BAPATLA ENGINEERING COLLEGE::BAPATLA

(Autonomous)

DEARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Academic RULES & REGULATIONS

(R24 REGULATIONS)

(w.e.f 2024-2025)

Two Years B.Tech. R-24 Schemes and Syllabi-(Draft)

Bapatla Engineering College:: Bapatla

(Autonomous under Acharya Nagarjuna University)

(Sponsored by Bapatla Education Society)

BAPATLA-522102, Guntur District, A.P.

www.becbapatla.ac.in

Department of Electrical and Electronics Engineering

COURSE STRUCTURE AND SYLLABAI FOR TWO YEAR B.Tech.-(Draft)

Vision of the Institute

To build centers of excellence, impart high quality education and instill 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 fields of engineering, technology and interdisciplinary endeavors.

Mission of the Institute

Our Mission is 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.
We continuously try 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.

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 knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2	Problem Analysis	Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3	Design/Development of Solutions	Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO4	Conduct Investigations of Complex Problems	Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO5	Engineering Tool Usage	Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO6	The Engineer and The World	Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO7	Ethics	Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO8	Individual and Collaborative Team work	Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams
PO9	Communication	Communicate effectively and inclusively within the engineering community and society at large, such as being

		able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
PO10	Project Management and Finance	Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11	Life-Long Learning	Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM SPECIFIC OUTCOMES (PSO'S)

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

BAPATLA ENGINEERING COLLEGE::BAPATLA
(Autonomous)

Academic Rules & Regulations
(R24 Regulations)
Regulations for Four Year Bachelor of Technology (B.Tech)
Degree Program for the Students Admitted from the Academic Year 2024-25

1. Admissions

The sanctioned intake in a particular B.Tech program comprises of Category-A (presently 70%) and Category-B (30%) seats which is supplemented with supernumerary (10%) EWS seats. Admissions for the Category-A seats and the supernumerary seats shall be made by the Andhra Pradesh (A.P.) State Government based on the merit rank obtained by the student in the common entrance examination conducted. Admissions for the remaining Category-B seats shall be made by the college in accordance with the guidelines issued by the A.P. State Government.

2. Medium of Instruction and Examination:

The medium of instruction of the entire B.Tech undergraduate program in Engineering and Technology and the examinations will be in English only.

3. Minimum Instruction Days:

A semester comprises of 90 working days and the year is divided into two semesters.

4. Award of B.Tech. Degree:

A student will be declared eligible for the award of the B.Tech degree if he / she fulfills the following academic regulations:

a. The student pursues a program of study in B.Tech for four academic years and in not more than eight academic years. A lateral entry student pursues a program of study for three academic years and not more than six 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.

b. The student 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.

c. **Award of B. Tech degree with Minor:**
The student secures an additional 16 credits from Minor stream chosen and fulfills all the requisites of a B.Tech program i.e. secures 160 (Regular program) / 121 (Lateral Entry program) credits.
Minor is to be completed simultaneously with B.Tech program. Registering for a Minor degree is optional.

d. **Award of B.Tech degree with Honors:**
The student secures an additional 16 credits fulfilling all the requisites of B.Tech program i.e. secures 160 (Regular program) / 121 (Lateral Entry program) credits.

Registering for Honors is optional and is to be completed simultaneously with B.Tech program.

Students can register either for Honors stream or Minor stream.

5. Courses of study:

At present the following B.Tech programs of study are offered.

S. No.	Title of the UG Program	Abbreviation
1.	Civil Engineering	CE
2.	Computer Science & Engineering	CS
3.	Computer Science & Engineering (Cyber Security)	CB
4.	Computer Science & Engineering (Data Science)	DS
5.	Computer Science & Engineering (Artificial Intelligence & Machine Learning)	CM
6.	Electronics & Communication Engineering	EC
7.	Electrical & Electronics Engineering	EE
8.	Information Technology	IT
9.	Mechanical Engineering	ME

6. Credits:

a. **Credit:** A unit by which the course work is measured. It determines the number of hours (60 minutes) of instruction required per week. One credit is equivalent to one hour of teaching (Lecture/Tutorial) or two hours of practical work/field work per week.

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

c. **Choice Based Credit System (CBCS):** The CBCS provides a choice for students to select courses (Professional, Job Oriented & Open Electives) from the prescribed set of courses.

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

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
Internship of 4 – 6 weeks	2 Credits
Project Work of 16 weeks	12 Credits

7. Course Structure:

Every course of the B.Tech program will be placed in one of the 7 categories with suggested credits as listed below.

S. No.	Category	AICTE Recommended Credits (%)	Breakup of Credits (Total 160)
1.	Humanities and Social Sciences including Management (HM)	5 – 8 %	8 – 13
2.	Basic Science Courses (BS)	12 – 16 %	19 – 26
3.	Engineering Science Courses (ES)	10 – 18 %	16 – 29
4.	Professional Core Courses (PC)	30 – 36 %	48 – 58
5.	Electives – Professional Electives (PE); Job Oriented Electives (JOE); Open Electives (OE); Skill Enhancement Courses (SEC)	19 – 23 %	31-37
6.	Internships & Project Work (PR)	8 – 11 %	13-18
7.	Mandatory Courses (MC)	-	Non-credit

8. Course Evaluation Process:

The performance of the students in each semester shall be assessed course wise. All assessments will be done on an 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 course, there shall be a comprehensive SEE of three hours duration at the end of each Semester, except Mandatory courses.

The performance of a student in internships, NSS/NCC/Scouts & Guides/Community Service and Health & Wellness/Yoga/Sports will be evaluated after completion of the course at the end of that semester.

8.1 Weightage for Course Evaluation:

The distribution of marks between CIE and SEE to be conducted at the end of the semester will be as follows:

Nature of the Course	CIE	SEE
Theory Courses	40	60
Practical Courses	40	60

Mandatory Courses	40	-
NSS/NCC/Scouts & Guides/Community Service and Health & Wellness/Yoga/Sports	-	100
Summer Internship	-	100
Project Work	40	60

8.2.1 CIE in Theory/Mandatory Courses:

In each Semester there shall be two Term examinations and ***Alternate Assessment Tools (AAT)*** like Home Assignment, Class Test, Problem Solving, Group Discussion, Quiz, Seminar and Field Study in every theory course. The AAT 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 semester 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.

Term Exams (Max. 20 marks*)	**AAT (Max. 15 marks**)**	**Attendance (Max. 5 marks)**
75% of marks obtained in the best performed term exam + 25% of marks obtained in the other term exam	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.	Attendance secured & marks awarded will be as under: ≥75% and <80% - 2 marks ≥80% and <85% - 3 marks ≥85% and <90% - 4 marks ≥90% - 5 marks

*Term Examination will be conducted for 30 marks and reduced to 20 marks.

**Each AAT will be conducted for 10 marks and the average performance shall be scaled up to 15 marks.

8.2.2 CIE in Laboratory Courses:

The CIE for 40 marks of a laboratory course comprises of 15 marks for day-to-day laboratory work, 5 marks for record submission, 5 marks for attendance and 15 marks for a laboratory examination at the end of the laboratory course work. In any semester, a minimum of 90% of prescribed number of experiments / exercises specified in the syllabi for laboratory course shall be completed 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.

8.2.3 CIE in Project Work:

The CIE is for 40 marks which consist of 20 marks for reviews at the end of each month as per the process document in the form of seminars / presentations, 5 marks for attendance and 15 marks for the evaluation of project report submitted at the end of the semester.

8.2.4 Pass criteria for CIE:

A minimum of 20 (50%) marks are to be secured exclusively in the CIE with a minimum of 65% attendance in that course to be declared as qualified (Q) in that course and be eligible to appear for the SEE of that course. If a student fails to obtain 20 marks in CIE or a minimum of 65% attendance in that course, then the student will be regarded as not qualified (NQ) and such a student can register for the course repetition as per the guidelines mentioned in clause 13 to qualify in that course. After securing 20 marks in course repetition, the student can appear for the SEE of that course as a supplementary candidate.

8.3.1 SEE in Theory Course and Project Work:

a) For each theory course, there shall be a comprehensive SEE of three hours duration at the end of each Semester for 60 marks.

b) Project Work shall be evaluated in the form of a Viva-Voce and demonstration of the thesis work for 60 marks. Viva-voce Examination in project work shall be conducted by one internal examiner appointed by the HOD and one external examiner to be appointed by the principal.

8.3.2 Evaluation of Internships:

Summer Internship at the end of IV & VI semesters carried out in industry / organization are to be evaluated in V & VII semesters respectively after the submission of certificate provided by the organization and a concise report submitted by the student to the department committee. The internship will be evaluated by the department committee for a total of 100 marks with 50 marks for the report and 50 marks based on seminars / presentation given to the department committee by the student.

8.3.3 Evaluation of NSS/NCC/Scouts & Guides/Community Service and Health & Wellness/Yoga/Sports:

The above courses will be evaluated by the department committee for a total of 100 marks with 50 marks for the activities pursued by the student during that semester and 50 marks based on seminars / presentation given to the department committee by the student.

8.3.4 Pass Criteria for SEE:

a) Theory/Laboratory Courses and Project Work

A minimum of 21 (35%) marks are to be secured exclusively in the SEE of the above courses for the award of the grade and securing the credits for that course.

A student eligible to appear for the SEE in a course but is absent or has failed the examination may appear for SEE of that course in the next supplementary examination when offered.

b) **Internship, NSS/ NCC/ Scouts & Guides/ Community Service and Health & Wellness/ Yoga/ Sports**
A minimum of 40 (40%) marks are to be secured exclusively in the evaluation of the above courses for the award of the grade and securing the credits for that course.

A student eligible to appear for the evaluation in the above courses but is absent or has failed in the examination may appear for evaluation of that course in the next supplementary examination when offered.

9. Choice Based Courses:

Students can select a course from a prescribed set of courses offered by the department in the following categories.

a) **Professional Elective Courses:** There shall be five Professional Elective Courses from V Semester to VII. For each elective course there shall be a choice such that the student can choose a course from the list of courses offered by the department for that elective.

b) **Job Oriented Elective Courses:** There shall be three Job Oriented elective Courses in all programs from V to VII semester. For each elective course there shall be a choice such that the student can choose a course from the list of courses offered by the department for that elective.

c) **Open Elective Courses:** One Open Elective course in VII semester will be offered by various departments. A student can choose and register for an open elective course which is offered by other departments only and he / she has not studied the same course in any form during the Program.

d) **Massive Open Online Courses (MOOCs):** A Student must pursue and complete one course compulsorily through MOOCs from approved organizations for awarding the degree. A student can pursue MOOCs courses from Professional Elective / Job Oriented Elective / Open Elective Courses only. The student must inform and take prior permission / approval from the Internal Department Committee. The courses must be of a minimum of 8 weeks in duration and shall contain proctored examinations. The student must acquire a certificate for the concerned course from the agency to earn the credits for that course. For further details and guidelines, the students can visit the college website.

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

10. Induction Program:

There shall be a mandatory induction program for three weeks before the commencement of the first semester with no credits.

11. There shall be credit programs like NSS/NCC/Scouts & Guides/Community Service and Health & Wellness/Yoga/Sports. Also Design Thinking & Innovation and Tinkering lab are made compulsory credit courses for all branches.

12. Make-up Test:

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

b) A student is eligible for the Make-up test which is conducted after the second Mid Term examination and before SEE examination if the student satisfies the following conditions.

i) Unable to secure 50% internal marks (CIE) and has more than or equal to 65% attendance in a particular theory course (After finalizing the internal marks).

ii) Attendance in Remedial classes is more than or equal to 65% (if Remedial classes are conducted) or secured 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).

The make-up test will be conducted for 40 marks (8 questions of 1 mark each, 2 questions of 16 marks each) in Mid Examination format covering the entire syllabus and the marks obtained in this test are final. However, the maximum marks awarded will be 20 only.

The students must apply to the principal through the respective HOD by paying prescribed fees.

The documents for registration of the Make-up test are available from the departments and college website.

13. Course Repetition:

The students not qualified to write SEE in a course may register for the repeater courses through Course Repetition. The students must apply to the principal through the respective HOD by paying prescribed fees.

A student can take up a maximum of two theory courses and one laboratory course in a semester immediately after the semester end examinations of that semester. The students who are not taking regular semester courses may additionally register for one more theory course.

The documents for registration of course and monitoring the candidates registered for course repetition are available from the departments and college website.

14. Minimum Academic Requirements for Promotion:

a) Semester Promotion

A student is eligible to register for SEE if he/she satisfies the following conditions. However, the student can appear only for the SEE of those courses in which the student is qualified (Q).

i) Attendance Requirements

A student shall be eligible to register for SEE, if he / she acquires a minimum of 75% of attendance in aggregate of all the courses 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 genuine medical grounds with a doctor certificate and duly approved by the principal.

A shortage of attendance below 65% in aggregate shall in NO case be condoned. Students whose shortage of attendance is not condoned in any semester are not eligible to take their SEE of that semester and will be considered as detained in that semester.

If a student does not satisfy the attendance requirements of the present semester, he / she will not be promoted to the next semester (considered as detained in the present semester). They may seek readmission for that semester when offered next.

A stipulated fee shall be payable towards condonation of shortage of attendance to the college.

ii) Qualification in CIE

A student must qualify in a minimum of three courses in each semester (as per Clause 8.2.4) in CIE to register for the SEE of that semester.

If a student does not satisfy the above conditions, he / she will not be promoted to the next semester (considered as detained in that semester). They may seek readmission for the detained semester when offered next.

b) Promotion / Detention Conditions based on the minimum credits to be secured by the student:

A student shall be promoted from I to II, III to IV, V to VI and VII to VIII semesters if he / she fulfills the academic requirement as specified in 14.a). For other semesters i.e. II to III (1st year to 2nd year), IV to V (2nd year to 3rd year) and VI to VII (3rd year to 4th year) semesters, the following criteria is to fulfilled in addition to 14.a) clause.

i) II semester to III semester (1st year to 2nd year)

A student shall be promoted from II semester to III semester only if he / she fulfills the academic requirement of securing 25% of the credits in the courses that have been studied up to I Semester.

ii) IV semester to V semester (2nd year to 3rd year)

A student shall be promoted from IV semester to V semester only if he/she fulfills the academic requirement of securing 40% of the credits in the courses that have been studied up to III Semester.

iii) VI semester to VII semester (3rd year to 4th year)

A student shall be promoted from VI semester to VII semester only if he/she fulfills the academic requirements of securing 40% of the credits in the courses that have been studied up to V semester.

If a student is not promoted or detained for want of credits in a particular semester as per clause 14.b) above, the student may secure the required credits through supplementary examinations and only after securing the required credits he / she shall be permitted to join in the III or V or VII Semester as the case may be.

c) With–holding of Results

If the candidate has any dues not paid to the college or case of indiscipline or malpractice is pending against him/her, the result of the candidate shall be withheld in such cases until the issue is resolved.

15. Guidelines for offering a Minor in a discipline:

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

a. Students who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in Minor specialization groups offered by a department other than their parent department.
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, VLSI etc.
c. The list of disciplines / branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BOS.
d. There shall be no limit on the number of programs offered under Minor. The Institution can offer Minor programs in emerging technologies based on expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the program.
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 students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BOS.
f. A student shall be permitted to register for Minor program at the beginning of 4^{th} semester provided that the student must have acquired a minimum of **7.0 CGPA** up to the end of 3^{rd} semester without any backlogs. A CGPA of 7.0 must be maintained in the subsequent semesters without any backlog to keep the Minor registration active.
g. A student must earn an additional 16 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. 160 credits for regular students and 121 credits for Lateral Entry students). The concerned BOS shall finalize the modalities to earn the above credits.
h. For securing the above additional 16 credits, the students must register and complete three courses of 4 credits each offered by the department concerned. These 3 courses must contain a laboratory component also (i.e. Embedded course having three lecture hours and two practical hours). The balance of 4 credits may be

secured through two MOOCs courses of 2 credits each or an embedded course offered by the department.

i. Courses that are used to fulfil the student's primary Major may not be double counted towards the Minor. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Minor.
j. The student registered for Minor shall pass in all subjects that constitute the requirement for the Minor program. No class / division (i.e., second class, first class, distinction, etc.) shall be awarded for Minor degree programme
k. 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.
l. In case a student fails to meet the CGPA requirement for B.Tech degree as per clause 15.f or drops (or terminated) from the Minor program, he/she will be dropped from the list of students eligible for Minors degree and they will receive B.Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
m. The Minor will be mentioned in the Major degree certificate only. No additional degree certificate will be given for Minor degree.
n. Transfer of credits from Minor to regular B. Tech degree and vice-versa shall not be permitted
o. Minor must be completed simultaneously with a Major degree program. A student cannot earn the Minor degree after he / she has already earned bachelor's degree.
p. The documents for registration of Minor courses are available from the departments and college website.

16. Guidelines for offering an Honors in a Discipline:

The objective of introducing B.Tech (Honors) is to facilitate the students to choose additional specialized courses of their choice and build their competence in a specialized area in the UG level. The programme is a best choice for academically excellent students having good academic record and interest towards higher studies and research.

