoop, Open Source Technologies – Cloud and Big Data, Mobile Business Intelligence, Crowd sourcing analytics, Inter and Trans firewall analytics.

UNIT-II **(15 Periods)**

BASICS OF HADOOP: Introduction to Hadoop, hadoop components, Configuration of Hadoop, Data format, Analyzing data with Hadoop, Scaling out, Hadoop streaming.

Hadoop Distributed File System: Design of HDFS, HDFS concepts, Command line interpreter, Basic File system operations, Hadoop File System Interface, Data Flow, Parallel copying with distcp, Java interface.

UNIT-III **(15 Periods)**

How MapReduce Works: Classic Map Reduce, Anatomy of Map Reduce job run, Failure in Map Reduce, Shuffle and sort, Task execution.

MapReduce Features: Counters, Sorting, Writing mapreduce programs, Deploying mapreduce programs on Hadoop Cluster.

YARN-Anatomy of YARN application run, YARN compared to Mapreduce 1, Scheduling in YARN, Failures In YARN.

UNIT-IV **(15 Periods)**

Hadoop Related Tools: Pig- Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts, User-Defined Functions-A Filter UDF, An Eval UDF.
Hive: Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

Sqoop: Getting Sqoop, Sqoop Connectors, A Sample Import, Text and Binary File Formats, Generated Code, Additional Serialization Systems, Imports: A Deeper Look, Controlling the Import, Imports and Consistency

TEXT BOOK:
1. **"**HADOOP "The Definitive Guide", Tom White, O'Reilly Publications, 4th Edition.

2. Black Book on Big Data, Dreamtech Publications.

REFERENCE BOOKS:
1. "Hadoop in Action, Hadoop Beginner's Guide,Optimizing Hadoop for MapReduce, Scaling Big Data with Hadoop and Solr

Journals/Journal Articles:

1. https://hadoopjournal.wordpress.com/

2 A Review Paper on Big Data and Hadoop.

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EMBEDDED SYSTEMS

IIIB.Tech–VISemester(Code:20EE604/JO1B)

Lectures	2	Tutorial	0	Problem Solving	0	Practical	2	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites:Problem-SolvingwithProgramming,Microprocessors,and Microcontrollers.

CourseObjectives (COs):

Themain objectivesof thiscourseare:

- Toimpartbasic designandarchitectural conceptsofembeddedsystems and ExplainKeilµVision4IDEandRTX51concepts.
- To impart the concepts of Real-Time Operating Systems and provide the schedulingAlgorithms. Explain RTOS task scheduling, task synchronization, and task communicationmechanisms.
- To provide fundamentals of prevalent IP-Core: ARM Cortex M3/M4 & Design of anembeddedsystem usingARM CortexProcessor and ExplaintheconceptsofARMCortexM3/M4Processor.
- To explain instruction set of ARM Cortex M3/M4 processor and explain the ALP'susingARM processor and also explainthebasicprogrammingconceptsARMProcessor.

Course Outcomes (CLOs): On successful completion of this course students will be able to

CO1: Have a basic understanding of different methodologies and approaches in the designofembedded systems and exploringthefeatures of Keiland RTX51OS.

CO2: Understand the requirements, and concepts of Real-Time Operating systems forreal-timetask processing and explain conceptsofRTOSalgorithmsforreal-timetaskprocessing.

CO3: Analyze the basic concepts, architecture, memory management unit, and features ofEmbeddedProcessors and exploring the features of ARM Cortex M3/M4 Processor.

CO4: Understand the basic concepts of ARM instruction set and design the embeddedapplications and explore the simple assembly language programs using ARM CortexM3/M4processor.

SYLLABUS

UNIT -I

Embedded Systems Design: Introduction to Embedded System, categories of embeddedsystem,specialties, and recent trends in EmbeddedSystem.

ArchitectureofanEmbeddedSystem:HardwareArchitecture,SoftwareArchitecture,applicationSoftware, Communication Software,Development/TestingTools.

UNIT -II

Overview of RTOS: Architecture of the Kernel, Tasks, Task scheduler, real-time tasks, Taskscheduling,

ageQueues, EventRegisters, Pipes.

Classification of scheduling algorithms: Clock driven Scheduling, Event-driven Scheduling,Resourcesharing, Priorityinversion problem, Deadlock.

UNIT -III

EmbeddedProcessors:IntroductiontoARMfamily,ARMArchitecture-Pipeline,Registers,Operation modes, Big Endian and Little Endian.Cache Mechanism, Memory ManagementUnit.

UNIT – IV

ARM Instructions: ARM and Thumb Instruction Sets, Data Processing Instructions, DataTransfer Instructions,ControlFlowInstructions,BasicAssemblyLanguagePrograms.
CaseStudy:SmartPhone,DigitalCamera,andAutomaticWashingMachine.

PracticalExercises

1. Exploringthe features of Keil and RTX51(CO1)
2. TaskCreation andDeletion usingRTX51in Keil(CO2)
3. TaskschedulingusingRTX51in Keil (CO2)
4. ProcessingCriticalSectionusingRTX51inKeil(CO2)
5. TaskSynchronizationusingRTX51semaphoresinKeil(CO2)
6. Task Communication usingshared memoryin Keil (CO2)
7. TaskCommunicationusingRTX51mailboxinKeil(CO2)
8. IntroductiontoARMCortex M3Processor (CO3)
9. ALP to multiplytwo16-bit binarynumbers (CO4)
10. ALPtofind thesumof thefirst 10integers.(CO4)
11. ALPtofind thenumberof 0'sand 1'sin32-bit data.(CO4)
12. ALPtodeterminewhetherthe given16-bitnumber isODD orEVEN.(CO4)
13. ALPtowritedatainRAM(CO4)
14. DisplayHelloWorld messageusingInternal UART.(CO4)
15. Interface aStepper motor androtateit inclockwiseand anti-clockwisedirection.(CO4)

***Any Ten programs**

Compulsory.TEXTBO

OK:

1. KVKKPrasad,"Embedded/RealTimeSystems"DreamtechPress,2005.
2. Andrew N. Sloss/ Dominic Symes/ Chris Wright, "ARM System Developer's GuideDesigningand Optimizing"Elsevier, 2004.

REFERENCEBOOKS:

1. Frank Vahid / Tony Givargis, “Embedded System Design A unified Hardware / SoftwareIntroduction”John Wiley&Sons,Inc.
2. Jonathan W Valvano, “Embedded Systems: Real-Time Operating Systems for ARM Corte-MMicrocontrollers”Create Space,Volume3, 5th Edition, 2019.

ONLINE SOURCES:

1. http://users.ece.utexas.edu/~valvano/
2. http://www.nptelvideos.in/2012/11/embedded-systems.html
3. https://developer.arm.com/ip-products/processors/cortex-m/cortex-m3

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OPERATIONS RESEARCH
IIIB.Tech–VISemester(Code:20EE604/JO1C)

Lectures	2	Tutorial	0	Problem Solving	0	Practical	2	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: NIL

Course Objectives: To make the students

- Concepts to solve linear programming problems which arise in real life using various methods and their advantages.
- Applications of linear programming namely transportation and assignment problems which arise in different engineering fields.
- Understand the Inventory control and Queuing theory.
- Develop the Project Scheduling and PERT-CPM and competitive strategies.

Course Outcomes: By the end of the course the student will be able to

CO1: Solve linear programming problems which arise in real life.

CO2: Describe the applications of transportation and assignment using Linear programmingProblems.

CO3: Develop the Inventory control and Queuing theory models.

CO4:planning the Project Scheduling and PERT-CPM and competitive strategies.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	2	-	-	-	2	2	2	-	1	-	2
CO2	3	3	3	3	2	-	-	-	2	2	2	-	1	-	2
CO3	3	3	3	3	2	-	-	-	2	2	2	-	1	-	2
CO4	3	3	3	3	2	-	-	-	2	2	2	-	1	-	2

Course Syllabus:

UNIT-I

Linear Programming Problem (LPP): Mathematical models and basic concepts of linear programming problem; Solution of linear programming problem - Graphical method, Simplex method, Artificial variable techniques (Big-M and Two-phase method), Duality in linear programming, dual simplex method.

UNIT-II

Special types of LPP: Mathematical model of transportation problem, Methods of finding initial basic feasible solution, optimal solution of transportation problem, Degeneracy in transportation problem; Exceptional cases in transportation problem- Unbalanced transportation problem, Maximization transportation problem;

Assignment problem- Mathematical formulation of the problem, Hungarian method to solve an assignment problem, Special cases in assignment problem- Maximization assignment problem.

UNIT-III

Inventory control - Introduction, types of inventories, costs associated with inventories, the concept of EOQ, deterministic inventory problems with no shortages, with shortages. Queuing theory - Introduction, queuing system, elements of queuing system operating characteristics of a queuing system, classification of queuing models.

UNIT-IV

Project Scheduling and PERT-CPM: Introduction, Basic Difference between PERT and CPM, PERT/CPM Network Components and Precedence Relationship, Project Management – PERT

Game Theory: Introduction, Competitive Situations, Characteristics of Competitive Games, Maximin – Minimax Principle, Dominance.

List of Experiments.

1. Experimental procedure for Solving linear programming problem with simplex methodusing TORA software.
2. Experimental procedure for Solving linear programming problem with Penalty simplex methodusing TORA software.
3. Experimental procedure for Solving linear programming problem with Two-phase method using TORA software.
4. Experimental procedure for Transportation problem using TORA software.
5. Experimental procedure for Assignment problem using TORA software.
6. Experimental procedure for Queuing problem using TORA software.

TEXT BOOK:

1. “Kanti swarup et.al, Operations Research, New Delhi: S. Chand & Sons, 16th ed.,2013
2. Hamdy. A. Taha, Operations Research, New Delhi: Prentice Hall of India Ltd, 7th ed., 2002.

REFERENCE BOOKS:

1. Singiresu S. Rao, Engineering Optimization Theory and Practice, 4th ed., Hoboken, New

ONLINE COURSES:

1. Operation Research NPTEL

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PIC MICROCONTROLLERS AND ARM PROCESSORS

IIIB.Tech–VISemester(Code:20EE605/JO2A)

Lectures	2	Tutorial	0	Problem Solving	0	Practical	2	Credits	3
Continuous Internal Evaluation			30	Semester End Examination (3 Hours)					70

Prerequisites: Microprocessor&Microcontrollers

Course Objectives: To make the students

- Introduce and explain the architecture of PIC microcontroller
- Explain on use of interrupts and timers
- Develop the peripheral devices for data communication and transfer
- Discuss the functional blocks of ARM processor

Course Outcomes: After completion of this course, students will be able to

CO1: Explain PIC Microcontrollers Programming structure

CO2: Illustrate about Controller interrupts and Timer programming

CO3: Demonstrate the hardware interfacing of peripherals

CO4: Demonstrate about ARM Processors

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	3	-	-	-	3	3	-	2	3	2	-
CO2	3	3	3	2	3	-	-	-	3	3	-	2	3	2	-
CO3	3	3	3	2	3	-	-	-	3	3	-	2	3	2	-
CO4	3	3	3	2	3	-	-	-	3	3	-	2	3	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: I^2C 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.

List of Experiments:

1. Programs on some logic functions using PIC16C6X
2. Programs to create Delay loop applications in PIC16C6X
3. Program to interface ADC and DAC with PIC16C6X
4. Program to interface LED to PIC16C6x
5. Program to demonstrate serial communication using I^2C protocol with PIC16C6x
6. Program to display "Hello World" message using internal UART of ARM cortex M3

TEXTBOOKS:

1. Peatman,J.B., —Design with PIC Micro Controllers‖PearsonEducation,3rdEdition, 2004.
2. Martin Bates-PIC Microcontrollers An Introduction to Microelectronics, newness, Elsevier, 2004

REFERENCE BOOKS:

1. Mazidi, M.A., —PIC Microcontroller‖ Rollin McKinlay, Danny causey Prentice Hall of India, 2007.
2. Furber,S., —ARM System on Chip Architecture‖ Addison Wesley trade Computer Publication, 2000.

Web References:

https://www.microcontrollerboard.com/pic_microcontroller.html

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SOLAR PV AND WIND PLANT DESIGN

IIIB.Tech–VISemester(Code:20EE605/JO2B)

Lectures	2	Tutorial	0	Problem Solving	0	Practical	2	Credits	3
Continuous Internal Evaluation			30	Semester End Examination (3 Hours)					70

Prerequisites: Engineering Mathematics,Semiconductor Physics,Generation and Transmission,

Course objectives:

- To make the student understand solar cell and types, PV plant design, array design and inverter types, grid interface.
- To make the students understand the principles of solar radiation, solar constant andvarious types of collectors
- To make the student Explain the concept of various forms of wind energy systems, components of wind energy converters and working principles of wind energy.
- To make the student analyze wind farm design, testing and standards, design procedure and technical specifications.

Course Outcomes: After completion of this course, student will be able to

CO1: Describe the principles of solar radiation, solar constant and various types ofCollectors.
CO2: Explain solar cell and types, PV plant design, array design and inverter types,Grid interface.
CO3: Explain the concept of various forms of wind energy systems, components of wind energy converters and working principles of wind energy.
CO4: Demonstrate wind farm design, testing and standards, design procedure and technical specifications.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	3	2	2	-	3	2	-	2	2	2	3
CO2	3	3	3	3	3	2	2	-	3	2	-	2	2	2	3
CO3	3	3	3	3	3	3	2	-	3	3	-	2	2	2	3
CO4	3	3	3	3	3	3	2	-	3	3	-	2	2	2	3

UNIT-I

Solar PV Systems: Fundamentals of solar cell, semiconductors as basis for solar cells, P-N junction, sources of losses and prevention, types of solar cells, PV plant design - estimating power and energy demand, site selection, land requirements, choice of modules, Array design, , Supporting structures, mounting and installation, battery storage, inverter types

power (single line diagram) SLD, Preparation of Net Metering solar power (single line diagram) SLD

UNIT-II

Types of Solar Power Plant: Grid connected solar Power Plant- Grid interactive solar power plant- Net Metering Solar Power Plant- Off-Grid / Hybrid solar power plant. Schemes of solar power plant-selection of site and shadow analysis -PV module structure inter row spacing calculation -Pitch analysis Selection of PV module tilt angle- Near shading object calculation -Site survey and plant assessment. Type of solar radiation - Irradiance assessment and comparison -Solar Radiation. Fill factor and Equivalent Solar cell Circuit.

UNIT-III

Wind Energy Basics: Status, Advantages and disadvantages of wind energy systems, Types of wind energy converters, local Effects on wind, site selection: roughness length, wind shear, Wind Speed Variability, Obstacles to wind flow. Components of a wind energy converter: Rotor Blades, Gearboxes, Synchronous or Asynchronous Generators, Towers, Miscellaneous components, Turbine Selection. Working principles of wind energy: Energy content in wind, Energy Conversion at the Blade.

UNIT-IV

Small and hybrid wind turbines: Introduction of micro/small and hybrid wind turbines, siting small turbines in complex terrain, offshore wind turbines, operation and challenge of offshore wind farms. Aerodynamics of wind turbine, Betz limit, blade elemental theory, blade shape, effect of drag and blade number on performance. Air foils and general concepts of aerodynamics. Wind farm design, testing and standards: design procedure, topologies, Wind turbine/farm simulation, wind turbine testing and standards, technical specifications, wind turbine component testing, safety aspects.

List of Experiments

1. MPPT algorithm and Charge controller testing
2. MPPT algorithm testing for a standalone system
3. Synchronization process for single phase solar Grid tied PV system
4. Evaluation of Cut in Speed of the Wind turbine
5. Evaluation of the efficiency of the charge Controller used in the wind energy training system

7. Evaluation of turbine power versus wind speed curve.

TEXT BOOKS:

1. C.S. Solanki, Solar Photovoltaics Fundamentals, Technologies and Applications, PHI Learning Pvt. Ltd. , 2016
2. S. N. Bhadra, D. Kastha, S. Banerjee, Wind Electrical Systems, Oxford Univ. Press , 2005

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REFERENCES:

1. Introduction to Wind Energy Systems Basics, Technology and OperationBy Hermann-Josef Wagner, Jyotirmay Mathur · 2017
2. Non-Conventional Energy Resources ShobhNath Singh Pearson 1st Edition, 2015
3. Solar Energy – Principles of Thermal Collections and Storage S.P. Sukhatme J.K.Nayak McGraw Hill 3rd Edition, 2008

NPTEL COURSE LINKS:

1. NOC:Solar Energy Engineering and Technology - NPTEL,https://nptel.ac.in/courses/112/1-5/1121-5-51/
2. Characteristics and Power Generation from Wind Energy: Part I https://archive.nptel.ac.in/courses/1-3/1-3/1-31-32-6/

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QUANTITATIVE APTITUDE

IIIB.Tech–VISemester(Code:20EEL601/SOC4)

Lectures	1	Tutorial	0	Problem Solving	0	Practical	2	Credits	2
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Pre requisite: basic mathematics

Course Objectives: To make the students

- Effectively organize, summarize and present information in quantitative forms including tables
- Use mathematical based reasoning and to evaluate alternatives and make decisions
- Think and reason logically and critically in any given situation.
- Apply logical thinking to solve problems and puzzles in qualifying exams for companies and in other competitive exams

Course Outcomes: Upon successful completion of the course, the student will be able to:

CO1: Solve basicnumerical problems.

CO2: Apply strategies to simplify the arithmetical problems.

CO3: Analyse mathematical skills in solving analytical and logical problems in personal life.

CO4: Evaluate the problems on data interpretation with help of graphs and charts.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2	2	-	-	-	-	3	2	-	3	3	-	-
CO2	2	2	2	2	-	-	-	-	3	2	-	3	3	-	-
CO3	2	2	2	2	-	-	-	-	3	2	-	3	3	-	-
CO4	2	2	2	2	-	-	-	-	3	2	-	3	3	-	-

UNIT I

Numerical Ability I: Number System, LCM & HCF, Ratio, Proportion & Variation, Partnership, Averages

Numerical Ability II: Mixtures & Allegations, Percentages, Profit & Loss.

UNIT-II

Arithmetical ability I: Problems on ages, time & work, pipes & cistern, chain rule

UNIT-III

Arithmetical ability III: Allegation, simple interest and compound interest, races & games of skills, calendar and clock.

Reasoning: Alphabet Test, Alphanumeric Series, Analogy, Direction sense, Blood Relations, Coding & Decoding, Seating arrangements, Puzzles

Logical ability: Permutations, combination and probability.

UNIT-IV

Mensuration: 2-D : Area, perimeter, Triangles, Quadrilaterals, Polygons, circles, problems 3-D: Volumes, Surface Area, Cube, Cuboid, Cylinder, Cone, Frustrum, Sphere, Hemi-Sphere, tetrahedrane, Pyramid, Prism

Data interpretation: Tabulation, bar graphs, pie charts, line graphs

TEXT BOOK:

1. R S Aggarwal, Quantitative Aptitude for Competitive Examinations, S Chand Publishing, Revised edition, 2017.
2. Arun Sharma, Quantitative Aptitude, McGraw Hill Education, 2019.

REFERENCE BOOKS:

1. R.V.Praveen, Quantitative Aptitude and Reasoning, 2nd Revised Edition, Prentice-Hall of India Pvt.Ltd, 2013.
2. Abhijit Guha, Quantitative Aptitude for All Competitive Examinations, McGraw Hill Education, 6th Edition, 2016.

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POWER ELECTRONICS LAB

IIIB.Tech–VISemester(Code:20EEL602)

Lectures	0	Tutorial	0	Problem Solving	0	Practical	3	Credits	1.5
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Semiconductor Physics and Nano Materials (2-EE2-2/PH-3).

Course Objectives: To make the students

- Conduct the Turning ON and OFF of Transistor and Power Electronics Devices.
- Illustrate AC to DC Conversion circuits on R, RL, Back emf Loads.
- Categorise the operation of inverters PWM techniques on R, Motor Loads.
- Outline the operation of DC-DC choppers and AC Voltage controllers on R Load.

Course Outcomes: After completion of this course students will be able to

CO1: Test the basic operation and compare performance of various power semiconductor devices, passive components and switching circuits.

CO2: Justify the performance of AC to DC Conversion circuits with different loads.

CO3: Measure the operation of inverters and PWM techniques.

CO4: Assess the operation of DC-DC choppers and AC Voltage controllers.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	1	3	-	-	-	-	3	2	-	2	3	2	2
CO2	3	3	2	3	-	-	-	-	3	2	-	2	3	3	3
CO3	3	3	3	3	3	-	-	-	3	2	-	2	3	3	3
CO4	3	3	3	3	1	-	-	-	3	2	-	2	3	3	3

LIST OF EXPERIMENTS:

A- Essential Experiments

1. Static characteristics of SCR, TRIAC.
2. Characteristics of MOSFET & IGBT.
3. Gate triggering methods for SCR (R, RC, UJT).
4. 1- phase Half & Full controlled rectifier with R, RL & RLE load.
5. Voltage commutated DC chopper with R load.
6. 1-phase modified series inverter with R load.
7. 1-phase parallel inverter with R & RL loads.

B- List of Optional Experiments:

(i) Chose one Experiment

8. 1-phase Cyclo-converter (Center tapped or Bridge) with R load.

9. 1- phase IGBT based inverter with R, RL loads.

1-. 1-phase Dual converter with R, RL & RLE loads (Circulating and Non-circulating modes).

(ii) Chose one Experiment

11. 3-phase Half & Full controlled Rectifier with R, RL and RLE loads.

12. 3-phase IGBT based inverter with R, RL loads.

13. Buck Boost Converter with R load.

(iii) Chose one Experiment

14. DSP based speed control of BLDC motor.

15. DSP based speed control of 3-phae Induction motor.

16. Study of 1-phase full wave Mc-Murray Bedford Inverter with R, RLE load.

Note: Minimum 10 experiments should be conducted.