Honors is introduced in the curriculum of all B. Tech. programs offering a Major degree and is applicable to all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology. Students are eligible to opt for Honors program offered by the same Department / Discipline.

a. Students who are desirous of pursuing special interest / advanced areas of their discipline of Engineering may opt for additional courses as part of Honors programs offered by the parent department.
b. The BOS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand.
c. A student shall be permitted to register for Honors program at the beginning of 4th semester provided that the student must have acquired a minimum of **7.5 CGPA** up to the end of 3rd semester without any backlogs. A CGPA of 7.5 must be maintained in the subsequent semesters without any backlog to keep the Honors registration active.
d. A student must earn additional 16 credits for award of B.Tech. (Honors) degree from the same branch / department / discipline registered for Major degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major

discipline (i.e., 160 credits for regular students and 121 credits for Lateral Entry students). The concerned BOS shall finalize the modalities to earn the above credits.

e. For securing the above additional 16 credits, the students must register and complete three courses of 4 credits each offered by the department concerned. These 3 courses must contain a laboratory component also (i.e. Embedded course having three lecture hours and two practical hours). The balance of 4 credits may be secured through two MOOCs courses of 2 credits each or an embedded course offered by the department.
f. Courses that are used to fulfil the student's primary Major may not be counted towards the Honors.
g. The student registered for Honors shall pass in all subjects that constitute the requirement for the Honors program. No class / division (i.e., second class, first class and distinction, etc.) shall be awarded for Honors program.
h. If a student drops or is terminated from the Honors program, the additional credits earned so far cannot be converted into open or core electives; they will remain extra.
i. In case a student fails to meet the CGPA requirement for B.Tech degree as per clause 16.c or drops (or terminated) from the Honors program, he/she will be dropped from the list of students eligible for degree with Honors and they will receive B.Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them
j. The Honors will be mentioned in the Major degree certificate only as Bachelor of Technology (Honors). No additional degree certificate will be given for Honors.
k. Transfer of credits from Honors to regular B. Tech degree and vice-versa shall not be permitted.
l. Honors is to be completed simultaneously with a Major degree. A student cannot earn the Honors after he / she has already earned bachelor's degree
m. The documents for registration of Honors are available from the departments and college website.

17. Summer Internships:

Students shall undergo two summer internships each for a minimum of four weeks duration at the end of second and third years of the program for 2 credits each. The organization in which the student wishes to carry out Internship needs to be approved by Internal Department Committee comprising Head of Department and two senior faculty members. The student shall submit a report along with an internship certificate from the organization. The evaluation of the first and second summer internships shall be conducted at the end of the V Semester & VII semester respectively.

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. The student pursuing two summer internships in the same summer is not permitted.

Community Service Project focussing on specific local issues shall be an alternative to the four weeks of summer Internship. The Community Service Project shall be for 4 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 1 week and a community exit report (a detailed report) for 1 week.

18. A student shall register and put-up minimum attendance in all 160 credits and earn all the 160 credits. In the case of lateral entry students, the number of credits is 121.

19. 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. Program, and their admission shall be cancelled. However, for the students availing the Gap year facility, this period shall be extended by corresponding gap year duration availed.

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 be cancelled. However, for the students availing gap year facility, this period shall be extended by corresponding gap year duration availed.

20. Securing Credits and award of Grade Points:

Grading

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

Structure of Grading of Academic Performance

Range in which the % of marks in the course 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 course when the next supplementary SEE is offered. Same is the case with a student who obtains 'Ab' in the SEE.

Since there are no credits for Mandatory /Audit courses, only 'Pass' or 'Fail' shall be mentioned for such courses.

21. Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

(i) The Semester Grade Point Average (SGPA) in a particular semester 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} course 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 considering 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 truncated to 2 decimal points and reported in the transcripts.

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

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

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

22. 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

23. Gap Year:

Gap year concept for Student Entrepreneur shall be introduced and outstanding students who wish to pursue entrepreneurship / become entrepreneur are allowed to take a break of one year at any time after II year to pursue entrepreneurship program / to establish startups. This period may be extended to two years at the most and these two years would not be counted as 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 to permit the student(s) to avail themselves of the Gap Year.

After rejoining the student can pursue the remaining period of study under transitory regulations (if the regulation changes).

24. Transitory Regulations:

Discontinued or detained candidates (as per clause 14.b) are eligible for readmission as and when the semester is offered and after fulfillment of academic regulations. Candidates who have been detained as per clause 14.a) are eligible for readmission 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.

Candidates who were permitted with Gap Year shall be eligible for rejoining into the succeeding year of their B.Tech from the date of commencement of class work, and they will be in the academic regulations into which the candidate is presently re-joining.

The readmitted students must follow the regulations in which he/she is admitted and residual courses if any must be completed based on the equivalent courses for each semester specified by the BOS considering the previous and readmitted regulations.

25. Credit Transfer Policy:

Adoption of MOOCs is mandatory, to enable Blended model of teaching-learning as also envisaged in the NEP 2020. As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, the Institution shall allow up to a maximum of 15 credits (5 courses, approximately 10% for the total credits of the program) through MOOCs platform.

a. The Institution shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online learning courses.
b. Student registration for the MOOCs shall be only through the respective department of the institution, it is mandatory for the student to share necessary information and take prior approval from the department.
c. Credit transfer policy will be applicable to the Professional Elective Courses, Job Oriented Elective Courses, Open Elective Courses & Management courses only.
d. The concerned department shall identify the courses permitted for credit transfer.
e. The department shall notify the list of the online learning courses at the beginning of semester eligible for credit transfer.
f. The department shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.

g. The department shall ensure no overlap of MOOC exams with that of the university examination schedule. In case of delay in results, the Institution will re-issue the marks sheet for such students.
h. Credits transfer will be considered only after successful completion of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.
i. The institution shall submit the following to the examination section:
    1. List of students who have passed MOOC courses in the current semester along with the certificate of completion.
    2. Undertaking form filled by the students for credit transfer.
j. The Institution shall resolve any issues that may arise in the implementation of this policy from time to time and shall review its credit transfer policy in the light of periodic changes brought by UGC, SWAYAM, NPTEL and state government.

26. Academic Bank of Credits (ABC):

The College has implemented Academic Bank of Credits (ABC) to promote flexibility in curriculum as per NEP 2020 to

a. Provide option of mobility for learners across the universities of their choice.
b. Provide option to gain the credits through MOOCs from approved digital platforms.
c. Facilitate award of Certificate / Diploma / Degree (B.Sc) in line with the accumulated credits in ABC
d. Execute Multiple Entry and Exit system with credit count and credit transfer.

27. Exit Policy:

The students can choose to exit the four-year programme at the end of first / second / third year of study.

a. UG Certificate (in Field of study / discipline) - Programme duration: First year (first two semesters) of the undergraduate programme, 39 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6-credit job-specific internship / apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

b. UG Diploma (in Field of study / discipline) - Programme duration: First two years (first four semesters) of the undergraduate programme, 80 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6-credit job-specific internship / apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

c. Bachelor of Science (in Field of study / discipline) i.e., B.Sc. Engineering in (Field of study / discipline)- Programme duration: First three years (first six semesters) of the undergraduate programme, 120 credits.

28. Student Transfers

Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh and the affiliated University from time to time.

29. Punishments for Malpractice cases – Guidelines:

a) If any student caught under malpractice during the CIE examinations, the entire cycle of examinations will be cancelled and awarded zero marks for all the courses during that cycle. For example, if any student is caught while doing malpractice in an AAT, the AAT marks of all the courses in that cycle will be cancelled. Similar punishment will be considered for mid-term examinations also.

b) For Semester End Examinations, 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. 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, Cellphones, pager, palm computers or any other form of material concerned with or related to the 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).	Expulsion from the examination hall and cancellation of the performance in that course only.
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.
8.	Refuses to obey the orders of the 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	In case of students of the college, they shall 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.

	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.	
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.No. 7 to S.No. 9.	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 the seat. Person(s) who do not belong to the College will be handed over to police 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 practical's 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.	

30.ADDITIONAL ACADEMIC REGULATIONS:

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

31. 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.

BAPATLA ENGINEERING COLLEGE :: BAPATLA

(Autonomous)

Department of Electrical and Electronics Engineering

DEPARTMENT OF EEE										
Effective From the Academic Year-2024-2025 (R24 Regulations)										
First Year B.Tech (SEMESTER – I)										
Code	**Category**	**Course Title**	**Scheme of Instruction (Hours per week)**				**Scheme of Examination (Maximum marks)**			**No. of Credits**
			L	**T**	**P**	**Total**	**CIE**	**SEE**	**Total Marks**	
24EE101	BS	Linear Algebra and Ordinary Differential Equations	2	1	0	3	40	60	100	3
24EE102	BS	Engineering Chemistry	3	0	0	3	40	60	100	3
24EE103	HM	Communicative English	2	0	0	2	40	60	100	2
24EE104	ES	Engineering Mechanics	2	1	0	3	40	60	100	3
24EE105	ES	Circuit Theory	2	1	0	3	40	60	100	3
24EEL101	BS	Engineering Chemistry Lab	0	0	2	2	40	60	100	1
24EEL102	HM	English Communication Skills Lab	0	0	2	2	40	60	100	1
24EEL103	ES	Circuit Theory Lab	0	0	3	3	40	60	100	1.5
24EEL104	ES	IT Workshop	0	0	2	2	40	60	100	1
Induction Program		First Three Weeks (Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Familiarization to Dept./Branch & Innovations)								
TOTAL			**11**	**3**	**9**	**23**	**360**	**540**	**900**	**18.5**
CIE: Continuous Internal Evaluation, SEE: Semester End Examination,										
L: Lecture, T: Tutorial, P: Practical										

DEPARTMENT OF EEE										
Effective From the Academic Year-2024-2025 (R24 Regulations)										
First Year B.Tech (SEMESTER – II)										
Code	**Category**	**Course Title**	**Scheme of Instruction (Hours per week)**				**Scheme of Examination (Maximum marks)**			**No. of Credits**
			L	**T**	**P**	**Total**	**CIE**	**SEE**	**Total Marks**	
24EE201	BS	Numerical Methods & Advanced Calculus	2	1	0	3	40	60	100	3
24EE202	BS	Advanced Optics and Materials Testing	3	0	0	3	40	60	100	3
24EE203	ES	Fundamentals of Computing	3	0	0	3	40	60	100	3
24EE204	ES	Basic Electronic Devices	3	0	0	3	40	60	100	3
24EEL201	ES	Engineering Graphics	1	0	4	5	40	60	100	3
24EEL202	BS	Engineering Physics Lab	0	0	2	2	40	60	100	1
24EEL203	ES	Fundamentals of Computing Lab	0	0	3	3	40	60	100	1.5
24EEL204	ES	Basic Electronic Devices Lab	0	0	3	3	40	60	100	1.5
24EEL205	ES	Workshop Practice	0	0	3	3	40	60	100	1.5
TOTAL			**12**	**1**	**15**	**28**	**360**	**540**	**900**	**20.5**
CIE: Continuous Internal Evaluation, SEE: Semester End Examination,										
L: Lecture, T: Tutorial, P: Practical										

Second Year B.Tech (SEMESTER – III)										
Code	**Category**	**Course Title**	**Scheme of Instruction (Hours per week)**				**Scheme of Examination (Maximum marks)**			**No. of Credits**
			L	**T**	**P**	**Total**	**CIE**	**SEE**	**Total Marks**	
24EE301	BS	Probability and Statistics	2	1	0	3	40	60	100	3
24EE302	PC	Network Analysis	2	1	0	3	40	60	100	3
24EE303	PC	Electro Magnetic Fields	3	0	0	3	40	60	100	3
24EE304	PC	Electrical Machines-I	2	1	0	3	40	60	100	3
24EE305	PC	Digital Electronics	2	1	0	3	40	60	100	3
24EEL301/SEC1	SEC	Data Structures and Algorithms Lab	1	0	2	3	40	60	100	2
24EEL302	ES	Design Thinking and Innovation Lab	1	0	2	3	40	60	100	2
24EEL303	BS	Measurements and Instrumentation Lab	1	0	2	3	40	60	100	2
24EEL304	HM	NSS/NCC/Scouts & Guides/Community Service	0	0	1	1	0	100	100	0.5
24EE306/MC01	MC	Environmental Science	2	0	0	2	40	0	40	0
TOTAL			**16**	**4**	**7**	**27**	**360**	**580**	**940**	**21.5**
CIE: Continuous Internal Evaluation, SEE: Semester End Examination,										
L: Lecture, T: Tutorial, P: Practical										

Second Year B.Tech (SEMESTER – IV)										
Code	**Category**	**Course Title**	**Scheme of Instruction (Hours per week)**				**Scheme of Examination (Maximum marks)**			**No. of Credits**
			L	**T**	**P**	**Total**	**CIE**	**SEE**	**Total Marks**	
24EE401	PC	Control Systems	2	1	0	3	40	60	100	3
24EE402	PC	Linear Integrated Circuits	2	1	0	3	40	60	100	3
24EE403	PC	Electrical Machines-II	2	1	0	3	40	60	100	3
24EE404	PC	Signals and Systems	2	1	0	3	40	60	100	3
24EE405	PC	Generation and Transmission	3	0	0	3	40	60	100	3
24EEL401/ SEC2	SEC	Python Programming Lab	1	0	2	3	40	60	100	2
24EEL402	PC	Electrical Machines-I Lab	0	0	3	3	40	60	100	1.5
24EEL403	PC	Digital Electronics and Linear Integrated Circuits Lab	0	0	3	3	40	60	100	1
24EEL404	HM	Health and Wellness, Yoga and Sports	0	0	1	1	0	100	100	0.5
24EE406/MC02	MC	Constitution of India	2	0	0	2	40	0	40	0
TOTAL			**14**	**4**	**9**	**26**	**360**	**580**	**940**	**20**
24EEM4-/24EEH4-		**Minor/ Honor Course**	**3**	**0**	**2**	**5**	**40**	**60**	**100**	**4**
CIE: Continuous Internal Evaluation, SEE: Semester End Examination,										
L: Lecture, T: Tutorial, P: Practical										

DEPARTMENT OF EEE										
Effective from the Academic Year-2024-2025 (R24 Regulations)										
Proposed Third Year B.Tech (SEMESTER – V)										
Code	**Category**	**Course Title**	**Scheme of Instruction (Hours per week)**				**Scheme of Examination (Maximum marks)**			**No. of Credits**
			L	**T**	**P**	**Total**	**CIE**	**SEE**	**Total Marks**	
24EE501	ES	Micro Processor and Microcontroller	3	0	0	3	40	60	100	3
24EE502	PC	Power System Analysis	2	1	0	3	40	60	100	3
24EE503	PC	Power Electronics	2	1	0	3	40	60	100	3
24EE504/PE1	PE	Professional Elective-I	3/2	0/1	0	3	40	60	100	3
24EE505/JO1	JOE	Job Oriented Elective - I	2	0	2	4	40	60	100	3
24EEL501	HM	Soft Skills	1	0	2	3	40	60	100	2
24EEL502	ES	Micro Processors and Microcontroller Lab	0	0	2	2	40	60	100	1
24EEL503	PC	Electrical Machines-II Lab	0	0	3	3	40	60	100	1.5
24EEL504	PC	Control Systems Lab	0	0	3	3	40	60	100	1.5
24EEL505/INT1	PR	Summer Internship-I	-	-	-	-	-	100	100	2
24EEL506/MC03	MC	Technical Paper Writing & IPR	2	0	0	2	40	0	40	0
TOTAL			**15**	**2**	**12**	**29**	**400**	**640**	**1040**	**23**
24EEM5-/24EEH5-		**Minor/ Honor Course**	**3**	**0**	**2**	**5**	**40**	**60**	**100**	**4**
CIE: Continuous Internal Evaluation, SEE: Semester End Examination,										
L: Lecture, T: Tutorial, P: Practical										

PE1
A. Electrical Power Distribution System
B. Utilization of Electrical Power
C. Optimization Techniques

JO1
A. Prompt Engineering and AI Tools
B. Drone Technology
C. Fundamentals of EV Technology

DEPARTMENT OF EEE										
Effective From the Academic Year-2024-2025 (R24 Regulations)										
Proposed Third Year B.Tech (SEMESTER – VI)										
Code	**Category**	**Course Title**	**Scheme of Instruction (Hours per week)**				**Scheme of Examination (Maximum marks)**			**No. of Credits**
			L	**T**	**P**	**Total**	**CIE**	**SEE**	**Total Marks**	
24EE601	PC	Power System Protection	3	0	0	3	40	60	100	3
24EE602	PC	Electrical Drives	2	1	0	3	40	60	100	3
24EE603	PC	Computer Aided Power Systems	2	1	0	3	40	60	100	3
24EE604/PE2	PE	Professional Elective -II	3	0	0	3	40	60	100	3
24EE605/JO2	JOE	Job Oriented Elective - II	2	0	2	4	40	60	100	3
24EEL601/SEC3	SEC	System Design through Verilog	1	0	2	3	40	60	100	2
24EEL602	PC	Electrical Simulation Lab	0	0	2	2	40	60	100	1
24EEL603	PC	Power Electronics Lab	0	0	3	3	40	60	100	1.5
24EE606/MC04	MC	Campus Recruitment Training	2	0	0	2	40	0	40	0
TOTAL			**18**	**2**	**9**	**29**	**400**	**540**	**940**	**19.5**
24EEM6-/24EEH6-		**Minor/ Honor Course**	**3**	**0**	**2**	**5**	**40**	**60**	**100**	**4**
CIE: Continuous Internal Evaluation, SEE: Semester End Examination,										
L: Lecture, T: Tutorial, P: Practical										

PE2
A. Switched Mode Power Supply
B. Power System Operation Control and Stability
C. HVDC & FACTS

JO2
A. Machine Learning
B. Embedded Systems
C. Design of Solar & Fuel Cells

BAPATLA ENGINEERING COLLEGE::BAPATLA
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LINEAR ALGEBRA AND ORDINATRY DIFFERENTIAL EQUATIONS I B. Tech. I Semester (24EE101)							
Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- 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 ordinary differential equations.
- Create and analyze mathematical models using higher order differential equations to solve application problems that arise in engineering.
- Verify mean value theorems and expand functions of a single variable using Taylor's and Maclaurin's series.

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	**Learn** the applications of mean value theorems and Taylor's theorem.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**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	2	2	2	-	-	-	-	-	-	-	-	2	3	-	-

UNIT-I

Linear Algebra: Rank of a Matrix; Elementary transformations of a matrix; Gauss-Jordan method of finding the inverse; Normal form of a matrix, Consistency of linear System of equations: Rouche's 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; 2.7.7; 2.10.1; 2.10.2; 2.10.3; 2.12; 2.13; 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; 11.4.1; 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: Introduction,Oscillatory Electrical Circuits.
[Sections: 13.1; 13.2; 13.3; 13.4; 13.5; 13.6; 13.7;13.8.1;14.1;14.5].

UNIT-IV

Differential Calculus:
Mean Value Theorems: Rolle's theorem, Lagrange's mean value theorem with their geometrical interpretation. Cauchy's mean value theorem. Taylor's and Maclaurin theorems with remainders (without proof),Maclaurin's series, Expansion by use of known series, Taylor's series.
[4.3.1; 4.3.2; 4.3.3; 4.3.4; 4.4.1; 4.4.2; 4.4.3]

Text Books :	1. B.S.Grewal, "Higher Engineering Mathematics", 44th edition, Khanna publishers, 2017.
References :	1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th edition, John Wiley & Sons, 2016. 2. N.P.Bali and M.Goyal, "A Text book of Engineering Mathematics" Laxmi Publications, 2010.
NPTEL Course Link	1. http://www.digimat.in/nptel/courses/video/111106100/L01.html 2. https://www.youtube.com/watch?v=NBcGLLU90fM

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ENGINEERING CHEMISTRY
I B. Tech. – Semester-I (Code: 24EE102)

Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- To familiarize importance of usage of various polymers and fuels in household & industry
- Outline the basics for the construction of electrochemical cells, batteries and fuel cells. Understand the mechanism of corrosion and how it can be prevented.
- To impart the concept of soft and hard waters, softening methods of hard water and various instrumental methods of analysis of samples.
- Outline the basics of some advanced concepts like computational chemistry, nanomaterials and liquid crystals.

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

CO1	**Explain** the preparation, properties, and applications of plastics, elastomers and biodegradable polymers also to explain calorific value, characteristics and applications of conventional and alternative fuels.
CO2	**Apply** the knowledge of electrochemistry for understanding the working of electrodes and electrochemical energy systems, as well as corrosion theories and protection methods.
CO3	**Analyse** the methods to produce soft water for industrial use and potable water by economical means and study the principles of different analytical techniques and their applications.
CO4	**Demonstrate** the knowledge of computational chemistry, and applications of advanced materials in engineering.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												PSO's		
CO	**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	3	-	-		2	-	-	-	-	2	2	-	-
CO3	3	3	3	2	-	2	2	-	-	-	-	3	2	-	-
CO4	3	3	2	3	3	-	-	-	-	-	-	2	2	-	-

UNIT-1 — 12 Hours

Polymers and Fuel Chemistry: Introduction to polymers, functionality of monomers. Thermoplastics and Thermo-setting plastics- Preparation, properties and applications of PVC and Bakelite.

Biodegradable polymers- Preparation, properties and applications of PHB and PHBV

Elastomers-Preparation, properties and applications of Buna S and Buna N

Fuels-Types of fuels, calorific value of fuels-determination by Bomb calorimeter, Liquid Fuels-refining of petroleum, Knocking, Octane and Cetane number, Flue gas analysis by Orsat's apparatus, Introduction to alternative fuels-methanol, ethanol and bio fuel-bio diesel (preparation and applications).

UNIT-2 — 12 Hours

Electrochemical Cells and Corrosion: Single electrode potential, Reference electrodes-construction and working of standard hydrogen electrode and calomel electrode; Batteries (Li ion battery and zinc air cells), fuel cells (H_2-O_2, and molten carbonate). Electrochemical

sensors-potentiometric sensors and amperometric sensors with examples.
Corrosion-Definition, theories of corrosion (chemical and electrochemical), Types of corrosion-galvanic corrosion, differential aeration corrosion, stress corrosion, factors influencing rate of corrosion, corrosion control (cathodic protection), Protective coatings-electroplating (Gold) and electroless plating (nickel).

UNIT-3	12 Hours

Water Technology: Soft and hard water, Estimation of hardness of water by EDTA Method-numerical problems, Boiler troubles-Priming, foaming**,** scale and sludge, Caustic embrittlement, Specifications for drinking water- World health organization (WHO) standards, Industrial water treatment- Ion-exchange process, desalination of brackish water by reverse osmosis (RO) and electro dialysis.
Instrumental Methods of Analysis: Electromagnetic spectrum-UV (Principle, instrumentation, and applications), FT-IR (Principle, instrumentation, and applications), magnetic resonance imaging and CT scan (procedure and applications).

UNIT-4	12 Hours

Computational Chemistry: Introduction to computational chemistry, and docking studies
Semiconductors-Introduction, basic concept, Types-Intrinsic & Extrinsic Semiconductors, applications.
Nano Materials: Introduction, classification of nano materials, engineering applications, properties and applications of Carbon nano tubes and Graphenes nanoparticles.
Liquid crystals: Introduction, liquid crystalline displays (LCD)-applications. Polymers for light emitting diodes (LEDs)-Introduction, classification of polymer LEDs, Organic LEDs-their commercial uses.

Text Books :	1. P.C. Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi 17th edition, 2017. 2. Seshi Chawla, "Engineering Chemistry" DhanpatRai Pub, Co LTD, New Delhi 13 th edition, 2013. 3. S.S. Dara, "A Textbook of Engineering Chemistry", S.Chand & Co, (2010).
References :	1. Engineering Chemistry by K. Maheswaramma, Pearson publishers 2015. 2. Fred W. Billmayer Jr, Textbook of Polymer Science, 3rd Edition, Wileypublisher, 2006. 3. B. S. Murthy, P. Shankar and et. al, "Textbook of Nanoscience and Nanotechnology", 1st edition, Orient Blackswan Private Limited, 2012. 4. CNR Rao and JM Honig (Eds) "Preparation and characterization of materials" Academic press, New York, 1981
NPTEL Course Links:	1. http://www.digimat.in/nptel/courses/video/122106028/L01.html 2. http://acl.digimat.in/nptel/courses/video/122106028/L06.html

BAPATLA ENGINEERING COLLEGE::BAPATLA
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COMMUNICATIVE ENGLISH
I B. Tech. – I Semester (Code: 24EE103/24EL01)

Lectures	2	Tutorial	0	Practical	0	Credits	2
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- To enhance the vocabulary competency of the students
- To enable the students to demonstrate proficiency in the use of written English, including Proper spelling, grammar, and punctuation
- To enhance theoretical and conceptual understanding of the elements of grammar
- Understand and apply the conventions of academic writing in English

Course Outcomes: At the end of this course, Students will 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 Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	-	-	-	-	-	-	2	2	3	2	2	-	-	-
CO2	-	-	-	-	-	-	-	2	2	3	2	2	-	-	-
CO3	-	-	-	-	-	-	-	2	2	3	2	2	-	-	-
CO4	-	-	-	-	-	-	-	2	2	3	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, 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, Conjunctions, Common Errors: Practice
2.3 **Basic Writing Skills**: Coherence in Writing: Jumbled Sentences
2.4 **Writing Practices**: Letter writing

UNIT-III

3.1 **Vocabulary Development:** One word Substitutes
3.2 **Essential Grammar:**Tenses, Modal Verbs, Voices
3.3 **Basic Writing Skills:** Using Phrases and clauses
3.4 **Writing Practices:** Note Making

UNIT-IV

4.1 **Vocabulary Development**: Words often confused
4.2 **Essential Grammar**: Reported speech, Common Errors: Practice
4.3 **Basic Writing Skills**: Sentence structures (Simple, Complex & Compound)

4.4 **Writing Practices**: Paraphrasing &Summarizing, Essay Writing	
Text Books :	1. Sanjay Kumar & Pushpa Latha, Communication Skills, 2nd edition, Oxford University Press, 2015. 2. Michael Swan, Practical English Usage, 4th international edition, Oxford University Press, 2016. 3. F.T.Wood, A Remedial English Grammar for Foreign Students, Macmillan Education 2016. 4. Liz Hamplyons & Ben Heasley, Study Writing, Cambridge University Press:2006
NPTEL Course Links:	1. https://www.youtube.com/watch?v=ZbCecM5VyTk 2. https://www.youtube.com/watch?v=DubH4DaWUcI 3. https://www.youtube.com/watch?v=wGR_mNyiunw

BAPATLA ENGINEERING COLLEGE::BAPATLA
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ENGINEERING MECHANICS I B. Tech. – I Semester (Code: 24EE104)							
Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basic Mathematics & Physics

Course Objectives: To learn

- The concepts Force systems, free body diagrams, resultant of forces and equations of equilibrium, Supports and support reaction sand 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 in rectilinear and curvilinear motions
- About Mass moment of inertia of material bodies, Plane motion of a body about a fixed axis

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

CO1	**Analyze** the forces developed at the contact of the bodies by constructing the freebody diagram and location of centroid.
CO2	**Analyze** the systems with friction, and M.I of composite figures.
CO3	**Apply** kinematic equations to determine position, velocity, and acceleration as functions of time. Solve problems involving rectilinear and curvilinear motion using D'Alembert's principle.
CO4	**Analyze** of moment of inertia of material bodies and Rotation of rigid body about fixed axis.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**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	-	-	-	-	-	-	-	-	2	-	-

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.

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	
Analysis of Plane Trusses: Trusses types – Axial forces finding in the members using method of joints. **Kinematics and Kinetics of a particle:** Kinematics of rectilinear motion – principles of dynamics – Differential equations of rectilinear motion, D'Alemberts principle - 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 a rigid body – Moment of inertia of a lamina – Moments of inertia of three – dimensional bodies. **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, 5th edition, Mc Graw-Hill education, 2017. (For concepts and symbolic problems) 2. R. C. Hibbeler and Ashok Gupta, Engineering Mechanics Statics and Dynamics, 14th edition, Pearson education, 2017. (For numerical problems using S.I. system of units)
References :	1. Beer and Johnston, Vector Mechanics for Engineers Statics and Dynamics, 12th edition, McGraw Hill Education, 2019. 2. A. K. Tayal, Engineering Mechanics Statics and Dynamics, Umesh publication, Delhi (For numerical problems using S.I. system of units
NPTEL Course Links:	1. https://www.youtube.com/watch?v=A-3W1EbQ13k&list=PLyqSpQzTE6M_MEUdn1izTMB2yZgP1NLfs 2. https://www.youtube.com/watch?v=nGfVTNfNwnk&list=PLOSWwFV98rfKXq2KBphJz95rao7q8PpwT

BAPATLA ENGINEERING COLLEGE::BAPATLA
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CIRCUIT THEORY I B. Tech. – I Semester (Code: 24EE105)							
Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basics of Mathematics, Physics and Chemistry

Course Objectives: Students will be able

- Discuss about basic Laws in circuits, circuit elements, sources, fundamental concepts of alternating current, 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: At the end of this course, Students will be able to

CO1	**Explain** the basic Laws, circuit elements, sources and their characteristics. Also **demonstrate** fundamental concepts of alternating current, voltages, power triangle and power factor.
CO2	**Solve** problems involving with different AC and DC sources in electrical circuits.
CO3	**Apply and analyze** the circuits with various theorems.
CO4	**Illustrate and analyze** the series and parallel resonance circuits.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	1	3	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	1	3	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	1	3	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	1	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 circuits with 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, 9th edition, McGraw Hill Education, 2020. 2. C K Alexander and M. N. O. Sadiku, Fundamentals of Electric Circuits, 7th edition, McGraw Hill Education, 2022.
References :	1. Abhijit chakrabarti, Circuit Theory Analysis and Synthesis, 7th edition, Dhanapatrai & co (p) Ltd, 2018. 2. A Sudhakar and Shyam Mohan SP, Circuits and Networks: Analysis and Synthesis, 5th edition, McGraw Hill Education, 2017. 3. A Edminister, Electric Circuits, Schaum Outline Series, 7th Edition, McGraw Hill, 2017. 4. M E Vanvalkenburg, Network Analysis, 3rd edition, PHI, 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/

BAPATLA ENGINEERING COLLEGE::BAPATLA
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ENGINEERING CHEMISTRY LAB
I B. Tech. – Semester-I (Code: 24EEL101)

Lectures	0	Tutorial	0	Practical	2	Credits	1
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives: Students will be able to

- Familiarize students with practical chemical analysis techniques for determining key water quality parameters.
- Provide hands-on experience in performing volumetric and instrumental titrations to understand their chemical principles and applications.
- Develop proficiency in using laboratory equipment, following safety protocols, and accurately conducting experiments.
- Teach students the synthesis of common organic compounds and their characterization techniques.

Course Outcomes: After the completion of the course students will be able to

CO1	**Determine** water quality parameters such as alkalinity and hardness.
CO2	**Conduct** volumetric titrations to estimate the concentration of chemical substances.
CO3	**Apply** instrumental methods such as pH metry and conductometry for titration experiments and colorimetry for verification of Beers law.
CO4	**Synthesize and characterize** common organic compounds like soap, resins, and aspirin.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

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

LIST OF EXPERIMENTS

1. Determination of Alkalinity of Tap water.
2. Determination of Total Hardness of ground water sample by EDTA method
3. Estimation of Mohr's salt by Permanganometry.
4. Estimation of Active Chlorine Content in Bleaching Powder
5. pH metric titration between strong acid and strong base.
6. Conductometric Titrations between Strong acid and strong base.
7. Verification of Beers Law using potassium permanganate by colorimetry.
8. Preparation of Soap.
9. Preparation of Urea-formaldehyde resin
10. Preparation of Aspirin.

Text Books :

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

References :

1. R.N. Goyal and HarrmendraGoel., Text Book of Engineering Chemistry
2. S.S. Dara, A Textbook on Experiments and Calculations- Engineering Chemistry, 9th edition, S Chand & Company, 2015
3. Chatwal, Anand, Instrumental Methods of Chemical Analysis, Himalaya Publications, 2011

BAPATLA ENGINEERING COLLEGE::BAPATLA
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ENGLISH COMMUNICATION SKILLS LAB
I B. Tech. – I Semester (Code: 24EEL102)

Lectures	0	Tutorial	0	Practical	2	Credits	1
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- 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 this course, Students will 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 Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
CO3	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
CO4	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-

LIST OF EXPERIMENTS

Unit-I

1.1 Introduction to Communication Skills- Importance-Process-Types
1.2 Barriers to Communication & Strategies for effective Communication
1.3 Listening Skills; Importance – Purpose- Process- Types
1.4 Barriers to Listening & Strategies for Effective Listening

Unit-II

2.1 Phonetics; Introduction to Consonant, Vowel and Diphthong sounds
2.2 Syllable & Stress
2.3 Rhythm & Intonation

Unit-III

3.1Interpersonal Communication in English
3.2 Conversational Practice in English

Unit-IV

4.1 JAM Session

4.2 Debates

Text Books :	1. Sanjay Kumar and Pushpa Lata, Communication Skills, Oxford University

	Press, 2011 2. J.D. O' Connor, Better English Pronunciation, Cambridge University Press, 1984 3. Jack C Richards, New Interchange, 4th edition, Cambridge University Press, 2015 4. Grant Taylor, English Conversation Practice, McGraw Hill, 2001
References (Software) :	1. iTell Orell Digital Lab 2. Buzzers for conversations, New Interchange series

BAPATLA ENGINEERING COLLEGE::BAPATLA
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CIRCUIT THEORY LAB
I B. Tech. – I Semester (Code: 24EEL103)

Lectures	0	Tutorial	0	Practical	3	Credits	1.5
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basics of Mathematics, Physics and Chemistry

Course Objectives: Students will be able

- 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 this course, Students will be able to

CO1	**Demonstrate** the ability to apply Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL) and validate through experimentation and calculation.
CO2	**Verify** the theorems of circuit theory, such as Thevenin's Theorem, Norton's Theorem, and Superposition Theorem, by comparing theoretical results with practical measurements.
CO3	**Determine** the parameters of a choke coil and understand its behavior in different circuit configurations.
CO4	**Draw and interpret** the locus diagrams for series RL and RC circuits, gaining insights into the impedance and phase relationships as the frequency varies.
CO5	**Utilize** circuit simulation software to model and analyze circuits, verifying the fundamental theorems of circuit theory and comparing the software results with theoretical and experimental outcomes.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	1	-	-	-	3	2	-	2	3	-	-
CO2	3	3	3	3	1	-	-	-	3	2	-	2	3	-	-
CO3	3	3	3	3	1	-	-	-	3	2	-	2	3	-	-
CO4	3	3	3	3	1	-	-	-	3	2	-	2	3	-	-
CO5	3	3	3	3	3	-	-	-	3	2	-	2	3	-	-

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.

BAPATLA ENGINEERING COLLEGE::BAPATLA
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IT Workshop
I B. Tech. – I Semester (Code: 24EEL104)

Lectures	0	Tutorial	0	Practical	2	Credits	1
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- To introduce the internal parts, peripherals, and I/O ports of a computer.
- To train the students on installation of operating system and other application software.
- To introduce office tools for word processing, accounting and presentation.
- To introduce AI tools such as ChatGPT, Dialogflow.

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

CO1	**Describe** the components of a computer.
CO2	**Resolve** the problems of a computer.
CO3	**Generate and prepare** report using mail merging, ppt, certificate and accounting applications with MS office tools.
CO4	**Use** AI tools for report generation.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	-	-	-	-	-	-	-	3	2	-	-	3	-	-
CO2	2	-	-	-	-	-	-	-	3	2	-	-	3	-	-
CO3	2	2	2	1	2	-	-	-	3	2	-	2	3	-	-
CO4	2	2	2	1	2	-	-	-	3	2	-	2	3	-	-

LIST OF EXPERIMENTS

1. Explore Peripherals of a Computer, Components of a motherboard and its functions.
2. Install and Uninstall System and Application software on a Computer.
3. Disassemble and Assemble the PC.
4. Troubleshoot a computer.
5. Prepare the following using MS office:
   i) PPT using MS-Power Point.
   ii) Design a Project Certificate and Newsletter using MS-Word
6. Implement the following using Excel:
   i) Create an Excel Work sheet for the six subjects and calculate Total, Average, Grade and Rank.
   ii) Merge the contents of two excel sheets using VLOOKUP and sort them.
7. Generating reports using Mail Merge.
8. Prepare a report using Latex or equivalent (FOSS) tool word as word Processors.
9. Prompt Engineering in Chat GPT.
10. Develop a simple AI Chatbot.