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POWER SYSTEMS LAB

IIIB.Tech–VISemester(Code:20EEL603)

Lectures	0	Tutorial	0	Problem Solving	0	Practical	3	Credits	1.5
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Power System Analysis, Renewable Energy Source

Course Objectives: To make the students

- Analyse the performance of transmission line
- Able to do Experiment in various protection of generator, feeder and transmission line using relays and circuit breakers
- Able to conduct testing about the various electromagnetic relays
- Be competent in use of static and digital relays.
- Develop simulation model for RES

Course Outcomes: After completion of this course,Students will be able to

CO1: Analyze the performance of transmission line

CO2: Examine various protection of generator, feeder and transmission line using relays and circuit breakers

CO3: Execute testing about the various electromagnetic relay

CO4: Competent in use of static and digital relays.

CO5: Analyze simulation model for RES

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	2	1	-	-	-	2	2	-	2	2	3	-
CO2	3	2	2	3	-	-	-	-	2	2	-	2	2	3	-
CO3	3	2	2	2	2	-	-	-	2	2	-	2	2	3	2
CO4	2	2	3	2	2	-	-	-	2	2	-	2	2	3	-
CO5	3	3	-	2	2	-	-	-	2	2	--	2	2	3	3

LIST OF EXPERIMENTS:

HAERDWARE EXPERMENTS

1. Determination of ABCD parameters/regulation and efficiency of transmission line model.

2. Characteristics of IDMT over current relay/ over voltage electromagnetic relay.

3. Finding the sequence impedances of 3-phase synchronous machine.
4. Surge impedance loading of transmission line model.
5. Characteristics of over current/earth fault using numerical relay.
6. Identifying and measuring the parameters of solar PV module in the field.
7. Series and parallel connection of PV Modules.

SOFTWARE EXPERMENTS

8. Simulation of single area load frequency control with and without PI controller and without PI controller using MATLAB
9. Formation of YBUS and ZBUS using MATLAB
10. Simulation of Three phase three level PWM converter using MATLAB.
11. Transfer function analysis of a given circuit and State model representation of transfer functions using MATLAB
12. Plotting of Bode, Nyquist and root-locus plots for transfer functions using MATLAB
13. Short circuit studies in power systems using MIPOWER
14. Transient stability analysis of power systems using MIPOWER
15. Relay co-ordination in power systems using MIPOWER

Note: Minimum 10 experiments should be conducted.
** From Each section minimum 50% experiments should be done.

EXPERMENTS BEYOND SYLLABUS

1. Find cable fault using cable fault locator.
2. Find hotspots using thermal image camera.
3. Study of solar-wind hybrid system.

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ELECTRONICS DESIGN LAB
III B.Tech-VI Semester (Code: 20EEL604)

Lectures	0	Tutorial	0	Problem Solving	0	Practical	3	Credits	1.5
Continuous Internal Evaluation			30	Semester End Examination (3 Hours)					70

Prerequisites: Basic Knowledge of C-programming, Basic of Electronics.

Course Objectives: To make the students

- Simulate a voltage regulator with short circuit protection and multiple output voltage levels for a power supply.
- Implement and simulate a reconfigurable pulse generator, time delay circuit, and power converter driver circuit.
- Create a PCB layout for a mobile charger, dual output adjustable linear power supply and light strobe.
- Develop a PCB layout to facilitate the retrofitting of conventional appliances control and design an automated water pumping system.
- Generate PCB layouts a mobile charger, dual output power supply, appliance control retrofitting and an automated water pumping system.

Course Outcomes: After completion of this course students will be able to

CO1: Implementation and simulation of voltage regulator with short circuit protection and multiple output voltage levels for a power supply.
CO2: Build and simulate a reconfigurable pulse generator, time delay circuit, and power converter driver circuit.
CO3: Develop a PCB layout for a mobile charger, dual output adjustable linear power supply and a light strobe.
CO4: Create a PCB layout to facilitate the retrofitting of conventional appliances control and design an automated water pumping system.
CO5: Design PCB layouts a mobile charger, dual output power supply, appliance control retrofitting and an automated water pumping system.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	2	-	-	-	3	2	-	2	3	2	2
CO2	3	3	3	3	2	-	-	-	3	2	-	2	3	2	2
CO3	3	3	3	3	2	-	-	-	3	2	-	2	3	2	2
CO4	3	3	3	3	2	-	-	-	3	2	-	2	3	2	2
CO5	3	3	3	3	3	-	-	-	3	2	-	2	3	2	2

LIST OF EXPERIMENTS:

1. Design and simulate a voltage regulator
2. Design and simulate a short circuit protection circuit

3. Design and simulate a power supply with multiple output voltage levels
4. Design and simulate a reconfigurable pulse generator
5. Design and simulate a time delay circuit
6. Design and simulate a power converter driver circuit
7. Design a PCB layout for mobile charger
8. Fabrication of PCB layout for mobile charger
9. Design a PCB layout for dual output adjustable linear power supply
10. Fabrication of PCB layout for dual output adjustable linear power supply
11. Design a PCB layout for light strobe
12. Fabrication of PCB layout for light strobe
13. Design a PCB layout to simplify a conventional appliance control through retrofitting
14. Fabrication of PCB layout to simplify a conventional appliance control through retrofitting
15. Design a PCB sketches for automated water pumping system
16. Fabrication of PCB layout for automated water pumping system.

Note: Minimum 10 experiments should be conducted.

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INDIAN TRADITIONAL KNOWLEDGE
III B.Tech – VI Semester (Code: 20EE606/MC04)

Lectures	2	Tutorial	0	Problem Solving	0	Practical	0	Credits	0
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: NIL

Course Outline: This Course is to facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.

Course Objectives:

- The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian traditional knowledge systems connecting society and nature.
- Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
- The course focuses on introduction to Indian knowledge system, Indian perspective of modern scientific world-view and basic principles of yoga and holistic healthcare system.

Course Outcomes: After completion of the course, students will be able to:

CO1: Explain the concept of Indian Traditional knowledge and its importance.
CO2: Compare the Indian traditional knowledge Systems with Other Global systems.
CO3: Describe the concept of yoga and its correlationsto science.
CO4: Study various case studies related to traditional knowledge.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	2	2	1	-	-	-	1	-	-	-
CO2	-	-	-	-	-	2	2	-	-	-	-	1	-	-	-
CO3	-	-	-	-	-	1	1	-	-	-	-	1	-	-	-
CO4	-	-	-	-	-	2	-	-	-	-	-	2	-	-	-

UNIT I

Basic Structure of Indian Knowledge System (i) वेद, (ii) उपवेद (आयुर्वेद, धनुर्वेद, गन्धर्वेद, स्थापत्य आदि) (iii) वेदांग (शिक्षा, कल्प, निरुत, व्याकरण, ज्योतिष छंद), (iv) उपाइग (धर्म शास्त्र, मीमांसा, पुराण, तर्कशास्त्र)

UNIT II

Modern Science and Indian Knowledge System

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical andsocial contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge Vs indigenous knowledge, traditional knowledge Vs western knowledge , traditional knowledge Vs formal knowledge

UNIT III

Yoga and Holistic Health care

Science of Yoga , Yoga as a tool for healthy Life style , 8 limbs of Yoga (Yama , Niyama , Aasana , Pranayama , Pratyahara , Dharana , Dhyana , Samadhi).

UNIT IV

Case Studies

Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment.

TEXT BOOKS:

1. Swami jitatmanand, “Modern Physics and Vedant, Bharatiya Vidya Bhavan Fritzof Capra”, Tao of Physics.Fritzof Capra, The wave of life.
2. G N Jha, (ENG. Trans.), Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, VidyanidhiPrakasam, Delhi, 2-16.

REFERENCE BOOKS:

1. V. Sivaramakrishna (Ed.), “Cultural Heritage of India-Course material”, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014.
2. Basanta Kumar Mohanta and Vipin Kumar Singh, “Traditional Knowledge System and Technology in India”, Pratibha Prakashan 2012.
3. Amit Jha, “Traditional Knowledge System in India” Atlantic publishers, 2002.
4. V N Jha(Eng. Trans.), “Tarkasangraha of Annam Bhatta”, International Chinmay Foundation, Vellarnad, Amaku, am.
5. “Yoga Sutra of Patanjali”, Ramakrishna Mission, Kolkatta.
6. R N Jha, Science of consciousness Psychotherapy and yoga practices, Vidyanidhiprakasham, Delhi, 2016.
7. P R Sharma (English translation), Shodashang Hridayam.

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POWER SYSTEM OPERATION, CONTROL AND STABLITY

IV B.Tech-VII Semester (Code: 20EE701)

Lectures	3	Tutorial	0	Problem Solving	1	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Linear algebra and differential equations, Numerical methods& Advanced Calculus,Generation and Transmission,Control Systems**.**

Course Objectives: To make the students

- Discuss the economic load dispatch under various operational constraints and techniques tosolve the problem.
- Modelling of turbines and generators and know the importance of quality of power,P-f, Q-V control loops, AGC
- Discuss the numerical methods studied in applied mathematics courses to get theSolutions of load flow problem and comparison of different methods.
- Discuss the concept of reactive power and voltage control in detail.
- Describe the power system stability and voltage stability in operation of powersystem.

Course Outcomes: After the completion of the course, Students will be able to

CO1: Explain the importance of economic operation of power plants.

CO2: Solve the mathematical models of turbines and governors and know theimportance of AGC.

CO3: Solve proper mathematical models for analysis of load flow study.

CO4: Demonstrate the importance and control of reactive power and voltage.

CO5: Illustrate the stability issues concerned with power system and compute the stability problems.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	-	-	-	-	-	-	-	-	2	3	2	-
CO2	3	3	3	2	-	-	-	-	-	-	-	2	3	2	-
CO3	3	3	3	-	-	-	-	-	-	-	-	2	3	2	-
CO4	3	3	3	-	-	-	-	-	-	-	-	2	3	3	2
CO5	3	3	3	2	-	-	-	-	-	-	-	2	3	2	-

UNIT – I

Economic Operation of Power Systems: Economic dispatch in thermal power station: Heat rate curves, cost curves, incremental fuel and Production costs, economic distribution of load between units without consideration to line losses; Transmission line losses as a function of plant generation, calculation of loss coefficients, Optimum generation allocation between thermal plants; Capability diagram of a synchronous generator.

UNIT – II

load frequency and AVR of a synchronous generator, mathematical modelling of generator, loads, prime mover and speed governor for LFC & corresponding block diagram representation, LFC block diagram of an isolated power system, steady state analysis, dynamic response. The automatic generation control (AGC) scheme – AGC in a single area and two area systems, block diagram representation of AGC for an isolated power system.

UNIT – III

Formulation of Load Flow Problem: Introduction – nonlinear equations - Power Flow Solution Algorithms, solution techniques using Gauss Seidel, Newton Raphson Load Flow Methods.
Reactive Power Control: The role of excitation system- exciter, generator and sensor models, simplified AVR block diagram,
Voltage Control of Distribution Systems: Tap changing, booster transformers, synchronous phase modifiers, induction regulators and static capacitors.
Transmission Line Compensation: Series compensation, shunt compensation, static VAR Compensators – thyristor-controlled reactors (TCR), thyristor switched capacitors (TSC), and STATCOM.

UNIT – IV

Power System Stability: Introduction – steady state stability, Transient stability, Review of machine swing equation - Equal area criterion of stability – applications. Step by step solution of the swing curve – factors affecting steady state and transient stabilities.
Voltage Stability: Introduction, comparison of angle & voltage stability, reactive power flow and voltage collapse, Mathematical formulation of voltage stability problem.