References:

1. David Anfinson and Ken Quamme, IT Essentials PC Hardware and Software Companion Guide, 3rd edition, CISCO Press, Pearson Education, 2008, ISBN: 978-1-58713-199-8.
2. Frank MittelBach, Ulrike Fischer, LaTeX Companion, 3rd edition, Addison-Wesley

Professional, 2023. ISBN: 978-0138166489.
3. Midhun Moorthi C, Dr. K. Vimala Devi, Dr. V. Manjula, Tareek Pattewar, ChatGPT: Comprehensive Study on Generative AI Tool, 1st edition, AG Publishing House,2023, ISBN: 978-81-19338-79-5

BAPATLA ENGINEERING COLLEGE::BAPATLA
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NUMERICAL METHODS AND ADVANCED CALCULUS
I B. Tech. – II Semester (Code:24EE201)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- 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 andapplications.

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 Numericaltechniques.
CO2	**Solve** the first order ordinary differential equations numerically with the given initialcondition.
CO3	**Find** the area and volume of plane and three dimensional figures using multiple integrals.
CO4	**Apply** vector integral theorems to obtain the solutions of engineering problemsinvolving circulation, flux, and divergence in vector fields.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs												PSOs		
	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

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-Jordan method, Factorization method; Iterative methods of solution: Jacobi's iteration method, Gauss-Seidel iteration method.

[Sections: 28.1; 28.2; 28.3; 28.5; 28.6.2, 28.6.3; 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; Euler's method; Runge-Kutta method.

[Sections: 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; 32.4; 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: For triple integrals.

[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).

[Sections: 8.4; 8.5.1; 8.5.3; 8.6; 8.11; 8.12.2; 8.12.3; 8.13; 8.14; 8.16]

Text Books :	1. B.S.Grewal, Higher Engineering Mathematics, 44th edition, Khanna publishers, 2017.
References :	1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th edition, JohnWiley & Sons, 2016. 2. N.P.Bali and M.Goyal, A Text book of Engineering Mathematics, 11th edition, Laxmi Publications, 2018.
NPTEL Course Links:	1. https://onlinecourses.nptel.ac.in/noc23_ma44/preview 2. https://archive.nptel.ac.in/courses/111/107/111107105/ 3. https://archive.nptel.ac.in/courses/111/105/111105160/

BAPATLA ENGINEERING COLLEGE::BAPATLA
(Autonomous)

ADVANCED OPTICS AND MATERIALS TESTING
I B.Tech – II Semester (Code: 24EE202)

Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- To circulate the knowledge about the advanced optics and know its Engineering applications.
- Project the basic properties of materials and their industrial utilization.
- To classify solids using Quantum Mechanics and to determine crystal structures using X-rays.
- To make aware of some of the analytical techniques for material testing.

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

CO1	**Understand** the principles in the production and application of lasers and their effective utilization in optical communications.
CO2	**Understand** dielectric and magnetic properties of materials and their applications in industry.
CO3	**Demonstrate** the ability to apply knowledge of band theory of solids and to make understand the concept of energy band gap and hole.
CO4	**Demonstrate** material testing tools using Ultrasonic and Nuclear radiation.

Mapping of Course Outcomes with Program Outcomes

CO	POs												PSOs		
	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	-	2	-	-	-	-	-	-	-	-	2	-	-
CO3	2	2	-	2	-	-	-	-	-	-	-	-	2	-	-
CO4	3	3	2	2	3	-	-	-	-	-	-	-	2	-	-

UNIT-I

Lasers: Interaction of radiation with matter. Einstein co-efficients, 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.

Fibre Optics: 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 fibres.

UNIT-II

Electric and magnetic properties of materials: Maxwell Equations, Magnetic deflecting force, Hall Effect, Magnetic materials and properties (Dia, Para, Ferro), Weiss theory of ferromagnetism, Hysteresis curve, Hard and Soft magnetic materials.

Dielectrics – Different types of polarizations (Electronic, Ionic & Orientation), Local Field, Claussius-Mossotti equation, Di-electric breakdown, Ferro electrics and applications.

UNIT-III
Band theory of solids and Structure determination: One dimensional time- independent Schrödinger wave equation, Kronig-Penny model (without Derivation), Classification of materials, effective mass of electron, concepts of energy band gap and hole. **Structure determination:** Crystal lattices (Bravias), Crystal systems and structures, planes, Miller indices, Bragg's law, structural analysis of crystals using X-Ray powder diffraction method (XRD).
UNIT-IV
Material testing Techniques: Production and Properties of ultrasonics, Industrial applications of ultrasonics, Weld inspection, Material analysis, corrosion testing, concrete under water measurements, Ultrasonic testing in the foundry industry. NDT: Pulse echo technique, time of flight diffraction technique, Medical Applications of ultrasonics. **Nuclear Techniques**: Nuclear radio isotopes, Applications of radio isotopes (medical and industry) Properties of α,β,ɤ-rays.

Text Books :	1. M N Avadhanulu, P G Kshirsagar, TVS Arun Murthy, A Text Book of Engineering Physics, 11th edition, S.Chand and Co., 2018. 2. P.Srinivasa Rao and K.Muralidhar. Basic Engineering Physics. Himalaya, 1st Edition, 2012
References :	1. Dr S L Gupta & Dr V Kumar, Solid State Physics, 9th edition, K. Nath & Co, Meerut, 2018. 2. A. J. Dekker , Solid State Physics, Publisher: Prentice-Hall, 1st Edition, 1957. 3. S.O. Pillai., Solid State Physics, 10th edition, New Age International publishers, 2022.
NPTEL Course Links:	1. http://digimat.in/nptel/courses/video/117101002/L25.html 2. https://nptel.ac.in/courses/115101004 3. http://acl.digimat.in/nptel/courses/video/117101002/L22.html 4. http://acl.digimat.in/nptel/courses/video/117101002/L37.html

BAPATLA ENGINEERING COLLEGE::BAPATLA
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FUNDAMENTALS OF COMPUTING
I B.Tech – II Semester (Code: 24EE203)

Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives: At the end of the course, the student will understand the

- Basic problem solving process using Flow Charts and algorithms.
- Basic concepts of control structures in C.
- Concepts of arrays, functions, pointers and Dynamic memory allocation in C.
- Concepts of structures, unions, files and command line arguments in C.

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

CO1	Develop algorithms and flow charts for simple problems.
CO2	Use suitable control structures for developing code in C.
CO3	Design modular programs using the concept of functions and pointers.
CO4	Develop code for complex applications using structures and file handling features.

Mapping of Course Outcomes with Program Outcomes

	POs												PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	-	2	2	2	2	-	-	-	-	-	-	3	-	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-	3	-	-
CO3	2	2	-	2	-	-	-	-	-	-	-	-	2	-	-
CO4	3	3	2	2	3	-	-	-	-	-	-	-	3	-	-

UNIT-I

Introductory concepts: Block Diagram of Computer, Computer Characteristics, Hardware vs Software, How to Develop a Program, Software Development Life Cycle, Structured Programming, Types of Programming Languages, Introduction to C program, Program Characteristics.

Introduction to C Programming: Character set, Identifiers and Keywords, Data types, Constants, type qualifiers, Declaration and Initialization of variables.

Operators & Expressions: Arithmetic Operators, Unary Operators, Relational and Logical Operators, Assignment Operators, Conditional Operator, Input/ Output functions.

UNIT-II

Control Statements: Branching, Looping, Nested Control Structures, Switch Statement, Break Statement, continue Statement, and Goto Statement.

Arrays: Defining an Array, Processing an Array, Multidimensional Arrays & Strings (Basic Programs only).

UNIT-III

Functions: Defining a Function, Accessing a Function, Function prototypes, Passing Arguments to a Function, Passing Arrays to Functions, Recursion, Storage Classes (Basic Programs only).

Pointers: Fundamentals, Pointer Declarations, Passing Pointers to a Function, Pointers and Arrays, Dynamic memory allocation (Basic Programs only).

UNIT-IV

Structures and Unions: Defining a Structure, Processing a Structure, User-Defined Data Types, Unions (Basic Programs only).

Files handling: Opening and Closing a Data File, Reading and Writing a Data File, Processing a Data File, Unformatted Data Files (Basic Programs only).	
Text Books :	1. K R Venugopal & Sudeep R Prasad, Mastering C, McGraw Hill Education, 2nd Edition, 2017. 2. E Balagurusamy, Computing Fundamentals & C Programming, 2nd edition, TataMcGrawHill, 2017 ,
References :	1. Byron Gottfried, Programming with C, Schaum's Outlines, Tata McGraw-Hill, 3rd Edition, 2017. 2. Yashavant P. Kanetkar, Let Us C: Authentic guide to C programming language, 19th edition, BPB Publications, 2022. 3. Pradip Dey, Manas Ghosh, Computer Fundamentals and Programming in C, 2nd edition, Oxford University Press, 2013.
NPTEL Course Links:	1. https://www.youtube.com/watch?v=IZ5dicfkIP4&list=PLyqSpQzTE6M-JIlXDZF7wGz5thLz15xWA 2. https://www.youtube.com/watch?v=XTiIiI-LOY8&list=PLEAYkSg4uSQ2k6GwNhpgSHodGT8wfvgwu 3. https://www.youtube.com/watch?v=t9WKOcRB63Q&list=PLJ5C_6qdAvBFzL9su5J-FX8x80BMhkPy1

BAPATLA ENGINEERING COLLEGE::BAPATLA
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BASIC ELECTRONIC DEVICES I B. Tech. – II Semester (Code: 20EE204)							
Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basics of Mathematics, Physics and Chemistry

Course Objectives: Students will be able

- Examine the fundamentals of Electronic Devices.
- Describe diode and it's applications in clipping and clamping circuits, Rectifiers
- Explain and design the working of transistor and its different biasing conditions
- Illustrate the characteristics of different types of FET and MOSFET.

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

CO1	**Apply** the knowledge of basic semiconductor physics and understand the working principles of various electronic devices.
CO2	**Implement** circuits for different applications using diodes
CO3	**Illustrate** the various circuit configurations of transistor and biasing circuits.
CO4	**Examine** the various circuit configurations of FET and MOSFET.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	1	-	-	-	-	-	-	-	3	3	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	3	3	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-	3	3	-	-
CO4	3	3	2	1	-	-	-	-	-	-	-	3	3	-	-

UNIT-I

Semi-Conductors: Classification of Insulators, Semiconductors & metals based on energy band diagram, Intrinsic Semiconductors, Extrinsic Semi-Conductors, Diffusion currents and drift currents.

Diodes: The open circuited p-n Junction, Volt-Ampere characteristics (Forward Bias and Reverse Bias and temperature dependence of the V/I characteristic), types of breakdowns in diode, Diode Resistance ,Diode capacitance, Zener diode V-I characteristics, Zener diode as voltage regulator.

UNIT-II

Rectifiers: Analysis of Half-wave Rectifier, Full-wave and Bridge Rectifiers.

Filters: Inductor filter, capacitor filter, L section & Π- section filters.

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

UNIT-III

BJT: Operation of PNP & NPN Transistor, Transistor as amplifier, CE, CB and CC configuration input, output characteristics.

BJT Biasing and Stabilization: Biasing techniques-different types of biasing, Thermal Runaway, Thermal Stability. Bias stabilization and compensation techniques.	
UNIT-IV	
JFET: Comparison of BJT & FET, JEFT volt ampere characteristics. **MOSFET:** MOSFET construction, Types of MOSFET (Enhancement type and Depletion type) and their characteristics.	
Text Books :	1. Jacob Millman and Christos C Halkias, Integrated Electronics Analog and Digital Circuits and Systems, Tata McGraw Hill, 2nd edition, 2017. 2. J.B. Gupta, Electronic Devices and Circuits, Electronic Devices and Circuits, S.K. Khataria & Sons, 6th edition, 2013.
References :	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. Robert L Boylested and Louis Nashelsky, Electronic Devices and Circuit Theory, Prentice Hall India, 11th edition, 2015.
NPTEL Course Link:	1. NPTEL::Electrical Engineering: Analog Electronic Circuits, https://nptel.ac.in/courses/108102112. 2. https://www.youtube.com/watch?v=SRPCg-nO_bA 3. https://www.youtube.com/watch?v=B5EZ4bWLUMg

BAPATLA ENGINEERING COLLEGE::BAPATLA
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ENGINEERING GRAPHICS
I B.Tech – II Semester (Code: 24EEL201)

Lectures	1	Tutorial	0	Practical	4	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- Clear picture about the importance of engineering graphics in the field of engineering
- The drawing skills and impart students to follow Bureau of Indian Standards
- To give an idea about Geometric constructions and orthographic projections
- Imagination skills about orientation of points, lines, surfaces and solids
- Basic drafting skills of AutoCAD

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

CO1	**Draw** projections of points and projections of lines using Auto CAD
CO2	**Plot** projections of surfaces like circle, pentagon, hexagon and rhombus
CO3	**Plot** the Projections of solids like Prisms and pyramids
CO4	**Development** of surfaces of cylinder, prism and pyramids, Convert the Isometric views into Orthographic views for simple objects.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	1	-	-	-	-	-	3	2	-	-	2	-	-
CO2	3	2	1	-	-	-	-	-	3	2	-	-	2	-	-
CO3	1	2	3	-	-	-	-	-	3	2	-	-	2	-	-
CO4	1	2	1	-	-	-	-	-	3	2	-	-	2	-	-

LIST OF EXPERIMENTS

UNIT-I

Introduction: Introduction to Engineering Drawing, geometrical constructions.

Introduction to AUTOCAD: Advantages of AutoCAD over manual drafting, Basics of sheet selection, Draw tools, Modify tools, dimensioning.

Method of Projections: Principles of projection, first angle and third angle projections, projections of points, projections of straight lines inclined to both the planes.

UNIT-II

Projections of Planes: Projections of plane figures: circle, triangle, pentagon, hexagon and rhombus.

UNIT-III

Projections of Solids: Projections of solids like square, pentagonal, hexagonal prisms and pyramids, axis inclined to one plane only.

UNIT-IV	
Development of Surfaces: Development of surfaces of trapezoidal tray, cylinder, prism and pyramid with sections. **Orthographic Projections:** Conversion of pictorial views into Orthographic views. (Treatment is limited to simple castings only).	
Text Books :	1. Dhananjay M. Kulkarni, Engineering Drawing with AutoCAD, Revised Edition, (PHI publication), 2018. 2. N.D. Bhatt & V.M. Panchal, Engineering Drawing, 43rd Edition, (Charotar Publishing House, Anand). (First angle projection) 2014.
References :	1. Dhananjay A Jolhe, Engineering Drawing, Revised Edition, Tata McGraw hill publishers,20219.

BAPATLA ENGINEERING COLLEGE::BAPATLA
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ENGINEERING PHYSICS LAB
I B.Tech –II Semester (Code: 24EEL202)

Lectures	0	Tutorial	0	Practical	2	Credits	1
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- Basic experiments such as Magnetic Field Measurements, Hall Effect and LCR resonance give the knowledge to apply them in magnetic applications.
- The measurements relating to various physical parameters of materials make the student to understand their utility, design and fabrication of several devices.
- Applicability of properties of light such as interference and diffraction to measure accurately the distances, radius of curvature, wavelength etc.
- The experiments like CRO, Photo cell and Solar cell gives the idea of electronic and electrical power production.

Course Outcomes: At the end of this course, Students will 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	**Measure** accurately the distances, radius of curvature, wavelength and detect flaws in the materials.
CO4	**Get** hands on experience in various Opto-electronic devices and design the cells for power production.

Mapping of Course Outcomes with Program Outcomes

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	-	-	-	-	3	2	-	-	3	-	-
CO2	3	3	2	2	-	-	-	-	3	2	-	-	3	-	-
CO3	3	3	2	2	2	-	-	-	3	2	-	-	3	-	-
CO4	3	2	-	-	-	-	3	-	3	2	-	2	3	-	-

LIST OF EXPERIMENTS

1. Determination of acceleration due to gravity at a place using compound pendulum.
2. To study the variation of intensity of magnetic field along the axis of a circular coil using Stewart-Gee's apparatus.
3. To draw the characteristic curves of P-N Junction diode.
4. Determination of radius of curvature of a Plano convex lens by forming Newton's rings.
5. Determination of wavelengths of mercury spectrum using grating normal incidence method.
6. To draw the characteristic curves of Zener diode.
7. To draw the resonant characteristic curves of L.C.R. series circuit and calculate the Resonant frequency.

8. To draw the characteristic curves of a photocell and calculate the maximum velocity of electron.
9. Verify the laws of transverse vibration of stretched string using Sonometer.
10. Determination of rigidity modulus of the given material of the wire using Torsional pendulum.
11. To draw the load characteristic curves of a solar cell.
12. Determination of Hall coefficient of a semiconductor.
13. Determination of voltage and frequency of an A.C. signal using C.R.O.
14. Determination of Forbidden energy gap of Si &Ge.
15. Determination of wavelength of laser source using Diode laser.
16. To draw the characteristic curves of Photo diode.
17. To draw the Diode valve characteristics.

Any three experiments are virtual

Note: A minimum of **ten (10 no.)** experiments to be done and recorded

Text Books :	P. Sreenivasarao & K. Muralidhar, Engineering Physics laboratory Manual, Himalaya Publications.

BAPATLA ENGINEERING COLLEGE::BAPATLA
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FUNDAMENTALS OF COMPUTING LAB
I B.Tech – II Semester (Code: 24EEL203)

Lectures	0	Tutorial	0	Practical	3	Credits	1.5
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives: At the end of the course, the student will understand the

- Basic problem solving process using Flow Charts and algorithms.
- Basic concepts of control structures in C.
- Concepts of arrays, functions, pointers and Dynamic memory allocation in C.
- Concepts of structures, unions, files and command line arguments in C.

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

CO1	**Develop** algorithms and flow charts for simple problems.
CO2	**Use** suitable control structures for developing code in C.
CO3	**Design** modular programs using the concept of functions and pointers.
CO4	**Develop** code for complex applications using structures and file handling features.

Mapping of Course Outcomes with Program Outcomes

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	2	2	2	2	-	-	3	2	-	2	3	-	-
CO2	3	3	-	2	-	-	-	-	3	2	-	2	3	-	-
CO3	2	2	-	2	-	-	-	-	3	2	-	2	2	-	-
CO4	3	3	2	2	3	-	-	-	3	2	-	2	3	-	-

LIST OF EXPERIMENTS

1. Write a C program for problem solving using computers - Familiarization with programming environment, Variable types and type conversions - Simple computational problems using arithmetic expressions.
2. Write a C program for Branching and logical expressions - Problems involving if-then-else structures
3. Write a C program for Loops, while and for loops - Iterative problems e.g., sum of series
4. Write a C program for 1D Arrays: searching, sorting - 1D Array manipulation
5. Write a C program for 2D arrays and Strings - Matrix problems, String operations
6. Write a C program for functions, call by value - Simple functions
7. Write a C program for Numerical methods (Root finding, numerical differentiation, numerical integration) - Programming for solving Numerical methods problems
8. Write a C program for recursion, structure of recursive calls - Recursive functions
9. Write a C program using Pointers, structures and dynamic memory allocation for arrays, matrix operations and data handling to maintain records
10. Write a C program for File handling - File operations.

BAPATLA ENGINEERING COLLEGE::BAPATLA
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BASIC ELECTRONIC DEVICES LAB
I B. Tech. – II Semester (Code: 20EEL204)

Lectures	0	Tutorial	0	Practical	3	Credits	1.5
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basics of Mathematics, Physics and Chemistry

Course Objectives: Students will be able

- Analyze PN junctions in semiconductor devices under forward and reverse bias conditions.
- Explore diode and it's applications in clipping and clamping circuits, Rectifiers and filter circuits.
- Outline characteristics in different configurations of BJT and analyze different biasing techniques.
- Illustrate the characteristics of different types of FET and MOSFET.

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

CO1	**Demonstrate** PN junctions in semiconductor devices under various conditions.
CO2	**Demonstrate and analyze** simple rectifiers, Clippers, Filters and voltage regulators using diodes.
CO3	**Explore** characteristics in different configurations of BJT and analyze different biasing techniques.
CO4	**Outline** the various characteristics of FET and MOSFET.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	3	-	-	-	-	3	2	-	2	3	-	-
CO2	3	3	2	3	-	-	-	-	3	2	-	2	3	-	-
CO3	3	3	2	3	-	-	-	-	3	2	-	2	3	-	-
CO4	3	3	2	3	-	-	-	-	3	2	-	2	3	-	-

LIST OF EXPERIMENTS

1. V-I characteristics of PN Junction.
2. V-I characteristics of Zener diode.
3. Design of Half wave rectifier.
4. Design of Full wave rectifier.
5. Design of Half wave rectifier with filter.
6. Design of Full wave rectifier with filter.
7. Non-linear wave shaping – clippers.
8. Non-linear wave shaping – clampers

9. Design of voltage regulators using Zener Diodes
10. Characteristics of Transistor in Common Emitter configuration.
11. Characteristics of Transistor in Common Base configuration.
12. Characteristics of Transistor in Common Collector configuration.
13. Verification of Transistor Self-Bias Circuit.
14. Characteristics of Junction Field Effect Transistor
15. Characteristics of MOSFET

Note: Minimum 10 experiments should be conducted.

BAPATLA ENGINEERING COLLEGE::BAPATLA
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WORKSHOP PRACTICE
I B.Tech – II Semester (Code:24MEL205)

Lectures	0	Tutorial	0	Practical	3	Credits	1.5
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- 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 this course, 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 Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	2	-	2	-	2	-	3	2	-	2	-	-	-
CO2	2	3	2	-	2	-	2	-	3	2	-	2	-	-	-
CO3	2	3	2	-	2	-	2	-	3	2	-	1	-	-	-
CO4	-	-	2	-	2	-	2	-	3	2	-	1	-	-	-

LIST OF EXPERIMENTS

1. To prepare half lap joint
2. To prepare Dovetail joint
3. To prepare Mortise and Tenon joint
4. To prepare a Butt joint with the given M.S plates
5. To prepare a Lap joint with the given M.S plates
6. To prepare a Tee joint with the given M S plates
7. To prepare a Trapezoidal tray of given dimensions.
8. To prepare a T – Joint of given dimensions.
9. To prepare a Funnel of given dimensions.
10. To make a connection for one light bulb controlled by one switch and to test the same
11. To make a connection for two bulbs in series controlled by one switch and to test the same
12. To make a connection for one light bulb controlled by two switches and to test the same

Text Books :

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

PROBABILITY AND STATISTICS

II B. Tech. – III Semester (Code: 24EE301)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives: Students will learn how to

- **Employ** discrete and continuous probability distributions to analyze and solve real world problems in Engineering fields.
- **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: After completion of this course, Students will be able to

CO1	**Apply** discrete and continuous probability distributions to various problems arising in Engineering 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 Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	2	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	2	-	-	-
CO4	3	3	3	-	-	-	-	-	-	-	2	-	-	-

UNIT-I

Descriptive measures, Random variables and Probability distributions:Arithmetic mean, median and mode, Random variables, Binomial distribution, The mean and variance of a probability distribution, Poisson approximation to the Binomial distribution, Continuous Random Variables, Normal Distribution, Normal Approximation to the Binomial Distribution, Uniform Distribution, Weibull distribution.
(Sections 2.5, 4.1, 4.2, 4.4, 4.6, 5.1, 5.2, 5.3, 5.5, 5.9.)

UNIT-II

Sampling distributions and Inferences concerning one mean: 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)

UNIT-III	
Comparing two treatments and Inferences concerning variances: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	
Inferences concerning proportions, Regression Analysis and Analysis of variance: Estimation of proportions, Hypotheses concerning one proportion, Hypotheses concerning two proportions, the method of least squares, curvilinear regression, multiple regression, correlation, some general principles, Completely Randomized Designs (One-way ANOVA). (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, 2011.
References :	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 & Statistics', Schaum's outline series.
NPTEL Course Links:	1. https://archive.nptel.ac.in/courses/111/105/111105090/ 2. https://nptel.ac.in/courses/111105090 3. https://archive.nptel.ac.in/courses/111/102/111102160/

NETWORK ANALYSIS

II B. Tech. – III Semester (Code: 24EE302)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basics of Mathematics.

Course Objectives: To make the students

- **Infer and evaluate** transient response, Steady state response for single phase systems.
- **Interpret** the circuits using Laplace Transforms.
- **Understand** the concepts of three-phase systems and their analysis.
- **Evaluate** two-port network parameters and network functions.
- **Formulate** the equations of coupled circuits and their behavior.
- **Construct** passive filters using constant K and M derived methods.

Course Outcomes: After completion of this course, Students will be able 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 their behavior.
CO6	**Illustrate** passive filters using constant K and M derived methods.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	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

Solution of First and Second Order Networks: Solution of first and second order differential equations for Series and parallel R-L, R-C, RLC circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response for DC and AC excitations.

Electrical Circuit Analysis Using Laplace Transforms: Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform.

UNIT-II

Poly Phase Systems: Advantages of 3-phase systems, phase sequence, interconnection of 3-phase sources and loads, voltage, current & power in star & delta connected systems, analysis of 3- phase balanced circuit, measurement of 3-phase power by using two wattmeter method.

Analysis of 3-phase unbalanced systems, star / delta transformation method and Mill man's method.

UNIT-III

Two Port Network and Network Functions: Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interrelation of two port network, interconnections of two port networks, image parameters, Two-Port bridged – T, Ladder and Lattice networks. Transfer function representation. Poles and Zeros - Network functions for the one port and two port - Poles and Zeros of network functions - Restrictions on pole and zero locations for driving point functions and transfer functions

UNIT-IV

Coupled Circuits: Defining self and mutual inductance, coefficient of coupling, dot convention, Development of circuit equations in time domain and frequency domain, solution of coupled circuits, series, and parallel connections of two coupled coils, tuned circuit analysis (single and double tuned) **Filters**: Low pass, high pass, band pass & band reject filters - frequency response, constant K– and M derived – filters.

Text Books:	1. William H. Hayt, Jack E. Kemmerly and Steven M. Durbin, Engineering Circuit Analysis, 9th edition, McGraw Hill Education, 2020. 2. A Sudhakar and Shyam Mohan SP, ―Circuits and Networks: Analysis and Synthesis, 5th Edition, TMH, 2017.
References:	1. M.E.Vanvalkenburg, ―Network Analysis‖, 3rd Edition, PHI, 2006. 2. C. K. Alexander and M. N. O. Sadiku, ―Electric Circuits‖, McGraw Hill Education, 5th Edition, 2016. 3. Abhijit Chakrabarti, ―Circuit theory analysis and synthesis‖ Dhanapatrai & co(p) Ltd, 2018. 4. C. L Wadhwa, ―Network analysis and synthesis‖, New Age International, 2nd Edition, 2006. 5. Mahmood Nahvi (Author), Joseph Edminister, Schaum's Outline of Electric Circuits,7th Edition McGraw Hill, ISBN-10 : 1260011968, 2017.
NPTEL Course Links:	1. NPTEL :: Electrical Engineering - NOC:Network Analysis 2. NPTEL :: Electrical Engineering - NOC:Basic Electrical Circuits 3. https://onlinecourses.nptel.ac.in/noc22_ee07/preview 4. https://archive.nptel.ac.in/courses/108/105/108105159/

ELECTRO MAGNETIC FIELDS
II B. Tech. – III Semester (Code: 24EE303)

Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basics of Mathematics, Physics.

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 Magnetic field and force concepts in magnetic fields.
- **Identify** the electromagnetic wave propagation in medium.

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

CO1	**Describe** the fundamentals in Electromagnetic field theory.
CO2	**Explain** basics in Electrostatics such as Dipole, Capacitance.
CO3	**Solve** various magneto static field problems.
CO4	**Demonstrate** time varying electric, magnetic fields and the concepts of Maxwell's equations.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	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	-

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).

UNIT-II

Electrostatics II: 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. Electric field intensity due to dipole. Current and current density, continuity of current, conductor properties and boundary conditions. The nature of dielectric materials, boundary conditions for perfect dielectric materials. Capacitance, Several capacitance examples.

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,	
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.	
Text Books :	1. W H Hayt, J A Buck , "Engineering Electromagnetics", 9th Edition TMH, 2020. 2. Mathew NO Sadiku, 'Elements of Electromagnetics', 6th Edition Oxford University Press, 2014.
References :	1. Joseph A Edminister, 'Theory and Problems of Electromagnetics', 4th Edition, Schaum's Outline Series, Mc-Graw Hill International, 2014. 2. EC Jordan and KG Balmain, "Electromagnetic Waves and Radiating Systems", PHI, 2003. 3. Nathan Ida, Engineering Electromagnetics, Springer, 4th Edition,2021.
NPTEL Course Links:	1. https://nptel.ac.in/courses/108/106/108106073/ 2. https://nptel.ac.in/courses/115/101/115101005/ 3. https://nptel.ac.in/courses/108/106/108106023/

ELECTRICAL MACHINES-I

II B. Tech. – III Semester (Code: 24EE304)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basic Physics, Basic Mathematics

Course Objectives: To make the students

- **Explain** the construction of dc machines and its characteristics
- **Explain** the construction and operation of Transformers.
- **Understand** the construction, operation and performance of Alternators
- **Familiarize** knowledge about construction, operation and performance of synchronous motors.

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

CO1	**Describe** the operation of dc generators and its characteristics.
CO2	**Assess** the construction and operation of Transformers.
CO3	**Analyze** operation and performance of Alternators.
CO4	**Analyze** operation and performance of synchronous motors.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	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 Circuits: Magnetic circuit parameters, magnetic leakage and fringing, B-H curve. Electromechanical-energy conversion for Single & Double excited systems.

DC Generators: Basic construction of a DC machine, Principle, operation of simple one loop generator -Types of field excitations-EMF equation-Armature reaction- commutation-Characteristics -Applications.

DC Motors: Principle and operation - Torque equation - Characteristics -Applications -starters -speed control methods- flux control method, armature control and voltage control method, Losses, Testings - Swinburne's test, Direct load test.

UNIT-II

Transformers: Principle, types, Construction and operation, EMF equation-equivalent circuit, phasor diagrams- under no load & loaded conditions. Voltage Regulation, losses and efficiency. Testings -OC and SC test, Sumpner's test. Auto- transformer- Three phase transformers**:** types of connections and their features.

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 method -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:	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:	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.
NPTEL Course 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/

DIGITAL ELECTRONICS
II B. Tech. – III Semester (Code: 24EE305)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basic Physics, Basic Mathematics.

Course Objectives: To make the students

- **Understand** different types of number systems used in digital systems. Boolean functions. simplification using Karnaugh map and theorems.
- **Analyze and apply** the design procedures of Combinational circuits design procedure and implementing them.
- **Analyze and design** the operation and design methodology for sequential circuits.
- **Understand** about different types of IC logic families & the programmable logic devices like ROM, PLA & PAL.

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

CO1	**Illustrate** basic digital logic fundamentals such as numbering systems, Boolean functions minimization methods.
CO2	**Describe** the operation and design procedure of combinational circuits.
CO3	**Comprehend** the operation and design methodology for sequential circuits
CO4	**Explain** different types of IC logic families & memory elements.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	2	1	2	-	2	-	-	-	2	3	2	-
CO2	3	2	2	1	2	-	2	-	-	-	2	3	2	-
CO3	3	2	2	1	2	-	2	-	-	-	2	3	2	-
CO4	3	2	2	1	2	-	2	-	-	-	2	3	2	-

UNIT-I

Number Systems & Codes: Decimal, Binary, Octal, Hexadecimal Number systems and their conversions, r's and (r-1)'s Complements, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean algebra: Boolean expressions and theorems, Logic gates, Universal gates, standard forms of logic expressions, simplification of Boolean functions using K maps (up to five variables).

UNIT-II

Combinational Logic Circuits: General design procedure for Combinational logic circuits, Design and applications of Binary Adders and Subtractors, Comparators, Encoders, Decoders, Multiplexers and Demultiplexers, Design of BCD to 7 Segment Decoder, Parity Generator and Checker, BCD Adder / Subtractor, Carry look ahead adders.

UNIT-III

Sequential Logic Circuits: Latches & flipflops (SR, D, JK & T), Timing Considerations, Characteristic Table, Characteristic Equation, Excitation table, State table and State diagrams for SR, D, JK & T Flip-flops, Conversion from one type of Flip-flop to another. Shift Registers, Counters – synchronous & asynchronous.

UNIT-IV	
IC Logic Families: Brief overview of Transistor as a switch, Logic gate characteristics – propagation delay, speed, noise margin, fan-out and power dissipation, Standard TTL and static CMOS gates. Programmable Logic Devices: ROM, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL).	
Text Books :	1. M Morris Mano, Digital Logic and Computer Design, PHI/Pearson Education, 2003. 2. Fundamentals of Digital Circuits, A.Anand Kumar, 4th Edition, Pearson Education.
References :	1. Wakerly J.F., Digital Design: Principles and Practices, Pearson India, 4th Edition, 2008. 2. RP Jain, Modern Digital Electronics, 3rd Edition, TMH, 2003. 3. Thomas L. Floyd - Digital Fundamentals, 10th Edition, Person Education, 2011. 4. Donald D. Givone - Digital Principles and Design, TMH, 2003.
NPTEL Course Links:	1. https://nptel.ac.in/courses/117103064/ 2. https://archive.nptel.ac.in/courses/108/105/108105132/

DATA STRUCTURES AND ALGORITHMS LAB
II B. Tech. – III Semester (Code: 24EEL301/SEC1)

Lectures	1	Tutorial	0	Practical	2	Credits	2
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Fundamentals of Computing.

Course Objectives: To make the students

- **To impart** the basic concepts of data structures and algorithms.
- **To apply** concepts about searching and sorting techniques
- **Apply** the basic concepts of data structures such as stacks, queues, lists, trees, and graphs.
- **Apply** fundamental data structures to write algorithms for solving computational problems.

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

CO1	**Implement** ADTs of different types of linked lists and applications.
CO2	**Implement** stack and queue ADT's using arrays and their applications.
CO3	**Construct** and implement different tree algorithms.
CO4	**Implement** various hashing techniques and Graph traversal methods.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	3	2	-	2	-	-	-	2	-	3	3	-	-
CO2	3	3	2	-	2	-	-	-	2	-	3	3	-	-
CO3	1	3	2	-	2	-	-	-	2	-	3	2	-	-
CO4	1	3	2	-	2	-	-	-	2	-	3	2	-	-

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.
11. Write a program to implement all the functions of a dictionary (ADT)using Linked List.
12. Write a program that implements the following i) Insertion sort ii) Merge sort iii)Heap sort.
13. Write a program to Implementation of Graph Search Methods.