TEXT BOOKS:

1. D.P.Kothari &I.J.Nagrath ,Modern Power System Analysis , McGraw Hill,4th Edition, 2011.
2. H. Saadat, Power System Analysis, McGraw Hill ,2nd Edition 2004.

REFERENCE BOOKS:

1. Prabha Kundur, Power System Stability and Control, McGraw Hill Education; 1st edition 2006.
2. T.K. Nagsarkar M.S.Sukhija ,Power System Analysis , OXFORD university press, 2nd edition 2014.
3. CL Wadhwa, Generation, Distribution and Utilization of Electrical Energy, New Age Int. Pub, Revised 2/E 3rd Edition 2015.
4. John Weedy, Electrical Energy Systems, Willey Eastern, 5th Edition 2012.
5. L. K. Kirchmeyer, Economic Operation of Power System, Wiley India Pvt Ltd 2009.

NPTEL COURSE LINKS:

1. https://archive.nptel.ac.in/courses/108/104/108104052/
2. https://archive.nptel.ac.in/courses/108/101/108101040/
3. https://archive.nptel.ac.in/courses/108/105/108105067/

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HIGHVOLTAGEENGINEERING

IV B.Tech–VIISemester(Code:20EE702/PE4A)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Pre-requisites: Physics,Circuittheory,Powersystems 1

Courseobjectives: Tomakethestudents.

- Understand the breakdown phenomenon in solids, liquids and gases.
- Identifythegenerationofhighvoltages.
- Employdifferentmeasuringtechniquesinhighvoltages.
- Interpret differenttestingtechniquesofdifferenthighvoltageapparatus and aware of the layout ofhighvoltage laboratories.

Courseoutcomes: Attheendofthiscourse,thestudentwill be able to

CO1: Demonstrate the basic physics related to various breakdown processes in solid, liquid and gaseous insulating materials.

CO2: Examine the generation and measurement of D. C., A.C., &Impulse voltages.

CO3: Illustrate the standards needed to conduct tests on H. V. equipment and on insulating materials, as per the standards.

CO4: Apply the knowledge of protection against over voltages and illustrate the layout of HV labs

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	1	1	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	1	2	-	-	-	-	-	-	-	-	3	3	-
CO3	2	1	2	2	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	2	2	-	-	-	-	-	-	-	-	3	-	-

UNIT-I

BreakdownphenomenonofGases,LiquidsandSolids: Ionizationprocessesandde-ionizationprocesses,TypesofDischarge,Gasesasinsulatingmaterials,BreakdowninUniformgap,non-uniformgaps,Townsend'stheory,Streamermechanism,Coronadischarge.Breakdowninpureandcommercialliquids,Soliddielectricsandcompositedielectrics,intrinsicbreakdown,electromechanicalbreakdownandthermalbreakdown,Partialdischarge, applicationsofinsulatingmaterials.

UNIT-II

Generation of High voltages: Generation of high D. C voltages: Half wave and Full wave rectifier circuits, Voltage doubler circuits, voltage multiplier circuits, Vande graff generator.

Generation of A.C. voltages: Cascaded transformers, resonant transformers, Tesla coil.

Generation ofimpulsevoltages: Standard impulse wave shape, circuits for producing impulse voltages and their analysis, wave shape control, multistage impulse generator, components of

UNIT-III

Measurementofhighvoltagesandcurrents: MeasurementsofPeakvoltage,impulsevoltage and high direct current measurement method, cathode ray oscillographs for impulsevoltage and current measurement, measurement of dielectric constant and loss factor, partialdischargemeasurements.Protectionagainstover-voltages,Surgediverters,Surgemodifiers.

UNIT-IV

High voltage testing techniques: Various standards for HV Testing of electrical apparatus,IS,IECstandards,Testingofinsulatorsandbushings,testingofisolatorsandcircuitbreakers,testingof cables,power transformers and some high voltage equipment,Highvoltagelaboratorylayout,indoorandoutdoorlaboratories,testingfacility requirements,safetyprecautionsinH. V. Labs.

TEXTBOOKS:

1. M.S.NaiduandV.Kamaraju ,HighVoltageEngineering,TMH, 5th edition, 2017.
2. C.L.Wadhwa, HighVoltageEngineering,New AgeInternational publishers, 3rd edition,2012.

REFERENCEBOOKS:

1. KuffelandZungel, HighVoltageEngineeringfundamentals,ElsavierPublications, 2nd edition, 2008.
2. D.V.Razevig(TranslatedbyDr.M.P.Chourasia),HighVoltageEngineeringFundamentals,Khanna Publishers, 2nd edition, 1993.
3. R.AroraandW.Mosch, HighVoltageandElectricalInsulationEngineering,JohnWiley&Sons,2nd edition, 2022.

NPTELCOURSELINK:

1. **NPTEL::ElectricalEngineering-HighVoltageEngineering**

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SOLAR & FUEL ENERGY SYSTEMS
IV B.Tech – VII Semester (Code: 20EE702/PE4B)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Basic Physics, Basic Mathematics

Course objectives: To make the students

- Demonstrate the concepts of Solar Cell Fundamentals.
- Gain knowledge about Classification of PV Systems.
- Categorize systems in fuel cells technology.
- Illustrate the concepts of Fuel cell characterization.

Course outcomes: At the end of this course, students will be able to

CO1: Explain the concepts of Solar Cell Fundamentals.
CO2: Differentiate the behaviour of PV Systems.
CO3: Categorize systems in fuel cells technology.
CO4: Demonstrate the concepts of Fuel cell characterization.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	-	-	-	-	-	-	-	2	2	2	3
CO2	2	3	3	2	-	-	-	-	-	-	-	2	2	2	3
CO3	3	3	3	2	-	-	-	-	-	-	-	2	2	2	3
CO4	2	3	3	2	-	-	-	-	-	-	-	2	2	2	3

UNIT – I

SolarCellFundamentals: Photovoltaiceffect-Principleofdirectsolarenergyconversionintoelectricityina solarcell.Semiconductorproperties,energylevels,basicequations.Solarcell,p-n junction, structure.

PV Module Performance: V-I characteristics of a PV module, maximum power point, cell efficiency, fill factor, effect of irradiation and temperature.

UNIT -II

Classification of PVSystems: CentralPowerStationSystem,DistributedPVSystem,Standalone PV system, Grid Interactive PV System, small system for consumer applications, Hybrid solar PV system, Concentrator solar photovoltaic.

PV System Applications: Building-integrated photovoltaicunits, grid-interacting central power stations, stand- alonedevicesfordistributedpowersupplyin remoteand ruralareas,solar cars, aircraft, space solar power satellites.

UNIT – III

Fuel Cell Technology: Introduction, low and high temperature fuel cells; Fuel cell thermodynamics - heat, work potentials, prediction of reversible voltage, fuel cell efficiency.

Fuel cell reaction kinetics - electrode kinetics, over voltages, Tafel equation, charge transfer reaction, exchange currents, Fuel cell charge and mass transport - flow field, transport in electrode and electrolyte.

UNIT – IV

Fuel Cell Characterization: In-situ and ex-situ characterization techniques, i-V curve, frequency response analyses; Fuel cell modelling and system integration: - 1D model - analytical solution and Computational fluid dynamics (CFD) models.

TEXT BOOKS:

1. Kalogirou.S.A., "Solar Energy Engineering: Processes and Systems", Academic Press, 2009.
2. Chetan Singh Solanki., Solar Photovoltaic: "Fundamentals, Technologies andApplication", PHI Learning Pvt., Ltd., 2009.

REFERENCE BOOKS:

1. Bansal.K, Leemann&Meliss "RenewableEnergy Sources& Conversion technology,Tata McGraw-Hill Publishing Company, 1990.
2. B. K. Hodge, "Alternative Energy Systems and Applications",Wiley, 2017.
3. DavidLinden, McGraw Hill BookCo..H. P. Hsu"Hand Book of Batteries and Fuel cells, "Signals and Systems", Schaum's series, McGraw Hill Education, 3rd Edition 2013.

NPTEL COURSE LINKS:

1.NOC:Solar Energy Engineering and Technology - NPTEL,https://nptel.ac.in/courses/112/105/112105051/
2.NPTEL :: Fuel Cell Technology - NPTEL , https://nptel.ac.in/courses/103/102/103102015/

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ADAPTIVE CONTROL SYSTEMS
IV B.Tech – VII Semester (Code: 20EE702/PE4C)

Lectures	3	Tutorial	0	Problem Solving	1	Practical	0	Credits	3
Continuous Internal Evaluation			30	Semester End Examination (3 Hours)					70

Prerequisites: Control Systems.

Course Objectives: To make the students

- To interpret distinct features of adaptive systems.
- To introduce the need and concept of self-tuning regulators.
- To impart knowledge about Model reference adaptive control.
- To familiarize with properties of adaptive systems.

Course Outcomes: After completion of this course, students will be able to

CO1: Describe distinct features of adaptive systems.

CO2: Interpret different strategies adopted in the design and analysis of self-tuning regulators.

CO3: Illustrate the design issues of Model reference adaptive control.

CO4: Characterize distinct properties of adaptive systems.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	-	-	2	-	-	-	-	-	3	-	-
CO2	3	3	3	2	-	-	2	-	-	-	-	-	3	-	-
CO3	3	3	3	2	-	-	2	-	-	-	-	-	3	3	3
CO4	3	3	3	2	-	-	2	-	-	-	-	-	3	3	3

UNIT – I

Introduction: Parametric models of dynamical systems, Adaptive control problem. **Real time parameter estimation**: Least squares and regression models, Estimating parameters in Dynamical Systems, Experimental conditions, Prior information, MLE, RLS, Instrument variable method.

UNIT – II

Deterministic Self tuning regulators (STR): Pole placement design, Indirect self-tuning regulators, Continuous time self-tuners, direct self-tuning regulators, disturbances with known characteristics.

Stochastic and Predictive Self tuning regulators: Design of Minimum variance and Moving average controllers, stochastic self-tuning regulators, Unification of direct self-tuning regulators, linear quadratic STR, adaptive predictive control.

UNIT – III

Model reference adaptive control (MRAS): The MIT Rule, Determination of adaptation gain, Lyapunov theory, Design of MRAS using Lyapunov theory, BIBO stability, Output feedback, Relations between MRAS and STR.

UNIT – IV

Properties of Adaptive systems: Nonlinear dynamics, Analysis of Indirect discrete time self-tuners, Stability of direct discrete time algorithms, Averaging, Application of averaging techniques, averaging in stochastic systems, robust adaptive controllers.

TEXT BOOKS:

1. K.J. Astrom and B. Wittenmark, Adaptive Control, Pearson Education India, 2nd edition, 2006.

2. Sankar Sastry and Marc Bodson, Adaptive Control- Stability, Convergence and Robustness, Springer, 2011.

REFERENCE BOOKS:

1. H.K. Khalil, Nonlinear Systems, Prentice Hall, 3rd edition, 2002.
2. Petros Ioannou and Baris Fidan, Adaptive Control Tutorial, SIAM, 2006.