Note: *Minimum of 10 Exercises have to be completed and documented.*

Text Books :	1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein "Introduction to Algorithms" 3rd edition, MIT Press, 2023. 2. Reema Thereja,"Data Structures Using C", 2nd Edition, Oxford University Press, 2014.
References :	1. Narasimha Karumanchi "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles" 5th edition, CareerMonk Publications,2016. 2. Robert Sedgewick and Kevin Wayne " Algorithms" Fourth Edition, Addison-Wesley Professional,2011.
NPTEL Course Links:	1. NPTEL :: Computer Science and Engineering - NOC:Programming, Data Structures and Algorithms 2. NPTEL :: Computer Science and Engineering - Data Structures And Algorithms

DESIGN THINKING AND INNOVATION LAB

II B. Tech. – III Semester (Code: 24EEL302)

Lectures	1	Tutorial	0	Practical	2	Credits	2
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None

Course Objectives: To make the students

- **Provide** an overview of design thinking.
- **Engage** students to allow them to integrate these components into their own courses.
- **Nurture** their skills to contribute for solving community-based problems.
- **Provide** a framework to work in teams to solve problems.

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

CO1	**Describe** the components of design thinking.
CO2	**Discuss** the importance of users& community partners in the design process in proposing solutions.
CO3	**Employ** prototyping and failure handling into their design experiences.
CO4	**List** attributes of expert designers.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	3	3	3	3	3	3	1	3	-	-	-	-
CO2	3	3	3	3	3	3	3	3	2	3	-	-	-	-
CO3	3	3	3	3	3	3	3	3	2	3	-	-	-	-
CO4	3	3	3	1	2	3	3	3	2	3	-	-	-	-

UNIT-I

Introduction to Design Thinking: Characteristics of design thinking, Expert and novice design characteristics, Opportunities for student to learn skills needed for the development of expertise.
Case study for design thinking success: Creating a culture of design learning, Gathering information from users, Rapid prototyping.

UNIT-II

Users and community partners: Understanding users, identifying users, creating tools for understanding users
Requirements and specifications: Defining specifications, State of the art comparisons, Testing requirements

UNIT-III

Prototyping: Prototypes for technology, Prototypes for communication
Ideation and concept generation: Brainstorming, Concept generation, Functional decomposition.
Testing and design to prevent failures: Testing of designs, Design for Failure Modes and Effects Analysis (DFMEA), Delivery to users.

UNIT-IV

Teaming concepts in design: Managing student teams, Organizing teams, Assessing teams, Mentoring and advising teams
Closure and summary: Reviewing design cycles and concepts, Putting it into action.

Practical Exercises

1.IDEO Tool Kit – Design Thinking Case Study.
2.Community Project – identification – community partner –prototype evaluation.
3.Functional Decomposition – eg: Mechanical Pencil.
4. Prototyping Exercise – using paper/thermos coal/cardboard/recyclable material, testability and maintainability.
5.Requirement and Specification Analysis.
6.The Lean Canvas Model – business model.
7.Thirty Circle Exercise – IDEO thinking.
8.Risk Analysis – case study – DFMEA Analysis.

Text Books:	1. IdrisMootee, "Design Thinking for Strategic Innovation", John Wiley & Sons (2013). 2. Tim Brown ,"Change by design", , Harper Collins, 2009. 3. "Design Thinking- The Guide Book" – Facilitated by the Royal Civil service Commission, Bhutan 4. George E Dieter , "Design Thinking- The Guide Book" – Facilitated by the Royal Civil service Commission, Bhutan 4. Engineering design.
References:	1. Vijay Kumar, "101 Design Methods: A Structured Approach for Driving Innovation in Your Organization", Wiley; 1st edition, ISBN-10: 1118083466, 2012. 2. IDEO , "Human-Centered Design Toolkit: An Open-Source Toolkit To Inspire New Solutions in the Developing World", Author house; 2nd edition, ISBN-10: 0984645705, 2011.
NPTEL Course Links:	1. https://www.interaction-design.ora/literature/topics/design-th/nking 2. https://www.interaction-design.prg/literature/article/how-tq-

MEASUREMENT AND INSTRUMENTATION LAB
II B. Tech. – III Semester (Code: 24EEL303)

Lectures	1	Tutorial	0	Practical	2	Credits	2
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basic Mathematics, Basic Electrical Engineering.

Course Objectives: To make the students

- **To understand** about characteristics of measuring instruments.
- To have an **adequate** knowledge in Calibration of measuring instruments.
- To **apply** the concepts of errors in bridges for accurate measurement and analysis
- To have an **adequate** knowledge in Sensors and Transducers.

Course Outcomes: After completion of this course, Students will 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	**Apply** calibration and validation techniques to DC and AC bridges to ensure accurate measurement results.
CO4	**Demonstrate** the Function of Various types of Transducers.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	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. Instrument transformers (CTs and PTs). Measurement of phase and time. Digital Meters.

UNIT-III

Bridges: Measurement of resistance-Low Medium and High- AC bridges- Measurement of inductance using Anderson's Bridge, Measurement of Capacitance using Schering Bridge.

UNIT-IV

Transducers: Temperature transducers- Resistance Temperature Detector (RTD), Thermistor, Thermocouple-Displacement transducer- Linear Variable Differential Transformer (LVDT), Pressure transducer- Strain gauge. Oscilloscope-Working Principle, operation and applications.

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, Acourse in electrical and electronic measurements and instrumentation, Dhanpatrai &Co, 19th Revised2014. 2. R.K.Rajput, Electrical &Electronics Measurements &Instrumentation ,S Chandand Company Ltd.
References :	1. J.B.Gupta,ACourse in Electrical & Electronics Measurement & Instrumentation, Kataria and Sons,Reprint 2013. 2. D.V.S.Moorthy,Transducers&Instrumentation,PrenticeHallofIndia,2ndEdition,2008. 3. B.C.Nakra and K.K.Choudhry ,Instrumentation Measurement and Analysis,,McGraw 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

NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE
II B. Tech. – III Semester (Code: 24EEL304)

Lectures	0	Tutorial	0	Practical	1	Credits	0.5
Continuous Internal Evaluation			0	Semester End Examination			100

Pre-Requisite: None.

Course Objectives: To make the students

- The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

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

CO1	**Understand** the importance of discipline, character and service motto.
CO2	**Solve** some societal issues by applying acquired knowledge, facts, and techniques.
CO3	**Explore** human relationships by analyzing social problems.
CO4	**Determine** to extend their help for the fellow beings and downtrodden people and also leadership skills and civic responsibilities.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	-	-	-	-	-	-	-	-	2	-	3	-	-	-
CO2	-	-	-	-	-	-	-	-	2	-	3	-	-	-
CO3	-	-	-	-	-	-	-	-	2	-	3	-	-	-
CO4	-	-	-	-	-	-	-	-	2	-	3	-	-	-

UNIT-I

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.

Activities:

i) Conducting -ice breaking sessions-expectations from the course-knowing personal talents and skills

ii) Conducting orientations programs for the students -future plans-activities-releasing road map etc.

iii) Displaying success stories-motivational biopics-award winning movies on societal issues etc.

iv) Conducting talent show in singing patriotic songs-paintings-any other contribution.

UNIT-II

Nature & Care

Activities:

i) Best out of waste competition.

ii) Poster and signs making competition to spread environmental awareness.

iii) Recycling and environmental pollution article writing competition.

iv) Organizing Zero-waste day.

v) Digital Environmental awareness activity via various social media platforms.

vi) Virtual demonstration of different eco-friendly approaches for sustainable living.

vii) Write a summary on any book related to environmental issues.
UNIT-III
Community Service **Activities:** i) Conducting One Day Special Camp in a village contacting village-area leaders-Survey in the village, identification of problems-helping them to solve via media-authorities-experts-etc. ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS. iii) Conducting consumer Awareness. Explaining various legal provisions etc. iv) Women Empowerment Programmes-Sexual Abuse, Adolescent Health and Population Education. v) Any other programmes in collaboration with local charities, NGOs etc.

Text Books :	1. Nirmalya Kumar Sinha & Surajit Majumder, A Text Book of National Service Scheme Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)

ENVIRONMENTAL SCIENCE

II B. Tech. – III Semester (Code: 24EE306/MC01)

Lectures	2	Tutorial	0	Practical	0	Credits	0
Continuous Internal Evaluation			40	Semester End Examination			0

Pre-Requisite: Chemistry, Physics, Geography and Earth Science.

Course Objectives: To make the students

- To understand and learn about ecosystem and biodiversity exist in nature.
- To know about the natural resources and sustainability.
- To understand different types of pollutions, present in Environment.
- To know the global environmental problems with case studies.

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

CO1	Students develop a strong understanding of ecosystems, biodiversity and the importance of their conservation.
CO2	Students gain an understanding of the protection of natural resources for environmental protection and sustainability.
CO3	Know how to manage the harmful pollutions.
CO4	Create awareness among the youth on environmental concerns important in the long-term interest of the society.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	-	3	-	-	-	-	-	1	-	-
CO2	3	2	-	-	-	3	2	-	-	-	-	1	-	-
CO3	3	2	-	-	-	3	2	-	3	-	-	1	-	-
CO4	3	2	-	-	-	3	-	-	-	-	-	1	-	-

UNIT-I

Ecosystems: Definition, Structure and Functions of Ecosystems, Forest Ecosystem.
Biodiversity: Definition and levels of Biodiversity; Values of Biodiversity, Threats and Conservation of Biodiversity.

UNIT-II

Natural Resources: Land: Land as a resource, Causes and effects of land degradation, **Water**: floods and drought, Dams - benefits and problems.
Sustainability: Rain water harvesting and Watershed management.

UNIT-III

Pollution: Definition; Causes, effects and control of air, water pollution.

Solid Waste Management - 3R approach, composting and vermin-composting.

UNIT-IV

Environmental Issues: Global warming, Ozone layer depletion, Acid rains

Case Studies: Bhopal Tragedy, Mathura Refinery and Taj Mahal.

Text Books:	1. Benny Joseph, "Environmental Science and Engineering" Tata McGraw-Hill Publishing Company Limited, New Delhi. 2. Anjaneyulu Y, "Introduction to Environmental Science", B.S.Publications. 3. JP Sharma, "Comprehensive environmental studies", Laxmi Publications.
References:	1. "Environmental studies", R. Rajagopalan, Oxford University Press. 2. "Environmental Science", 11th Edition – Thomson Series – By Jr. G. Tyler Miller. 3. Text Book of environmental Studies – Erach Bharucha
NPTEL Course Links:	1. https://onlinecourses.nptel.ac.in/noc23_hs155/preview

CONTROL SYSTEMS
II B. Tech. – IV Semester (Code: 24EE401)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basics of Mathematics, Physics and Network Analysis.

Course Objectives: Make the students

- To **provide** students with a fundamental understanding of control systems by introducing different types of systems, feedback mechanisms, and mathematical modeling techniques such as transfer functions, block diagrams, and signal flow graphs.
- To **enable** students to analyze system performance in the time domain by evaluating transient and steady-state responses, error constants, and stability criteria using standard test signals.
- To **develop** students' skills in frequency-domain analysis and stability assessment using techniques such as Bode plots, Nyquist plots, and Root Locus, and to establish the relationship between time and frequency responses.
- To **equip** students with controller and compensator design techniques by applying Proportional–Integral–Derivative (PID) controllers, lead–lag compensators, and state-space methods, while ensuring system controllability and observability.

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

CO1	Students will be able to **interpret** different physical systems, **develop** mathematical models, and **simplify** them using block diagram reduction techniques.
CO2	Students will be able to **employ** time-domain analysis to **evaluate** transient and steady-state performance parameters and **assess** system stability using complex-domain techniques.
CO3	Students will be able to **formulate** and **conduct** system analysis in both time and frequency domains using Bode plots, Nyquist plots, and Root Locus techniques to **predict** system dynamic behavior and performance.
CO4	Students will be able **to identify** the required dynamic response, **apply** appropriate control techniques, and **assess** system controllability and observability using state-space analysis to **design** effective controllers.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	2	2	-	-	-	1	1	1	3	2	2
CO2	3	3	2	3	2	-	-	-	1	1	1	3	3	2
CO3	3	3	3	3	2	-	-	-	1	1	1	3	3	3
CO4	3	3	3	3	3	-	-	-	1	1	1	3	3	3

UNIT-I

Introduction to Control Systems: Basic concepts and classification of control systems,Open-loop and closed-loop control systems, Effects of feedback on system performance (sensitivity, bandwidth, and disturbance rejection),Linear Time-Invariant (LTI), Time-Variant, and Nonlinear Control Systems.

Modeling of LTI Systems: Mathematical modeling of physical systems, Transfer function derivation, Block diagram representation and reduction techniques, Signal Flow Graph (SFG) and Mason's Gain Formula.	
UNIT-II	
Time Domain Analysis: Standard test signals, Step, Ramp, Parabolic, and Impulse response, Time response of first-order and second-order systems, Performance indices: Rise time, peak time, settling time, and overshoot. **Errors in Response and Stability:** Steady-state error and error constants, Effect of additional poles and zeros on system response, Basic concepts of stability and Routh-Hurwitz Criterion	
UNIT-III	
Frequency Response Analysis: Frequency response characteristics and time-domain correlation, Bode plots – Gain margin and phase margin, Nyquist stability criterion and Nyquist plots, Polar plots and their significance. **Root Locus Technique:** Definition and properties, Construction of Root Locus, Effects of pole-zero addition on stability, Introduction to controller design using Root Locus	
UNIT-IV	
Design of Controllers and Compensators: Proportional (P), Integral (I), and Derivative (D) controllers, Lead, Lag, and Lead-Lag compensation techniques, Design of feedback controllers using frequency domain methods. **State Space Analysis:** Concepts of state variables and state-space representation, Solution of state equations using Laplace Transform, Controllability and Observability – Kalman's criteria System diagonalization.	
Text Books :	1. I.J. Nagrath and M. Gopal "Control Systems Engineering" 6th edition was published in 2018 by New Age International Pvt Ltd. 2. S.K. Bhattacharya "Control Systems Engineering" 3rd edition was published in 2013 by Pearson Education India.
References:	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., 5Edition, 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 Education3rd Edition, 2017.
NPTEL Course Links:	1. NPTEL: Electrical Engineering Control, engineering-https://nptel.ac.in/courses/108/ 106/ 108106098/ 2. NPTEL :: Electrical Engineering Control Engineering-https://nptel.ac.in/courses/ 108/102/108102043/ 3. NPTEL :: Electrical Engineering-Control Engineering-https://nptel.ac.in/courses/108/102/108102044/ 4. NPTEL :: Engineering Design-NOC: Control systemshttps://nptel.ac.in/courses/107/106/107106081/

LINEAR INTEGRATED CIRCUITS
II B. Tech. – IV Semester (Code: 24EE402)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basics of Mathematics, Physics.

Course Objectives: To make the students

- **Describe** op-amp circuits to perform arithmetic operations.
- **Analyze** linear and non-linear applications using op-amps.
- **Evaluate** A/D and D/A converters for signal processing applications.
- **Analyze** oscillators and filters using functional ICs.

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

CO1	**Understand** operational amplifier fundamentals including characteristics and configurations.
CO2	**Analyze** linear and non-linear applications of op-amps such as amplifiers, oscillators, and comparators.
CO3	**Apply** A/D and D/A conversion techniques for signal processing applications
CO4	**Explore** special ICs and active filters for waveform generation and frequency selective circuits.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	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	-	-

UNIT-I

Introduction to Op-Amp: Introduction to op-amps, ideal Characteristics, Pin configuration of 741 op-amps. Bias, offsets and drift, bandwidth and slew rate. Offset and Frequency compensation. Inverting and noninverting amplifiers and their analysis. Applications: inverting and non-inverting summers, difference amplifier, Instrumentation Amplifier, differentiator and integrator, Absolute value output circuit, Peak detector, Sample and hold circuit.

UNIT-II

Op-Amp Applications: Oscillator principles - Oscillator types - Frequency stability - Phase shift oscillator - Wein bridge oscillator - Quadrature oscillator - Square-wave generator - Triangular wave generator - Saw tooth wave generator - Voltage controlled oscillator.

Comparators: Introduction to comparator - Basic comparator - Zero-crossing detector - Schmitt Trigger - Comparator characteristics - Limitations of Op-Amps as comparators - Voltage limiters.

UNIT-III	
ADCs and DACs: D/A conversion fundamentals - Weighted resistor summing D/A Converter - R-2R Ladder D/A converter. A/D conversion: Ramp converters - Successive Approximation A/D converters - Dual slope converters - Parallel A/D converters - Tracking A/D converters.	
UNIT-IV	
Applications of Special ICS: The 555 timer - 555 as Monostable and Astable Multivibrator and applications. Phase Locked Loops - Operating principles. **Active Filters**: Active LP and HP filters - Band pass filters: Wideband - Narrow Band pass filters - Band stop filters, All pass filters.	
Text Books :	1. Rama Kant A. Gayakwad, Op-Amps and Linear Integrated Circuits, 4th Edition, PHI/ Pearson Education, 2003 2. D.Roy and Choudhury, Shail B.Jain, Linear Integrated Circuits, 2nd Edition, New Age International, 2003.
References :	1. Denton J Dailey, Operational Amplifiers and Linear Integrated Circuit Theory and Applications TMH. 2. J. Michael Jacob, Applications and Design with Analog Integrated Circuits, 2nd Edition, PHI, 2003.
NPTEL Course Links:	1. NPTEL::Electrical Engineering: Analog Electronic Circuits, https://nptel.ac.in/courses/108102112

ELECTRICAL MACHINES-II
II B.Tech – IV Semester (Code: 24EE403)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basic Physics, Basic Mathematics, DC Machines and Transformers.

Course Objectives: To make the students

- **Explain** the construction of Three-phase Asynchronous motors and its characteristics.
- **Explain** the construction and operation of 1-phase Induction motors.
- **Understand** the construction, operation and performance of Servo motors & BLDC Motors.
- **Gain** knowledge about construction, operation and performance of Stepper motors & Switched reluctance motors.