NPTEL COURSE LINKS:

3. https://archive.nptel.ac.in/courses/108/102/108102113/

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ADVANCED ELECTRIC DRIVES
IV B.Tech-VII Semester (Code: 20EE702/PE4D)

Lectures	3	Tutorial	0	Problem Solving	1	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites:Electrical Drives (20EE602/PE2B), Power Electronics (20EE504).

CourseObjectives: Tomakethe Students

- Apply theVector control of Induction motor.
- Describethe different speed control strategiesSynchronous motor.
- Describethe different speed control strategiesSwitched Reluctance motor.
- Demonstrate thebasicoperationofBrushless DC motordrives.

Course Outcomes: Aftercompletionofthiscourse,the studentwillbeableto

CO1: Apply the basic concepts of Vector Control of Induction Motor.

CO2: Demonstrate the speed control methods of Synchronous Motor drives.

CO3: Categorise theknowledgeofdifferentspeedcontrolmethodsinSwitched Reluctance Motors.

CO4: Illustrate the various speed control methods of BLDC motor drives, Energy Conservation in Electrical Drives.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	-	-	-	-	-	-	-	2	3	2	2
CO2	3	3	3	2	-	-	-	-	-	-	-	2	3	3	3
CO3	3	3	3	2	-	-	-	-	-	-	-	2	3	3	3
CO4	3	3	3	2	-	-	-	-	-	-	-	2	3	3	3

UNIT–I

Introduction: Vector Control of Induction Motor: Principles of vector control, direct vector control, derivation of indirect vector control, implementation-block diagram; estimation of flux, flux weakening operation.

UNIT–II

Control of Synchronous Motor Drives: Synchronous motor and its characteristics- Control Strategies-Constant torque angle control- power factor control, constant flux control, flux weakening operation, Load commutated inverter fed synchronous motor drive, motoring and regeneration, phasor diagrams.

UNIT– III

Control of Switched Reluctance Motor Drives: SRM Structure-Stator Excitation-techniques of sensor less operation-convertor topologies-SRM Waveforms-SRM drive design factors-

Torque controlled SRM-Torque Ripple-Instantaneous Torque control -using current controllers-flux controllers.

UNIT–IV

Control of BLDC Motor Drives: Principle of operation of BLDC Machine, Sensing and logic switching scheme, BLDM as Variable Speed Synchronous motor-methods of reducing Torque pulsations -Three-phase full wave Brushless dc motor -Sinusoidal type of Brushless dc motor - current controlled Brushless dc motor Servo drive.

Energy Conservation in Electrical Drives: Losses in electrical drive system, Measures for energy conservation in electric drives, Use of efficient motor, Energy efficient operation of drives, Improvement of power factor and quality of supply.

TEXTBOOKS:

1. De Doncker, Rik W, Pulle, Duco W.J, Veltman, Andre, Advanced Electrical Drives,Springer; 11th Edition, 2010.
2. Paul C. Krause, Oleg Wasynczuk, Scott D. Sudhoff, Steven D. Pekarek, Analysis of Electric **MACHINERY AND DRIVE SYSTEMS, WILEY, 3RD EDITION, 2013.**

REFERENCEBOOKS:

1. G.K.Dubey, Fundamentals of Electrical Drives, Narosa Publishing House Pvt Ltd; 2nd Edition, 2010.
2. Ned Mohan, Advanced Electric Drives: Analysis Control, and Modeling Using MATLAB/Simulink, John Wiley & Sons, 1st Edition, 2014.
3. R. Krishnan, "Electric Motor Drives: Modeling, Analysis and Control", Prentice Hall, 1st Edition, 2015.

E-resources and other digital material

1. https://archive.nptel.ac.in/courses/108/104/108104011/
2. https://www.classcentral.com/course/swayam-fundamentals-of-electric-drives-14073

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SMART GRID TECHNOLOGY AND APPLICATIONS

IVB.Tech VII-Semester (20EE703/ PE5A)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation			30	Semester End Examination (3 Hours)					70

Prerequisites: Generation and Transmission (20EE405), Power System Analysis (20EE502)

Course objectives: To make the students

- Explain the Basic conceptof Smart Grid.
- Discuss the Information & Communications Technology for The Smart Grid.
- Acquire Knowledge about Smart Metering and Advanced Metering infrastructure.
- Describe he operationof Demand Side Integration and Distribution Management Systems.

Courseoutcomes: Attheendofthiscourse,studentswillbeable to

CO1: Explain Basic conceptof Smart Grid.

CO2: Describe Suitable Communication Network and Security System for Smart Grid.

CO3: Demonstrate Operation of Smart Metering and Advanced Metering infrastructure.

CO4: SummarizeOperation of Demand Side Integration and Distribution Management Systems

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	2	-	-	-	-	-	-	-	2	3	2	2
CO2	2	2	3	2	-	-	-	-	-	-	-	2	3	2	2
CO3	2	2	3	2	-	-	-	-	-	-	-	2	3	2	2
CO4	2	2	3	2	-	-	-	-	-	-	-	2	3	2	2

UNIT-I

Introduction to Smart Grid: Introduction, Ageing Assets and Lack of Circuit Capacity, Thermal Constraints, Operational Constraints, Security of Supply, National Initiatives, Early Smart Grid Initiatives, Active Distribution Networks, Virtual Power Plant, Other Initiatives and Demonstrations, Overview of The Technologies Required for The Smart Grid.

UNIT-II

Data communication: Introduction, Dedicated and shared communication channels, Switching techniques, Communication channels, Layered architecture and protocols. Communication technologies for the Smart Grid: Introduction- Communication technologies-IEEE 802 series, Mobile communications, Multi-protocol label switching, Power line communication. Standards for information exchange-Standards for smart metering Modbus, DNP3, IEC 61850.

Information security for the Smart Grid: Encryption and decryption, authentication, Digital signatures, Cyber security standards

UNIT-III

Smart Metering and Advanced Metering infrastructure: Introduction, smart metering, evolution of electricity metering, key components of smart metering, smart meters: an overview of the hardware used – signal acquisition, signal conditioning, analogue to digital conversion, computation, input/output, and communication.

Communication infrastructure and protocols for smart metering- Home area network, Neighborhood Area Network, Data Concentrator, meter data management system, Protocols for communication.

Advanced Metering infrastructure (AMI), AMI protocols – Standards and initiatives.

UNIT-IV

Demand Side Integration and Distribution Management Systems: Demand Side Integration-Services Provided by DSI. Introduction Data Sources and Associated External Systems, SCADA, Customer Information System, Modeling and Analysis Tools, Distribution System Modeling, Topology Analysis, Load Forecasting, Power Flow Analysis, Fault Calculations, Applications, System Monitoring, Operation, Management, Outage Management System.

TEXT BOOKS:

1. Janaka Ekanayake, Liyanage, Wu, Akihiko Yokoyama, Jenkins, Smart Grid: Technology and Applications, Wiley Publications, 1st Edition, 2015.
2. James Momoh ,Smart Grid: Fundamentals of Design and Analysis, , Wiley, IEEE Press., 1st Edition, 2016.

REFERENCES:

1. Clark W. Gellings, P.E., The Smart Grid – Enabling Energy efficiency and demand response, CRC Press, Taylor & Francis group, First Indian. 2020.
2. Lars Torsten Berger, Krzysztof Iniewski,Smart Grid – Applications, Communications, and Security ,WILEY, ISBN-13 978-8126557363, 2015.

NPTEL VIDEO LINK:

https://nptel.ac.in/courses/108/107/108107113/

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AI APPLICATIONS TO ELECTRICAL ENGINEERING

IV B.Tech VII-Semester (Code:20EE703/PE5B)

Lectures	3	Tutorial	0	Problem Solving	1	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Course Objectives: To make the students.

- Explain the concepts of artificial neural networks.
- Interpret the concepts of Fuzzy Logic.
- Grasp the concepts of Meta Heuristic techniques.
- Recognise the applications of AI techniques to Electrical Engineering

Course Outcomes (COs): After completion of this course, students will be able to

CO1 Demonstrate the concepts of ANN Algorithms.

CO2 Describe the concepts of Fuzzy Logic.

CO3 Illustrate the concepts of Meta Heuristic techniques.

CO4 Apply soft computing (AI) techniques to real-world Electrical engineering problems.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	2	3	3	-	-	-	-	-	-	3	3	-	-
CO2	2	3	2	3	2	-	-	-	-	-	-	3	3	-	-
CO3	2	3	2	3	3	-	-	-	-	-	-	3	3	-	-
CO4	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3

UNIT – I

Artificial Neural Networks: Introduction, Models of Neuron Network-Architectures – Knowledge representation, Artificial Intelligence and Neural networks–Learning process- Error correction learning, Hebbian learning–Competitive learning-Boltzman learning, supervised learning-Unsupervised learning–Reinforcement learning-Learning tasks.

ANN Paradigms: Multi-layer perceptron using Back propagation Algorithm (BPA), Self – Organizing Map (SOM), Radial Basis Function Network-Functional Link Network (FLN), Hopfield Network.

UNIT – II

. **Fuzzy Logic:** Introduction –Fuzzy versus crisp, Fuzzy sets-Membership function –Basic Fuzzy set operations, Properties of Fuzzy sets –Fuzzy cartesion Product, Operations on Fuzzy relations –Fuzzy logic –Fuzzy Quantifiers, Fuzzy Inference-Fuzzy Rule based system, Defuzzification methods.

UNIT – III

Meta Heuristic techniques: Introduction Description of meta heuristics, Principle of population-based meta heuristics Principle of population-based meta heuristics, Genetic algorithm, Differential evolution, Evolutionary programming, Backtracking search optimization algorithm, Particle swarm optimization, Ant colony optimization, Artificial bee colony, Firefly algorithm, Teaching–learning-based optimization

UNIT – IV

Applications of AI Techniques: ANN applications to Load forecasting and frequency control in Single area system, Fuzzy logic application to PSS and Speed control of DC and AC Motors, Meta Heuristic applications to Economic load dispatch.

TEXT BOOKS:

1. S.Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic & Genetic Algorithms", PHI, New Delhi, 2003.
2. Chaturvedi, Devendra K, "Soft Computing Techniques and its Applications in Electrical Engineering", Springer, 2008. J

REFERENCE BOOKS:

1. Hassoun, "Fundamentals of Artificial Neural Networks", MIT Press, 2010.
2. Kosko, "Neural Networks and Fuzzy Systems", Pearson Education, 2007.
3. Samir Roy, Udit Chakraborty, "Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms", Pearson Education India, 1st edition, 2013.

NPTEL COURSE LINKS:

1. NPTEL :: Computer Science and Engineering - NOC:Introduction to Soft Computing
2. NPTEL :: Electronics & Communication Engineering - Neural Networks and Applications
3. NPTEL :: Electrical Engineering - NOC:Fuzzy Sets, Logic and Systems & Applications
4. NPTEL :: Mechanical Engineering - NOC:Traditional and Non-Traditional Optimization Tools

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DIGITAL PROTECTION OF POWER SYSTEMS

IV B.Tech VII-Semester (Code:20EE703/PE5C)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				0

Prerequisites: Power system protection, Power System

Course Objectives: To make the students

- Explain the advantages of digital relays over conventional relays.
- Apply the suitable signal processing technique for protection.
- Demonstrate the adaptive criterion for relay decision making.
- Identify the new developments in protective relaying and applications.