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

CO1	**Describe** the operation of Induction motors and its characteristics.
CO2	**Assess** the construction and operation of 1-phase Induction motors.
CO3	**Analyze** operation and performance of Servo motors & BLDC Motors.
CO4	**Analyze** operation and performance of Stepper motors & Switched reluctance motors.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	Pos											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	2	-	-	-	-	-	-	2	3	2	-
CO2	3	3	2	3	-	-	-	-	-	-	2	3	2	-
CO3	3	3	2	2	-	-	-	-	-	-	2	3	2	-
CO4	3	3	3	2	-	-	-	-	-	-	2	3	2	-

UNIT-I

Induction Machines: Construction and types of induction motors-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 methods of induction motor-Induction generator.

UNIT-II

Single-Phase Induction Motors: Constructional features-working principle- equivalent circuit-various starting methods-characteristics-applications.

Single Phase Special Electrical Machines: AC series Motor, Repulsion motor, Hysteresis motor, Universal Motor-Shaded Pole Motor-construction-principle of operation–applications.

UNIT-III

AC and DC servo motors, Constructional features, and Principle of operation, Torque production, Performance Characteristics, applications and Transfer function.

Permanent Magnet Synchronous Motors (PMSM): Permanent magnet machines-types, Principle of operation, EMF and torque equation, Torque speed characteristics, Transfer function of PMSM, and closed loop control scheme of PMSM.

Permanent Magnet Brushless DC Motor: Constructional Features-Principle of operation-types- EMF and torque equation-Torque- speed characteristics, speed control methods and its applications.

UNIT-IV

Stepper Motor: Constructional features, Principle of operation, Modes of excitation, Drive system and circuit for open loop control, closed loop control and applications.

Switched Reluctance Motor (SRM): Switched Reluctance Motor-Constructional features-Principle of operation- Torque equation- Characteristics-speed control methods of SRM-Applications.

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. 3. E.G.Janardanan, "Special Electrical Machines", PHI learning Private limited, Delhi first edition re printed in 2014.
References :	1.A.E. Fritzgerald, C. Kingsley & S. Umans –Electric Machinary, McGraw-Hill Companies, 6th Edition 2017 2. J. B. Gupta, Theory & performance of Electric Machines, S.K. Kataria&Sons,15th Edition, 2015 3. K. Venkataratnam "Special Electrical Machines" Universities Press (India) Private Limited, Hyderabad, First Edition reprinted in 2013. 4. R.S.Krishnan "Switched Reluctance Motor Drives: Modeling Simulation Analysis, Design and Application" CRC press 2001. 5. R.S.Krishnan "Permanent Magnet Synchronous Motor and Brushless DC Motor Drives" Rc press First edition, 2002. 6. Kenjo, T " Stepping Motor and their Microprocessor control", Clarendon press Oxford, Second edition, 1989.
NPTEL Course 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/ 3. https://unacademy.com/course/special-electrical-machines/21AZBGE3

SIGNALS AND SYSTEMS

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

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basic Physics, Basic Mathematics.

Course Objectives: To make the students

- **Explain** the concepts of continuous time and discrete time Signals.
- **Gain** knowledge about LTI systems and its time domain analysis.
- **Represent** the system in the frequency domain using Fourier analysis tool like CTFS, DTFS, DTFT and DFT.
- **Analyse** discrete time systems using Z-Transform.
- **Describe** sampling theorem and its implications.

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

CO1	**Explain** the concepts of continuous time and discrete time signals.
CO2	**Demonstrate and analyse** continuous and discrete LTI systems.
CO3	**Determine** the frequency response of continuous and discrete time systems using Fourier analysis tools.
CO4	**Analysis** of discrete time systems using Z- transforms.
CO5	**Illustrate** sampling theorem and reconstruct of signals.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	Pos											PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	2	3	-	-	-	-	-	-	1	3	2	2
CO2	3	3	2	3	-	-	-	-	-	-	1	3	2	2
CO3	3	3	2	3	-	-	-	-	-	-	1	3	2	2
CO4	3	3	2	3	-	-	-	-	-	-	1	3	2	2
CO5	3	3	2	3	-	-	-	-	-	-	1	3	2	2

UNIT-I

Introduction to Signals: Representation of continuous & discrete time signals, Signal properties, Basic operations on continuous and discrete time signals, continuous special signals and discrete special signals.

UNIT-II

Introduction to Systems & Behavior of LTI Systems: System properties, Convolution, interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. Impulse response and step response.

UNIT-III

Fourier Series: Introduction, Fourier series representation of continuous-time periodic signals, Convergence of the Fourier series, Properties of continuous-time Fourier series.

Fourier Transforms: Introduction, Representation of aperiodic signals: The continuous Fourier transform, The Fourier transform for periodic signals, Properties of the Continuous-time Fourier transform.	
UNIT-IV	
Z-Transform: The Z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, Z-domain analysis. **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.	
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.
References :	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. M. J. Robert, Fundamentals of Signals and Systems, McGraw Hill Education, 2007. 4. Dr. P Ramesh Babu, Digital Signal Processing, Scitech Publications (India) Pvt Ltd, 7th Revised Edition 2011. 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/

GENERATION AND TRANSMISSION

II B. Tech. – IV Semester (Code: 24EE405)

Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basics of Mathematics, Electrical Machines, Electro Magnetic Fields.

Course Objectives: Students will be able

- **Discuss** the economic 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: At the end of this course, Students will be able to

CO1	**Explain** the economic 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 modeling of different types of transmission line.
CO4	**Demonstrate** the types of insulators and illustrate mechanical design, the travelling wave's phenomenon on transmission lines.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	2	1	1	2	-	-	-	-	-	3	2	2
CO2	3	3	2	2	2	3	-	-	-	-	-	3	3	2
CO3	3	3	3	2	2	2	-	-	-	-	-	3	3	3
CO4	3	3	3	3	2	1	-	-	-	-	-	3	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. Causes of low power factor its improvement methods. 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.

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 and capacitance for single phase and three phase double circuit lines, concept of GMR & GMD; symmetrical and asymmetrical conductor configuration with and without transposition.

Transmission line theory: Short, medium and long lines – regulation and efficiency - π, T and rigorous methods of solution - ABCD constants. Surge impedance loading - Ferranti effect.

UNIT-IV

Insulators, Corona: Types of Insulators calculation of String efficiency and Methods for improving of string efficiency. Failure of insulator and testing. 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, sag template.

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, Attenuation and Distortion, Arcing ground.

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.
References :	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(EncapsulatedfromearlierVideo), **https://nptel.ac.in/courses/108/102/108102047/** 2. NPTEL :: ElectricalEngineering-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

PYTHON PROGRAMMING LAB

II B. Tech. – IV Semester (Code: 24EEL401/SEC2)

Lectures	1	Tutorial	0	Practical	2	Credits	2
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Fundamentals of Computing.

Course Objectives: To make the students

- **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.
- **To enable** students to use NumPy, Pandas and Matplotlib libraries for Data analysis.

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

CO1	**Explain** basic concepts on Python constructs.
CO2	**Practice** programs using sequences in Python.
CO3	**Demonstrate** Object oriented programming concepts of python.
CO4	**Illustrate** handling of errors, exceptions and libraries for data analysis.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	Pos											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	3	3	2	3	3	-	-	3	-	3	3	-	-
CO2	2	3	3	2	3	-	-	-	3	-	3	3	-	-
CO3	2	3	3	2	3	-	-	-	3	-	3	3	-	-
CO4	2	3	3	3	3	-	-	-	3	-	3	3	-	-

UNIT-I

Introduction to Python basics, including its features, variables, data types, expressions, operators, and input/output. **Conditional execution** using if, logical operators, and exception handling. **Looping** constructs like while and for. **Function** definitions, built-in functions, and parameter passing**.**

UNIT-II

Strings as sequences, string operations, slicing, methods, and formatting. **File I/O concepts** like reading/writing files and using exceptions. **Lists** and their operations, mutability, and parsing. Sets and their methods, operations, and comprehensions. **Tuples**, **Dictionaries**, dictionary operations, text parsing, and data handling.

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, Many Instances, Inheritance.

UNIT-IV

Exception Handling: Errors and Exceptions. **NumPy array:** Generate NumPy arrays and construct multidimensional arrays. **Libraries for Data Analysis:** Introduction to Pandas and Matplotlib.

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 python program to find mean, mode, median and standard deviation using statistics module.
5. Write a script to print Fibonacci numbers up to and including the first command line argument.
6. Write a python program utilizing a list to display the name of a month based on a given month number.
7. Write a simple script that reads from a file detail of students in a section and finds top ten meritorious students in the section.
8. Write a script to Implement Stack.
9. Write a script to Implement Queue.
10. Write a python program to multiply two matrices using NumPy.
11. Write programs to perform following operations using pandas.
    a).Create a data frame b) Read and Write CSV files c) Insert -delete d) Group-merge e) Data visualization f) Creation of Pivot tables.

Text Books :	1. Charles R Severance, "Python for Everybody: Exploring Data in Python 3. 4", ISBN 978 1530051120, 2016. 2. Ljubomir Perkovic. ,"Introduction to Computing Using Python: An Application Development Focus", Wiley, 2 edition, 8 2015. ISBN 9781118890943.
References :	1. Kenneth A. Lambert., "Fundamentals of Python: First Programs", Cengage, 2nd edition, 2019. ISBN 9781337560092. 2. Guido van Rossum and Jr Fred L. Drake,"Python Tutorial", Python Software Foundation. doi: https: //docs.python.org/3/.
NPTEL Course Links:	1. https://www.python.org/doc/ 2. https://www.w3schools.com/python/python_reference.asp

ELECTRICAL MACHINES -I LAB

II B.Tech – IV Semester (Code: 24EEL402)

Lectures	0	Tutorial	0	Practical	3	Credits	1.5
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Circuit Theory lab.

Course Objectives: To make the students

- **To develop** experimental setups for studying the performance and operation of DC Generators and DC motors.
- **To explore** and understand the experimental setups to study the performance and operation of Transformers under various conditions.
- **Acquire** hands on experience of conducting various tests on alternators and obtaining their performance indices using standard analytical as well as graphical methods.
- **To develop** experimental setups for studying the performance and operation of Synchronous Motors.

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

CO1	**To analyze** and evaluate the performance characteristics of DC generators and motors.
CO2	**Examine** the performance of single-phase transformer.
CO3	**To examine** and understand the performance aspects of synchronous generators.
CO4	**Examine** the performance of the Synchronous Motor.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	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. Load test on D.C Shunt Generator.
2. Load test on D.C Compound Generator.
3. Load test on D.C series Generator.
4. Speed control of DC Shunt motor.
5. Swinburne's Test on a D.C Shunt Motor
6. Brake test on D.C Shunt Motor.
7. OC & SC tests on single - phase transformer. (Equivalent circuit parameters, efficiency and voltage regulation)
8. Load test on single - phase transformer.(Efficiency and voltage regulation)
9. Sumpner's test on two single-phase Transformers. (Efficiency and voltage regulation)

10. Scott Connection of Transformers.
11. Parallel Operation of two Single - Phase Transformers.
12. Regulation of alternator by EMF method.
13. Regulation of alternator by ZPF method.
14. Synchronization of alternator with infinite busbar with P & Q control.
15. Load test on 3-phase Alternator
16. V and inverted V curves of synchronous motor.
17. Synchronous Motor performance with Normal, over and under excitations.

Note: Student Minimum 10 experiments should be carried out in above list.

DIGITAL ELECTRONICS AND LINEAR INTEGRATED CIRCUITS LAB
II B.Tech – IV Semester (Code: 24EEL403)

Lectures	0	Tutorial	0	Practical	3	Credits	1
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Digital Electronics and Linear Integrated Circuits.

Course Objectives: To make the students

- **Design** and verify different types of logic gates using universal gates, combinational logic circuits, code converters and comparator circuits.
- **Design** MUX, DEMUX, Counters and Flip-Flops using logic gates.
- **Analyze** and design various applications of Op-Amp and waveform generation circuits.
- **Design** of 555 Timer, RC Phase Shift Oscillator and Schmitt Trigger circuit.

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

CO1	**Verify** different types of logic gates using universal gates, combinational logic circuits, code converters and comparator circuits.
CO2	**Examine** MUX, DEMUX, Counters and Flip-Flops using logic gates.
CO3	**Ability** to use Op-Amp to design various applications like comparators, active filters and waveform generators.
CO4	**Test and Design** 555 Timer, RC Phase Shift Oscillator and Schmitt Trigger circuit.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	3	-	-	-	3	2	-	2	3	-	-
CO2	3	3	2	3	-	-	-	3	2	-	2	3	-	-
CO3	3	3	2	3	-	-	-	3	2	-	2	3	-	-
CO4	3	3	2	3	-	-	-	3	2	-	2	3	-	-

LIST OF EXPERIMENTS

1. Realization of Logic Gates Using Discrete Components & Universal Building Blocks.
2. Design of Combinational Logic Circuits like half-adder, Full adder, Half-subtractor and Full-subtractor.
3. Design of Code Converters.
4. Design of 4 Bit Magnitude Comparator.
5. Design of 4X1 Multiplexer and 1X4 Demultiplexer.
6. Realization of RS-JK & D Flip-Flop using Logic Gates.
7. Design of Synchronous Counter, Mod Counter, UP Counter, Down Counter and UP/Down Counter Using Flip Flops.
8. Design of Adder, Subtractor and Comparator circuits using Op-Amp.
9. Design of Integrator and Differentiator Using IC741 Op-Amp.

10. Design of Active Filters – LPF and HPF.
11. IC741 Waveform Generators – Sine, Sqaure and Triangular Waves.
12. IC555 Timer – Monostable and Astable Multivibrators.
13. Design of RC Phase Shift Oscillator.
14. Schmitt Trigger circuit using IC 741.
15. Design a 4-bit R-2R ladder type of digital to analog converter.

Note: Minimum 10 experiments should be carried out.

HEALTH AND WELLNESS YOGA AND SPORTS
II B.Tech – IV Semester (Code: 24EEL404)

Lectures	0	Tutorial	0	Practical	1	Credits	0.5
Continuous Internal Evaluation			0	Semester End Examination			100

Pre-Requisite:None.

Course Objectives: Students will be able

- The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life.
- It mainly enhances the essential traits required for the development of the personality.

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

CO1	**Outline** the importance of yoga and sports for Physical fitness and sound health.
CO2	**Make** use of various activities that help to enhance their health.
CO3	**Develop** Positive Personality for individual and group work.
CO4	**Categorize** the health-related fitness components and analyze the current personal fitness levels.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	-	-	-	-	-	-	-	-	2	-	3	-	-	-
CO2	-	-	-	-	-	-	-	-	2	-	3	-	-	-
CO3	-	-	-	-	-	-	-	-	2	-	3	-	-	-
CO4	-	-	-	-	-	-	-	-	2	-	3	-	-	-

UNIT-I

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

Activities:

i) Organizing health awareness programs in community.
ii) Preparation of health profile.
iii) Preparation of chart for balance diet for all age groups.

UNIT-II

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas-Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices -Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar.

UNIT-III

i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table Tennis, Cricket etc., Practicing general and specific warm up, aerobics.

ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.	
Text Books:	1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning,2022 2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice 3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
References:	1. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to SurvivingAnywhere Third Edition, William Morrow Paperbacks, 2014. 2. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014

CONSTITUTION OF INDIA

II B. Tech. – IV Semester (Code: 24EE406/MC02)

Lectures	2	Tutorial	0	Practical	0	Credits	0
Continuous Internal Evaluation			40	Semester End Examination			0

Pre-Requisite: None.

Course Objectives: To make the students

- **To provide** basic information about fundamental law of the country.
- **To educate** the student about fundamental Rights and fundamental duties of citizens.
- **To educate** the students about Government organs, methods of functioning
- **To motivate** students to leave narrow selfish outlook and inculcate broad national, human outlook.

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

CO1	**Understand** the importance of the constitution in a Democratic Society
CO2	**Understand** the fundamental rights, duties of a citizen by discharging his duties to become a good citizen.
CO3	**Remember** about judicial supremacy and independence of judiciary and fight for his legitimate rights through court of law.
CO4	**Applying** the principles to participate in the democratic process of governance and in nation building activities.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	Pos											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	1	2	2	-	1	-	-	-	3	-	3	3	-	-
CO2	-	-	1	1	1	2	-	-	-	-	3	3	3	2
CO3	-	-	1	-	1	-	2	-	-	-	3	3	-	-
CO4	3	1	2	-	-	2	-	-	3	-	1	3	2	-

UNIT-I

1.1 Meaning of the constitutional law and constitutionalism.
1.2 Historical perceptive of the constitution of India.
1.3 Salient features and characteristics of the constitution of India.
1.4 Preamble, union and its territory and citizenship.

UNIT-II

2.1 Fundamental rights principles.
2.2 Directive principles of state policy.
2.3 Fundamental duties.
2.4 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	
3.1 The Machinery of Government in the states, The Governor, The Chief Minister and council of Ministers, The State legislature, High court, Judiciary in the states 3.2 Union territories. 3.3 The Federal System, division of powers between centre and states, legislative administration and financial relation. 3.4 Emergency Provisions, President Rule, National Emergency, Financial Emergency.	
UNIT-IV	
4.1 Local self-Government, Panchayat Raj, Municipalities and municipal Corporation 4.2 Miscellaneous Provisions, the comptroller and Auditor general of India, The Public Service commission, Special Provisions relating to certain classes, Elections — Political parties. 4.3 Amendment of the Constitution. 4.4 Laws Relating to Women	
Text Books:	1. Introduction to constitution of India, D.D.Basu, 24th Edition, Lexis Nexus, 2019. 2. The constitution of India by P.M.Bhakshi, 18th Edition, UniversaI law publishing, 2021.
References:	1. Constitutional Government in India - M V Pylee , Kindle Edition, Asia Publishing House, 2004. 2. Indian Government and Politics — D C Dasgupta,8th Edition,Vikas Publishing house, 2007. 3. The Oxford Hand Book of the Indian Constitution, Sujit Chowdary, Madhav Khosla Pratapabhem Mehla, oxford university press UK, 2016. 4. Laws Relating to Women, National Commission For Women, New Delhi, July 2020.
NPTEL Course Links:	1. https://archive.nptel.ac.in/courses/129/106/129106002/

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MICROPROCESSORS AND MICROCONTROLLERS
III B. Tech. – I Semester (Code: 24EE501)

Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Digital Logic Design.