Course Outcomes: After completion of this course students will be able to

CO1: Demonstrate the advantages of digital relays over conventional relays.

CO2: Apply the suitable signal processing techniques for protection.

CO3: Illustrate the adaptive criterion for relay decision making.

CO4: Demonstrate the new developments in protective relaying and applications.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	2	-	-	-	-	-	-	2	3	2	2
CO2	3	3	3	2	2	-	-	-	-	-	-	2	3	2	2
CO3	3	3	3	2	2	-	-	-	-	-	-	2	3	2	2
CO4	3	3	3	2	2	-	-	-	-	-	-	2	3	2	2

UNIT – I

Static and Digital Relays: Overview of Static relays, Transmission line protection, Transformer protection, Need for digital protection., Basic elements of a digital relay and their functions, signal conditioning subsystem, conversion subsystem, digital relay subsystem.

UNIT –II

Signal processing techniques: Sinusoidal based algorithms, Fourier Analysis based algorithms, Least squares-based algorithm, Discrete Fourier Transforms, Wavelet Transforms, Kalman Filtering.

Digital filters: Fundamentals of Infinite Impulse Response Filters, Finite Impulse Response filters, Filters with sine and cosine windows. Travelling Wave Protection scheme, Digital Protection of Transformers.

UNIT-III

Decision making in Protective Relays: Deterministic decision making, Statistical Hypothesis testing, Decision making with multiple criterion, Adaptive decision schemes, Adaptive Differential protective scheme.

UNIT-IV

Applications: Applications of Fuzzy Logic and ANN for power system protection, Fault location algorithm, Wide Area Monitoring and Protection.

TEXT BOOKS:

1. Bhide S. R., Digital Power System Protection, PHI Learning Private Limited,ISBN-10 : 8120349792, 2014.
2. Arun G. Phadke, James S. Thorp, Computer Relaying for power Systems, Wiley India Pvt Ltd, 2nd Edition, 2012.

REFERENCE BOOKS:

1. Badri Ram, D. N. Vishwakarma, Power System Protection and Switchgear, Tata Mc-Graw Hill, 2nd Edition, 2017.
2. T.S. Madhava Rao, Power system protection Static relays, Tata Mc-Graw Hill, 2nd Edition, 2017.
3. Waldemar Rebizant, Janusz Szafran and Andrzej Wiszniewski, Digital Signal Processing in Power System Protection and Control, Springer, 11th Edition, 2013.

NPTEL LINKS:

1. NPTEL: Digital Protection of Power System, IIT Roorkee, Prof. Bhaveshkumar R. Bhalja, https://nptel.ac.in/courses/117107148
2. NPTEL :: Electrical Engineering - NOC:Power System Protection
3. NPTEL: Power System Protection, https://archive.nptel.ac.in/courses/108/101/108101039

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COMPUTER APPLICATIONS ON POWERSYSTEMS

IV B.Tech VII-Semester (Code:20EE703/PE5D)

Lectures	3	Tutorial	0	Problem Solving	1	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Mathematics-I, Power System-II

Course Objectives: To make the students

- To form incidence matrices and to prepare primitive impedance and admittance matriceswith and without mutual coupling.
- To deal with the numerical methods studied in applied mathematics courses to get thesolutions of load flow and comparison of different methods.
- To teach the methods of mathematical formulation of complex power system and shortcircuit calculations.
- To analyse the Contingency situations in the power system network
- To understand the Transient Stability analysis of power system

Course Outcomes: After completion of this course, Students will be able to

CO1: Demonstrate the formation ofincidence matrices and to prepare primitive impedanceand admittance matrices with and without mutual coupling.

CO2: Build and solve proper mathematical models for the load flow analysis.

CO3: Identify the significance to conduct short circuit analysis of power system network forselection of protective devices.

CO4: Model the contingency analysis of the existing system for the purpose of security.

CO5: Solve transient stability problems in powersystem.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	2	-	-	-	-	-	-	3	3	2	3
CO2	3	3	3	2	2	-	-	-	-	-	-	3	3	2	3
CO3	3	3	3	2	2	-	-	-	-	-	-	3	3	2	3
CO4	3	3	3	2	2	-	-	-	-	-	-	3	3	2	3
CO5	3	3	3	2	2	-	-	-	-	-	-	3	3	2	3

UNIT – I

Incidence & Network Matrices: Introduction to Graph Theory, Element-node incidence matrix - reduced incidence matrix or bus incidence matrix - basic loop incidence matrix - augmented loop incidence matrix - basic cut set incidence matrix - augmented cut set incidence matrix - branch path incidence matrix - concept of primitive network - primitive impedance and admittance matrices with and without mutual coupling -

network performance equations - formation of network matrices using singular & non-singular transformation.

UNIT – II

Formulation of Load Flow Problem: Introduction – nonlinear equations - Power Flow Solution

Algorithms solution techniques using Gauss iterative, Gauss Seidel Power Flow Equations, Newton Raphson Load Flow Method, Fast Decoupled Load Flow Method and DC Load Flow Methods. AC-DC System Power Flow Analysis- Sequential and Simultaneous Solution Algorithms.

UNIT – III

Algorithm for formation of network matrices: Formation of bus admittance and bus impedance matrices and respective algorithms - modifications of bus impedance and admittance matrices for changes in the networks with and without mutual coupling. Representation of three phase network elements for balanced and unbalanced systems.

Short Circuit studies: Short circuit calculations for symmetrical and unsymmetrical faults using Bus Impedance matrix.

UNIT – IV

Security Analysis: Basic Concepts, Static Security Analysis at Control Centres, Contingency

Analysis, Importance of contingency analysis, Contingency Selection**.**

Formulation of Transient Stability Problem: Transient Stability Analysis of Multi-Machine Systems, Eigen Analysis of Dynamical Systems, Small Signal Stability Analysis using Classical Model. Flow chart for digital simulation of transient stability problem.Infinite bus using swing equation for the machine and incorporating excitation (IEEE, 1981) turbine and speed governor controls.

TEXT BOOKS:

1. Stagg, G.W. & El-Abiad, Computer methods in Power System Analysis, Medtechscientific international,ISBN-10 : 9388716159,2019
2. L.P. Singh, Advanced Power System Analysis and Dynamics, New Age International Private Limited, 6th edition, 2012.

REFERENCE BOOKS:

1. Anderson &Fouad, Power Systems Control and stability, Wiley-IEEE **Press,** 3rd edition 2019.
2. Nagrath&Kothari, Modern power system analysis 4th edition, TMH 2011.
3. M.A. Pai,Computer Techniques in Power System Analysis, TMH 2017.
4. P. Kundur, Power System Stability & Control, 1st edition TMH 2006.

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NPTEL LINKS:

1. NPTEL :: Electrical Engineering - NOC:Computer Aided Power System Analysis
2. NPTELComputer Aided Power System Analysis

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VLSI Design
IV B.Tech. – VII Semester (Code: 20EE705/JO3A)

Lectures	2	Tutorial	0	Problem Solving	0	Practical	2	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Prerequisites: Nil

CourseObjectives: To make the students

- Explain overview of fabrication Processes and electrical characteristics of MOS circuits
- Learn how to draw stick diagrams and layout diagrams for various MOS circuits using lambda based design rules and basic circuit concepts like R_s,C_g, †
- Illustrate the nature of and approach to structured design through some examples.
- Discuss various concepts like VLSI design flow, Types of ASICs, CPLDs, FPGA architectures
- Describe the basic language features of Verilog HDL and the role of HDL in digital logic design

Course Outcomes: By the end of the course the student will be able to

CO1: Examine various MOS fabrication processes and basic electrical properties of MOS

and BiCMOS circuits

CO2: Illustrate Mos and BiCMOS circuit design processes and basic circuit concepts like R_s,□,

CO3: Characterize subsystems in structured design approach

CO4: Provide the concepts VLSI design flow, Types of ASICs, CPLDs, FPGA architectures to make simple designs.

CO5: Simulate various combinational circuits using Verilog descriptions

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	-	-	-	-	-	-	-	2	3	2	2
CO2	3	3	3	3	-	-	-	-	-	-	-	2	3	2	2
CO3	3	3	3	3	-	-	-	-	-	-	-	2	3	2	2
CO4	3	3	3	3	-	-	-	-	-	-	-	2	3	2	2
CO5	2	2	2	2	3	-	-	-	3	3	-	2	2	2	2

Course Syllabus

UNIT - I

An introduction to MOS technology: Introduction to IC technology, Basic MOS transistors, Enhancement mode Transistor action,Depletion mode Transistor action,nMOS fabrication, CMOS fabrication and BICMOS technology.

Basic Electrical Properties of MOS and BICMOS Circuits: Ids versus Vds relationships, Aspects of MOS transistor threshold voltage Vt, Transconductance gm, Figure of merit w_0, pass transistor, nMOS inverter, Alternative forms of pull-up,CMOS inverter, BICMOS inverters.

UNIT - II

MOS and BICMOS circuit Design processes: MOS layers, Stick diagrams, Design rules and layout.

Basic Circuit Concepts: Sheet resistance Rs, Standard unit of capacitance, The Delay unit, Inverter delays, Propagation delays, Wiring capacitances.

UNIT – III

Subsystem design and layout: Architectural issues, Switch logic, Gate Logic, Examples of Structured Design: Combinational logic- Parity generator,Multiplexers and Some Clocked Sequential Circuits-Two-phase Clocking, Dynamic Register element, Dynamic Shift Register.

UNIT – IV

VLSI design flow, Introduction to ASICs, Types of ASICs: Full Custom ASICs, and Standard cell-based ASICs, Gate array-based ASICs, Programmable logic devices: ROM, PLAs, PALs, CPLDs and FPGAs.

Practical Exercises:

Write the Verilog code for following circuits and simulate using any HDL simulator/Synthesis software (Xilinx/Model Sim/Simulink etc).

1. Verilog Description for all logic gates

2. Verilog Description for Full adder, Full subtractor

3.Verilog Description for Multiplexer, Demultiplexer

4.Verilog Description for Encoder, Decoder

5.Verilog Description for Even & Odd Parity generator

TEXTBOOKS:

1. "Basic VLSIDesign" Douglas A. PucknellandKamranEshraghian,Third Edition,PHI Learning Pvt.Ltd.
2. "Application-Specific Integrated Circuits" Michael John Sebastian Smith, Pearson India.

REFERENCE BOOKS:

1.CMOS VLSI Design- A Circuits and Systems Perspective, Neil H. E. Weste, David Money Harris, 4th Edition, PearsonEducation.

NPTEL LINKS:

https://onlinecourses.nptel.ac.in/noc23_ee142/preview

https://onlinecourses.nptel.ac.in/noc22_ee104/preview

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METAHEURISTIC TECHNIQUES TO ELECTRICAL ENGINEERING

IV B.Tech – VII Semester (Code: 20EE705/JO7B)

Lectures	2	Tutorial	0	Problem Solving	0	Practical	2	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

CourseObjectives: This course enables the studentsto know

- Elaborate the Metaheuristic Techniques and software frame work
- Demonstrate the Single-Solution Based and Population-Based Metaheuristics implementation
- Combine the Multi objective Optimum and hybrid metaheuristic approach.
- Enhance the solution for electrical engineering problems

Course Outcomes (COs): By the end of the course the student would be able to

CO1: Demonstrate the concepts of Metaheuristic Techniques and software framework.

CO2: Formulate the Single-Solution Based and Population-Based Metaheuristicsimplementation

CO3: Compose the various Multi objective Optimum and hybrid algorithm developments

CO4: Generate the solutions to analyze Electrical Engineering problems using metaheuristic algorithms.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	2	3	3	-	-	-	3	3	-	3	3	-	-
CO2	3	2	3	3	3	-	-	-	3	3	-	3	3	2	-
CO3	3	2	3	3	3	-	-	-	3	3	-	3	3	2	-
CO4	3	2	3	3	3	-	-	-	3	3	-	3	3	2	3

UNIT-I

Introduction to Metaheuristic Techniques

Introduction-decision making steps-classical optimization models and Methods-Applications of Metaheuristics- classification of metaheuristic- Common concepts for metaheuristic- Optimization using a meta-model-performance analysis of metaheuristics

Software Framework for Metaheuristics- Guidelines for solving a given optimization problem.main objectives of the used framework-limitations- set of modules

UNIT-II

Single-Solution Based Metaheuristics: Common Concepts-Neighborhood-Very Large Neighborhoods - Heuristic Search- Simulated Annealing- Tabu Search- Iterated Local Search

Population-Based Metaheuristics: Initial Population- Evolutionary Algorithms- Genetic Algorithms- Evolution Strategies-Evolutionary Programming-Genetic Programming- Selection Methods- Reproduction- Replacement Strategies- Swarm Intelligence-Ant Colony Optimization Algorithms- Other Population-Based Method-Bees Colony-Artificial immune systems

UNIT-III

Metaheuristics for Multi objective Optimization: Multi objective Optimization Problems- Main Design Issues of Multi objective Metaheuristic, Fitness Assignment Strategies- Scalar Approaches- Criterion-Based Methods- Dominance-Based Approaches- Indicator-Based Approaches.

Hybrid Metaheuristics: Design Issues - Implementation Issues - Combining Metaheuristics with Constraint Programming- Hybrid Metaheuristics with Machine Learning and Data Mining- Hybrid Metaheuristics for Multi objective Optimization

UNIT-IV

Applications of heuristic methods in Electrical Engineering: heuristic methods for unit commitment Problem-Particle Swarm Optimization-Economic Dispatch Based on Genetic Algorithms and Particle Swarm-Artificial Bee Colony Algorithm for Solving Optimal Power Flow.Differential evolution in active power multi-objective optimal dispatch, Multi-Objective Model of Active Power Optimization for Wind Power Integrated Systems Load Flow Computation via Particle Swarm Optimization with Mutation Operation.

List of Experiments using MATLAB:

Develop the code for

1. Simulated Annealing Algorithm.
2. Genetic Algorithms.
3. Particle swarm Optimization Algorithms.
4. Artificial Bee Colony Algorithms.
5. Economic Dispatch Based on Genetic Algorithms
6. Differential evolution in active power multi-objective optimal dispatch

TEXT BOOKS:

1. El-Ghazali Talbi, Metaheuristics from design to implementation John Wiley & Sons, Inc., Hoboken, New Jersey, 2009.
2. Kwang Y. Lee,Zita A. Vale applications of modern heuristic optimization methods in power and energy systems, wilay, IEEE Press,2020.

REFENCE BOOKS:

1. Sunith Bandarua , Kalyanmoy Debb, Metaheuristic Techniques, COIN Report Number 2016029 Decision Sciences: Theory and Practice, CRC Press, Taylor & Francis Group.
2. Sean Luke: Essentials of Metaheuristics, Lulu, second edition, 2013, available for free at http://cs.gmu.edu/~sean/book/metaheuristic
3. Coello C.A., van Veldhuizen D.A., Lamont, G.B.: Evolutionary Algorithms for Solving Multi objective Problems, Kluwer, 2002

NPTEL COURSE LINKS:

https://nptel.ac.in/courses/110/105/110105096/

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ELECTRIC VEHICLES

IV-B.Tech VII-Semester (20EE705/ JO3C)

Lectures	2	Tutorial	0	Problem Solving	0	Practical	2	Credits	3
Continuous Internal Evaluation			30	Semester End Examination (3 Hours)					70

Prerequisites: Induction motors and Synchronous Machines (20EE403), Power Electronics (20EE504)

Course objectives: To make the students

- Understandtheconceptof Vehicle Fundamentals.
- IdentifytheOperation of Electric and Hybrid drive-train topologies.
- Categorize the configuration and control of different motor drives.
- Distinguish the Operation ofdifferent types of energy storage systems and interface the vehicle to grid system.

Courseoutcomes: Attheendofthiscourse,studentswillbeable to

CO1: Explain the concepts of Vehicle Fundamentals

CO2: Describe the operation of Electric and Hybrid drive-train topologies.

CO3: Summarize configuration and control of different motor drives.

CO4: Design operationofdifferent types of energy storage and management systems and interface the vehicle to grid system.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	2	-	-	-	-	2	2	-	2	3	2	2
CO2	3	2	3	3	-	-	-	-	2	2	-	2	3	2	2
CO3	3	2	3	3	-	-	-	-	2	2	-	2	3	2	2
CO4	3	2	3	2	-	-	-	-	2	2	-	2	3	2	2

UNIT-I

Introduction and Vehicle Fundamentals: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance.

UNIT-II

Electric and Hybrid drive-trains: Basic concept of electric traction - introduction to various electric drive-train topologies - power flow control in electric drive-train topologies, Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies.

UNIT-III

Electric propulsion unit: Introduction to electric components used in electric vehicles - Configuration

control of Permanent Magnet Motor drives - Configuration and control of Switch Reluctance Motor drives - Drive system efficiency.

UNIT-IV

Energy storage and Management: Introduction to Energy Storage Requirements in Electric Vehicles - Battery based energy storage and its analysis Super Capacitor based energy storage and its analysis. Introduction to energy management strategies used in electric vehicle, classification of different energy management strategies.

Electric Vehicle and Power Grid: Charging station-types,components.Vehicle grid interface-grid to Vehicle (G2V), grid to Vehicle and Its challenges, electric vehicle charging profile –constant current, constant voltage.

List of experiments:

1. New Step-up Multi-Input DC-DC Converter for Hybrid Electric Vehicles using MATLAB Simulink
2. Modeling of a series-parallel electric vehiclewith system-level and detailed variants of electrical system using MATLAB.
3. Simulation of series, parallel, combination of series –parallel battery connection for EV applications.
4. Design suitable power converters for EV applications using MATLAB.
5. Design a battery management system for EV applications using MATLAB.
6. Electric Vehicle Simulation in Simulink
7. Simulation of Vehicle-to- Grid(V2G) System.
8. Simulation of Grid –to- Vehicle (G2V) System.

TEXT BOOKS:

Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press,Second Edition 2005.

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. Ali Emadi, Advanced Electric Drive Vehicles, CRC Press, 2014.

REFERENCES:

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, Second Edition 2003.
2. H. Partab: Modern Electric Traction – Dhanpat Rai& Co, 2007.
3. Bimal Bose, ‘Power electronics and motor drives’, Elsevier, First Edition 2006.
4. Ion Boldea and S.A Nasar, ‘Electric drives’, CRC Press, Second Edition 2005.

NPTEL VIDEO LINK:

https://nptel.ac.in/courses/108/103/108103009/
https://nptel.ac.in/courses/108/106/108106182/
https://nptel.ac.in/courses/108/102/108102121/

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INDUSTRIAL MANAGEMENT & ENTERPRENEURSHIP DEVELOPMENT

IV B.Tech – VII Semester (Code: 20EE706/ME01)

Lectures	3	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Course Objectives: Student will be able

- To provide students an insight into the concepts of general, scientific management and various forms of business organizations along with awareness about various organization structures
- To provide the students with an understanding of basics of human resource management, marketing management.
- To make the students to understand inventory control concepts, fundamentals of TQM,and supply chain management.
- To provide an understanding of financial management and realize the importance of Entrepreneurship.

Course Outcomes: After the end of the course Studentwill beable to

CO1: Describe the various functions of the management. Learn various forms and structures of business organizations.

CO2: Understand how resources to be planned and also understand various motivation theories, leadership styles and marketing management.

CO3: Developknowledgeaboutinventorycontrol.GaintheknowledgeonTotalquality management and understand supply chain management.

CO4: Grasp complete knowledge on importance ofentrepreneurship andability to understandcapital and various types of capital.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	-	1	2	3	-	-	-	1
CO2	-	-	-	-	-	2	-	-	3	-	1	-	-	-	1
CO3	-	-	-	-	-	-	-	-	3	2	1	2	-	-	1
CO4	2	3	2	3	-	-	-	-	-	-	-	-	-	-	-

UNIT – I

General Management: Management definition, Functions of Management and Principles of Management.

Scientific Management: Definition, Principles of Scientific Management.

Forms of Business Organization: Choice of form of organization, Salient features of Sole Proprietorship,Partnership,JointStockCompany: Private LimitedandPublicLimitedcompanies; Merits and demerits. **Organization**: Definition, Line, line and staff, functional and matrix organization **Introduction to Strategic Management:** Definition and scope

UNIT – II

Human Resource Management: Functions of HR management, human resource planning, recruitment, selection, placement, training & development and performance appraisal, Motivation theories, leadership styles.

Marketing Management: Concepts of Selling and Marketing, Functions of Marketing,Marketing mix (4 Ps); Advertising and sales promotion; Product life cycle; distribution channels

UNIT – III

Materials Management: Inventory Control, objectives of inventory control, Inventory costs, Basic EOQ model, Model with Price breaks, ABC analysis, FSN Analysis, VED Analysis.

TotalQualityManagement:Definitionof,Importanceofquality,Phasesofqualitymanagement , quality control, Difference between Inspection and Quality control, Components of total quality, Quality Function Deployment

Introduction to Supply Chain Management: Definition, scope of SCM, Drivers of SCM, Advantages, limitations

UNIT – IV

Financial Management: Functions of finance, Types of Capital-Fixed and Working Capital, Break Even Analysis.

Entrepreneurship Development: Introduction, Entrepreneurial characteristics, Functions of an Entrepreneur; Factors affecting entrepreneurship; Role of communication in entrepreneurship; Entrepreneurial Development-Objectives, Need of Training for enterprises; Finance for the enterprises.

TEXT BOOKS:

1. EssentialsofManagement/Koontz andHeinz Weihrich/Tata-McGraw-Hill10thEd.
2. ManufacturingOrganizationandManagement/Amrine/PearsonEducation

REFERENCEBOOKS:

1. ManagementScience,A.R.Aryasri.
2. IndustrialEngineeringandproductionmanagementbyMMahajan,DhanapatraiPublications
3. MarketingManagement,Philip Kotler.

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INUSTRIAL AUTOMATION

IV B.Tech – VII Semester (Code: 20EEL701/SOC5)

Lectures	1	Tutorial	0	Problem Solving	0	Practical	2	Credits	2
Continuous Internal Evaluation				30	Semester End Examination (3 Hours)				70

Course Objectives: To make the students

- The functionality of the basic elements of industrial automation systems
- The fundamental principles of operation of numerous instruments and machines.
- The various control techniques employed in process automation including programmable logic controllers.
- The substantial applications of automation systems and analyze real-life problems from an automation perspective based on engineering and cost-oriented thinking.

Course Outcomes: After completion of this course student will be able to

CO1: Illustrate the architecture of automation system for supervisory control of an industrial process.
CO2: Identify the suitable control technique to control a given process for achieving desired response.
CO3: Illustrate the organization of programmable logic controller to familiarize numerous control modules in physical environment.
CO4: Choose an appropriate electric drive for an industrial application based on drive characteristics.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	3	3	2	-	-	3	2	-	2	3	2	2
CO2	3	3	2	3	3	2	-	-	3	2	-	2	3	2	2
CO3	3	3	2	3	3	2	-	-	3	2	-	2	3	2	2
CO4	3	3	2	3	3	2	-	-	3	2	-	2	3	2	2

UNIT – I

Introduction to Industrial Automation & Control: Introduction to Industrial Automation and Control: Introduction to industrial automation and control architecture of industrial automation system, measurement systems specifications, temperature measurement, pressure and force measurement, displacement and speed measurement, signal conditioning circuits, errors and calibration.

UNIT – II

Process Control: Introduction to process control, PID control, controller tuning, implementation of PID controllers, special control structures, feed forward and ratio control special control structures;

predictive control, control of systems with inverse response.

UNIT – III

Programmable Logic Control Systems: Programmable logic control systems: introduction to sequence or logic control and programmable logic controllers, the software environment and programming of PLCs, formal modelling of sequence control
specifications. Programming, programming of PLCs: sequential function charts, the PLC hardware environment**.**

UNIT – IV

Electrical Machine Drives: Electrical machine drives: Energy savings with variable speed drives, step motors: principles, construction and drives, electrical actuators, DC motor drives, electrical actuators: induction motor drives, electrical actuators,BLDC motor drives.

TEXT BOOKS:

1. Madhu Chanda Mitra, Samarjit Sen Gupta, "Programmable Logic Controllers and Industrial Automation:An Introduction", Penram International Publishing (India) Pvt. Ltd., 1st Edition, 2008.
2. K Krishnaswamy, S Vijayachitra, "Industrial Instrumentation", New Age Publications, 1st Edition, 2010.

REFERENCE BOOKS:

1. AK Gupta, S K Arora, "Industrial Automation and Robotics", Laxmi Publications, 2nd Edition, 2013.
2. Jon Stenerson, "Industrial Automation and Process Control", Prentice Hall, 1st Edition, 2002.

WEB REFERENCES:

1. https://www.google.co.in/search?q=introduction+to+industrial+automation+and+control&ie=utf-8&oe=utf-8&client=firefox-b-ab&gfe_rd=cr&ei=puocwoxvl67v8wekwzngaw
2. https://www.noorropidah.files.wordpress.com/2012/01/plc-1-3.pdf
3. https://www.radix.co.in/families/automation?gclid=cjfw24pbjtacfuyeaaodicqghq

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Industry/Research Internship

IV B.Tech – VII Semester (Code: 20EEL702/INT02)

Lectures	0	Tutorial	0	Problem Solving	0	Practical	0	Credits	3
Continuous Internal Evaluation				0	Semester End Examination (3 Hours)				100

Course Objectives: To make the students

- Equip students with a comprehensive understanding of key environmental regulations and standards relevant to electrical engineering projects.
- Develop students' ability to tackle complex engineering problems by considering environmental impacts and sustainability.
- Foster innovation by integrating environmental sustainability into the design and development of electrical engineering projects.
- Promote teamwork and collaboration across different disciplines to address environmental and engineering challenges.

Course Outcomes: After completion of this course student will be able to

CO1: Identify and apply appropriate environmental laws and guidelines in their engineering designs and projects.

CO2: Demonstrate improved problem-solving skills by incorporating environmental considerations into their engineering solutions.

CO3: Create project designs that are both innovative and aligned with current industry trends in sustainability.

CO4: Effectively work in interdisciplinary teams, gaining exposure to diverse perspectives and enhancing their collaborative skills.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	2	-	2	2	3	3	-	3	3	2	2
CO2	3	3	2	2	2	-	2	2	3	3	-	3	3	2	2
CO3	3	3	2	2	2	-	2	2	3	3	-	3	3	2	2
CO4	3	3	2	2	2	-	2	2	3	3	-	3	3	2	2

GUIDELINES AND EVALUATION OF INTERNSHIP PROGRAM

As per R20 guidelines, every student has to undergo internship twice, once between IV and V semester, the other between VI and VII Semester. The first internship is for duration of 4 weeks and the second internship is for duration of 6 weeks.

There shall be a departmental internship committee consisting of the Head of the Department and two faculty members nominated by the HOD. The committee shall identify the potential organizations which can provide internship opportunity to the students. The department shall

enter into an MOU with the concerned organization and the details will be shared with the students.

The students shall be informed to apply for undergoing internship in the specified proforma. The details and consent of the organization in which he/she is seeking for internship are to be furnished. Further, the student along with the parent must submit an undertaking form. The committee shall scrutinize the applications and approve the same. If a student fails to acquire internship, he/she may be permitted to undergo equivalent work (mini project, research project, fabrication work, field work, research paper, etc.,) in the department under the guidance of a faculty member.

After the completion of the internship, the student mustsubmit the report and attend a departmental internal assessment for award of grade and credits.

- **Weightage for Evaluation:**
  The various stages of evaluation and weightage at each stage are given below:

Stage	Marks	Remarks
Internship Certificate	20 M	Company Supervisor will assess the interns in the internship company premises. Company supervisor assesses the intern and provide certificate.
Report Submission	30M	After the completion of the internship, the student mustsubmit the report along with certificate.
Final Assessment- in the college premises	50 M	The HOD of the concern department acts as convener of the committee and two faulty members are members to assess the intern's performance.

Bapatla Engineering College:: Bapatla

(Autonomous)

Project Work and Internship

IV B.Tech – VIII Semester (Code: 20EEL801/PW)

Lectures	0	Tutorial	0	Problem Solving	0	Practical	24	Credits	12
Continuous Internal Evaluation				0	Semester End Examination (3 Hours)				100

Course Objectives: To make the students

- Implement practical/simulation models by utilization domain knowledge and sciences.
- Illustrate the environment impact and economic feasibility.
- Create advance technologies on proposed model.
- Develop solutions for enhancing the efficiency, reliability and sustainability of the proposed project.

Course Outcomes:Afterthecompletionofthiscourse,thestudentswillbeableto

CO1: Implement practical/simulation models by applying domain knowledge and scientific principles effectively..

CO2: Assess and illustrate the environmental impact and economic feasibility of proposed models and projects.

CO3: Develop advanced technologies to enhance the proposed models, incorporating innovative solutions and state-of-the-art advancements.

CO4: Develop and implement solutions that enhance the efficiency, reliability, and sustainability of proposed projects.

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3	1	2	2	3	3	2	3	3	3	2
CO2	3	3	3	3	3	1	2	2	3	3	2	3	3	3	2
CO3	3	3	3	3	3	1	2	2	3	3	2	3	3	3	2
CO4	3	3	3	3	3	1	2	2	3	3	2	3	3	3	2

Guidelines for Project work

1. In R20 regulations, there is no theory or practical courses in VIII semester. An exclusive 12 credit course is included as Project Work and Internship. The student should mandatorily undergo internship as well as project work parallelly. At the end of the semester the student should submit an internship completion certificate along with a project report. A student shall also be permitted to submit project report on the work carried out during the internship.

2. The departmental internship committee is advised to strictly adhere to the established guidelines for internships. Furthermore, it is recommended that internships for

INTERNSHIP PORTAL/PUBLIC SECTOR ORGANIZATIONS. This restriction applies to both online and offline internship opportunities.

3. The Head of the department should constitute a three-member Project Work Committee (PWC) under his chairmanship with three faculty members as defined in the Process Document for project work (R20 regulation). The PWC shall adhere to the process explained in the said document.

4. Evaluation of the Project work:
   i) The evaluation shall be based on CIE and SEE. The CIE is for 30 marks which consists of reviews at the end of each month as per the Process Document in the form of seminars/presentations for 15 marks and the project report submitted at the end of the semester which is evaluated for 15 marks. A minimum of 15 (50%) marks and 50% attendance are to be secured by the student exclusively in CIE in order to be declared as qualified in the project work and eligible to write the SEE in the project work.
   ii) SEE shall be evaluated in the form of a Viva-Voce and demonstration of the thesis work for 70 marks. Viva-voce Examination in project work shall be conducted by one internal examiner (Member of PWC) and one external examiner to be appointed by the principal. A minimum of 25 marks shall be obtained exclusively in SEE in order to be declared as passed in the Project work.
   iii) Completion of internships along with Project work in VIII Semester is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student has to repeat and complete the internship.

5. The project work committee should ensure the following, if the students are doing project work at any organization/ industry.
   iv) The student gets placement before commencement of eighth semester and joined the organization/Industry as advance placement. The student who obtained project work opportunity in organization / Industry may also be allowed as per the recommendation of the PWC.
   v) The above students will be informed to apply in the specified proforma for approval to undergo for project work along with the details and consent of the organization in which he/she is seeking for doing project work. Further, the student and the parent/guardian have to submit an undertaking form to the concerned department. The PWC shall scrutinize the applications and approve.
   vi) The list of such approved students undertaking project work in organization/ industry shall be maintained in the department by the PWC.
   vii) The students who are undertaking the project work out side the campus have to necessarily submit the monthly attendance duly certified by the concerned authority in the organization/ industry.

viii) The PWC will have to maintain interaction regularly with the out-side organization/ concerned who are offering the project works.

ix) During the course of project work, the student has to attend the departmental internal reviews/assessment periodically as notified by the department mandatory. After the completion of the project work, the student has to submit the report and attend semester end assessment examination by paying prescribed exam fee for award of grade and credits.

x) The students who are undertaking the project work outside the campus will have to complete their project work with in the stipulated period (as per Academic Calander) along with the in-house project work students and also submit the internship completion certificate at the end of the semester..

6. Methodology to assess individual as well as collective Contribution/understanding of Project:
   i. The project guide and project coordinator should monitor the presence (attendance) of each student in the project work
   ii. The project guide should ensure that the batch allocated to him is able to understand the objectives of the project. The guide should also identify the requirements (hardware and software) of the project. If a particular software or hardware is not available, same may be communicated to the HOD and may be procured based on the financial and budgetary requirements.
7. Evaluation of the project is based on
   i. Understanding the objectives of the project.
   ii. Day to day work done by the students (Should be documented)
   iii. Partial/Full completion of the project
   iv. Students presentation and demonstration
   v. Results and documentation
8. Papers published/Awards won/conferences attended
   i. It is encouraged for every project batch to publish/communicate a paper in any national/ international conference/journal. The project guide may encourage the students so that the work of their batch is published as a research paper.
   ii. Students must be given some awareness/training program for effective writing of a research paper. The research papers should be checked with anti-plagiarism software before the submission to the concerned journal or conference.