Course Objectives: To make the students

- Understand the architecture, operation, and assembly language programming of the Intel 8086.
- Apply interfacing techniques of the Intel 8086 with memory and peripheral devices.
- Comprehend the architecture, programming, and interfacing of the 8051 Microcontroller.
- Understand the fundamentals of advanced processors, particularly ARM Cortex-M series architecture and programming concepts.

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

CO1	Explain the architecture and operation, and to develop assembly language programs for 8086 microprocessors.
CO2	Implement 8086 processor concepts for interfacing with the required peripherals.
CO3	Demonstrate the architecture of the 8051 Microcontroller and perform interfacing with the required peripherals.
CO4	Comprehend the fundamental concepts of advanced processors, particularly ARM processors.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	2	1	2	-	-	2	-	1	2	3	2	2
CO2	3	3	3	2	3	1	-	2	1	1	2	3	2	2
CO3	3	3	3	2	3	1	-	2	1	1	2	3	2	2
CO4	3	2	2	1	2	-	-	2	2	1	3	3	2	2

UNIT-I

Introduction: Basic Microprocessor architecture, Microprocessor Unit versus Microcontroller Unit, History and classifications of Microprocessor and Microcontroller.

8086 Architecture: register organization, internal architecture of 8086, pin description of 8086, minimum mode and maximum mode of 8086 operation and timing diagrams. **8086 Programming:** instruction set, addressing modes, assembler directives, programming with an assembler, writing simple programs with an assembler, stack, interrupts and interrupt service routines.
UNIT-II
8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing seven segment displays, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, and the need for 8259 programmable interrupt controllers.
UNIT-III
Intel 8051 Microcontroller: Architecture, Hardware concepts, input/output ports and circuits, external memory, counters/timers, serial data input/output, interrupts. Assembly language programming: Instructions, addressing modes, simple programs. **Interfacing to 8051:** Stepper motor interface, keyboard, LCD Interfacing, Traffic light control.
UNIT-IV
ARM Architectures and Processors: Introduction to CISC and RISC architectures, ARM Architecture, ARM Processors Families, ARM Cortex-M Series Family, ARM Cortex-M3 Processor Functional Description, Instruction set summary, System address map, write buffer, bit-banding. Programmers Model – Modes of operation and execution, stack pointer, exceptions and interrupt handling.

Text Books:	1. Advanced microprocessors and peripherals by K. M. Bhurchandi, A. K. Ray 3e Tata Mcgraw Hill,2012. 2. The 8051 Microcontrollers and Embedded systems Using Assembly and C, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D.McKinlay; Pearson 2-Edition,2011. 3. The Definitive Guide to ARM Cortex-M3 and Cortex- M4 Processors by Joseph Yiu Newnes Third edition,2013.
References:	1. Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach in English, by Dr. Alexander G. Dean, Published by Arm EducationMedia,2017. 2. Cortex-M3TechnicalReference Manual. https://www.keil.com/dd/docs/datashts/arm/cortex_m3/r2p0/ddi0337g_cortex_m3_r2p0_trm.pdf

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NPTEL Course Links:	1. https://onlinecourses.nptel.ac.in/noc25_ee49/preview?utm_source=chatgpt.com 2. https://elearn.nptel.ac.in/shop/nptel/microprocessors-and-interfacing/?utm_source=chatgpt.com 3. https://elearn.nptel.ac.in/shop/nptel/embedded-system-design-with-arm/?utm_source=chatgpt.com

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POWER SYSTEM ANALYSIS

III B. Tech. – V Semester (Code: 24EE502)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Linear algebra and differential equations, 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 networks and analysis of Unsymmetrical faults.
- Explain distribution of various supply systems and types of substations.

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

CO1	Explain performance of underground cables and solve all power system problems using per unit system.
CO2	Assess Power flow control of a synchronous machine and analyse the power system networks by using Symmetrical faults.
CO3	Determine the symmetrical components and solve the unsymmetrical faults using symmetrical components.
CO4	Discuss the distribution of various supply systems and types of substations.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	3	3	2	-	-	-	-	-	-	3	2	2
CO2	3	3	3	3	2	2	-	2	-	2	2	3	2	2
CO3	3	3	3	3	2	2	-	2	2	2	2	3	2	3
CO4	3	3	3	3	2	2	-	2	2	2	2	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: Modelling 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.

Substation Practice: Classification of substations, indoor and outdoor substations.

Text Books:	1. John J. Grainer, W D Stevenson Jr, Power System Analysis, McGraw Hill Education, 2nd edition, 2017 2. D P Kothari, I J Nagrath, Power System Engineering, McGraw-Hill Education, 3rd Edition, 2019
References:	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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POWER ELECTRONICS
III B. Tech. – V Semester (Code: 24EE503)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basic Electronic Devices, Linear Integrated Circuits, Circuit Theory.

Course Objectives: To make the students

- **Discuss** the thyristor and its family devices, ratings and protection.
- **Deducing** AC to DC Conversion circuits with various loads
- **Outline** the operation of inverters and 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	**Explain** the basic operation and compare performance of various power semiconductor devices, passive components and switching circuits.
CO2	**Describe** the performance of AC to DC Conversion circuits with different loads.
CO3	**Describe** the operation of inverters and apply PWM techniques for power conversion applications.
CO4	**Illustrate** the operation of DC-DC choppers and AC Voltage controllers.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	2	1	2	-	-	-	2	-	3	3	3
CO3	3	3	3	2	2	3	-	2	-	3	2	3	3	3
CO4	3	3	3	2	2	2	-	2	-	2	2	3	3	3

UNIT-I

Introduction to Power Electronics devices and protection: Thyristor family devices. Principle operation-voltage, current and switching characteristics of SCR, TRIAC, MOSFET, IGBT. Turn ON methods of SCR. R, RC, UJT Firing schemes. Commutation. Ratings and protection of SCR.

UNIT-II

AC to DC converters: working principle and operation of Single phase Three phase-Uncontrolled-**S**emi controlled rectifier, Midpoint rectifier, Full controlled rectifier and Dual

converter with R-load, RL-load and RLE loads with and without freewheeling diode. Magnitude and Phase of line current harmonics for uncontrolled and thyristor-based converters; Power factor and Distortion Factor of AC to DC converters. Single phase asymmetrical rectifier. Effect of source inductance in single phase and three phase rectifiers. Numerical Problems on AC to DC converters. Applications of AC to DC converters.

UNIT-III

Inverters: Basics principle and operation of single-phase half bridge inverter and full bridge inverter with R, RL load. Three phase voltage source inverter (VSI) with 180^0 and 120^0 modes of operation. Current Source Inverter, Bidirectional voltage source converter. **PWM techniques**- Single pulse width modulation, Multiple pulse width modulation, Square wave and sinusoidal pulse width modulation (SPWM) control methods. Numerical Problems and Inverter applications.

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 converters, single-phase and three-phase ac voltage controller circuit configuration with R, RL load Analysis. **Cyclo-Converters**: Single-phase center taped and bridge type cycloconverter, three-phase to single-phase circuit configuration. Numerical Problems and Applications.

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.
References :	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, 7th Edition, 2022. 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. 3. https://doi.org/10.1051/e3sconf/202454703002

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ELECTRICAL POWER DISTRIBUTION SYSTEMS
III B. Tech. – V Semester (Code: 24EE504/PE1A)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basics of Mathematics.

Course Objectives: To make the students

- Describe the distribution system planning models and study different load characteristics.
- Illustrate the different types of distribution transformers and sub-transmission systems.
- Learn about the primary distribution system, secondary distribution systems and about protection devices.
- Determine voltage drop and power loss for non-three phase primary lines.

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

CO1	Explain the various factors affecting the distribution system and also about distribution system planning.
CO2	Illustrate the Distribution Transformers, voltage regulation, Efficiency calculations and design considerations of sub-transmission lines.
CO3	Classify the substation, feeders, primary and secondary distribution systems, also the protective devices.
CO4	Determine the voltage drop, line loss calculation and the effect of compensation on power factor improvement.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	2	2	2	-	-	-	-	-	2	3	2	2
CO2	3	2	2	2	2	-	-	2	2	2	2	3	2	2
CO3	3	2	2	2	2	2	-	2	2	2	2	3	2	2
CO4	3	2	2	2	2	2	-	2	2	2	2	3	2	2

UNIT-I

Distribution system planning and automation: Distribution systems planning – Factors affecting systems planning – Present distribution system planning techniques-distribution system planning models - present and future role of computers in distribution system planning,

Introduction to automation-DAC & SCADA. - Load characteristics – Definitions load growth – tariffs - Diversified demand method.
UNIT-II
Distribution transformers: Types - Regulation and Efficiency- distribution factors – KW KVA Method of determining regulation. **Design of sub transmission lines and distribution substations:** Introduction – sub transmission systems - distribution substation – Substation bus schemes - description and comparison of switching schemes – substation location and rating.
UNIT-III
Design considerations on primary systems: Introduction, types of feeders, - voltage levels Radial type feeders, feeders with uniformly distributed load and non-uniformly distributed loads. **Design considerations of secondary systems**: Introduction, secondary voltage levels, - Secondary banking, existing systems improvement. Distribution system Protection: Basic definitions, fuses, automatic circuit reclosures, automatic line sectionalizer, coordination of protective devices.
UNIT-IV
Voltage drop and power loss calculations: Three phase primary lines, non 3 phase primary lines, 4 wire multi grounded primary lines, copper loss, Distribution feeder costs, loss reduction and voltage improvement in rural distribution networks. **Distribution System Voltage Regulation:** Basic definitions, Quality of service, voltage control, line drop compensation.

Text Books:	1. Turan Gönen, Chee-Wooi Ten, Ali Mehrizi-Sani – *Electric Power Distribution Engineering*, CRC Press, 4th edition 2024. 2. Dr. V. Kamaraju, Electrical distribution systems, McGraw hill, 2017.
References:	1. A.S. Pabla, Electric Power Distribution TMH, 7th Edition. 2019. 2. James J. Burke, *Power Distribution Engineering*, 2nd ed. Boca Raton, FL, USA: CRC Press, 2017.
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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UTILIZATION OF ELECTRICAL POWER
III B. Tech. – V Semester (Code: 24EE504/PE1B)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Electrical Machines.

Course Objectives: To make the students

- To derive the heating and cooling curve and to study the various classes of duty and Selection of power rating.
- Provides knowledge on electrical traction systems
- To discuss different methods of electrical heating and electric welding.
- To make students learn the various usage of electrical energy such as illumination, heating, welding etc.

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

CO1	Apply the principles of motor rating selection, load equalization, and electric braking methods for DC and induction motor drive applications.
CO2	Describe the mechanics of train movement & understand the basic principle of electric traction including speed– time curves of different traction services
CO3	Identify the usage of various types of Heating and Welding systems based on the application.
CO4	Design Illumination systems for various applications

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	3	2	-	-	-	-	-	-	2	3	2	2
CO2	3	3	2	2	3	-	-	-	-	2	2	3	2	2
CO3	2	2	3	1	2	-	2	2	3	2	2	2	2	2
CO4	3	2	3	2	2	-	3	2	3	2	2	2	3	3

UNIT-I

Motor Power Rating and selection: General considerations in selecting motor power ratings - Selection of motor capacity for continuous duty - Equivalent current - torque and power methods - Selection of capacity for short time and intermittent periodic duty - Heating and cooling of motors - Load equalization - fly wheel and its applications in load equalization. Electric braking

advantages - plugging - dynamic and regenerative braking applied to DC motors and Induction motors.

UNIT-II

Electric Traction

Train movement: Typical speed-time curves, Crest speed average speed and schedule speed, Factors affecting schedule speed, Simplified speed-time curves, Mechanics of train movement, Tractive effort for propulsion of train.

Energy consumption: Power output from the driving axles, Energy output from the driving axles, Specific energy output using simplified speed-time curve, Factors affecting specific energy consumption, Dead weight accelerating weight and adhesive weight.

Control of traction motors: series – parallel method of speed control shunt bridge transition – collectors - different types of electric braking - reverse current - dynamic and regenerative braking. Counter current braking and reversal of shunt motors.

UNIT-III

Electric Heating: Elementary principles of heat transfer - Stefan's law - electric arc furnaces - Resistance heating - design of heating element - losses and efficiency - Construction and working of different types of induction furnaces - Dielectric heating - arc furnaces .
Electric Welding Types of welding – resistance and arc welding - characteristics of Carbon and metallic arc welding - comparison (Excluding electronic controls).

UNIT-IV

Illumination: Terms used in illumination, Laws of illumination, polar curves, Gas discharge lamps - Fluorescent lamps - Ultraviolet lamps - Arc lamps - Filament lamps –CFL'S -LEDS-Lighting calculations -solid angle and square law methods of calculation – Domestic lighting-Factory lighting -Flood lighting and street lighting.

Text Books:	1.J.B.Gupta, "Utilization of Electrical Power and Electric Traction",S.K.Kataria & sons publications, 9th edition 2. Sunil S Rao, "Utilization, generation & conservation of electrical energy", by Khanna publishers, first edition 2005. 3. G.C.Garg, utilization of electric power and electrric traction. Khanna publishers, 2004.
References:	1. CL Wadhwa, "Generation distribution and utilization of electrical energy", New Age 2005. 2. M.L.Soni, P.V.Gupta, U. S. Bhatnagar and A Chakraborti, "A Text Book on Power System Engineering",DhanpatRai& Co. Pvt. Ltd., 2001.

	3. Openshaw Taylor, "Utilization Electric Power", Orient Longman, 1986. 4. Partab H, "Art and Science of Utilization of Electrical Energy", DhanpatRai and Sons, Second edition. 5. Energy Efficiency in Electrical Utilities, BEE guide book, 2010.
NPTEL Course Links:	1. http://nptel.iitm.ac.in/video.php?subjectId=108105060 2.http://www.nptel.ac.in/courses/108105061/Illumination%20%20Engineering/Lesson20/pdf/L20(NKK)(IE)%20((EE)NPTEL).pdf 3. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/ 4. www.bee-india.org 5. www.irfca.org

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OPTIMIZATION TECHNIQUES

III B. Tech. – V Semester (Code: 24EE504/PE1C)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basics of Mathematics.

Course Objectives: To make the students

- Apply optimization techniques to formulate, classify, and solve single-variable and equality-constrained problems using design variables, objective function.
- Explain the Concepts to solve linear programming problems arise in real life situations involving several parameters using various methods and their advantages.
- Discuss the applications of linear programming namely transportation, assignment and travelling salesman problem which arise in different situations in all engineering branches.
- Explain the non-linearity in optimization problems, direct search techniques and iterative methods.

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

CO1	Apply the optimization problem without and with constraints to classical optimization techniques to minimize or maximize.
CO2	Develop the mathematical model of an optimization problem and solve a given linear programming problem using suitable method.
CO3	Determine the solution for a special type linear programming problem namely transportation, assignment & travelling salesman problem.
CO4	Describe the characteristics of non-linearity in optimization and solve certain NLPP using searching and iterative techniques.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	3	2	-	-	-	-	-	-	3	3	2	2
CO2	3	3	3	2	-	-	-	2	2	2	3	3	2	2
CO3	3	3	3	2	-	-	-	2	2	2	3	3	2	2
CO4	3	3	3	2	-	-	-	2	2	2	3	3	2	2

UNIT-I
Introduction to Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – objective function classification of Optimization problems. **Classical Optimization Techniques:** Single variable Optimization with and without constraints – necessary and sufficient conditions for minimum/maximum.
UNIT-II
Linear Programming Problems (LPP): Mathematical models and basic concepts of linear programming problem; Solution of linear programming problems - Graphical method, Analytical method, Simplex method, Artificial variable technique (Big-M and Two-phase methods), Duality principle and dual simplex method.
UNIT-III
Special type of LPPs: Mathematical model of transportation problem, Methods of finding initial basic feasible solution to find the optimal solution of transportation problem, Exceptional cases in transportation problem, Degenerate solution of transportation problem, Assignment problem as a special case of transportation problem, Hungarian algorithm to solve an assignment problem.
UNIT-IV
Non-linear Programming Problems (NLPP): Classical method of optimization using Hessian matrix, Iterative methods - Random search methods, Steepest decent method and Conjugate gradient method. **Dynamic Programming:** Principle of optimality – recursive relations – solution of LPP – simple examples.

Text Books:	1. Kanti Swarup, P. K. Gupta, Man Mohan, ―Operations Research, S. Chand & Sons, New Delhi. 16/e., 2013. (Unit I, II) 2. S.S. Rao, ―Optimization Techniques, New Age International, New Delhi, 3/e., 2013.
References:	1. Hamdy. A. Taha, Operations Research, Prentice Hall of India Ltd, New Delhi, 7/e., 2002. 2. J.C. Pant, ―Introduction to Optimization, Jain Brothers, New Delhi, 7/e., 2012. 3. K. V. Mittal: Optimization Methods, Wiley Eastern Ltd. 2005
NPTEL Course Links:	1. NPTEL :: https://onlinecourses.nptel.ac.in/noc26_me09/preview 2. NPTEL :: https://onlinecourses.swayam2.ac.in/elearning/preview/ntr26_ed56 3. NPTEL :: https://onlinecourses.nptel.ac.in/noc26_ma31/preview

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PROMPT ENGINEERING AND AI TOOLS
III B. Tech. – V Semester (Code: 24EE505/JO1A)

Lectures	2	Tutorial	0	Practical	2	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None

Course Objectives: To make the students

- Understand the fundamentals of prompt engineering and effective interaction with AI tools.
- Develop skills to design prompts for generating text, images, and structured outputs.
- Apply AI tools for practical tasks such as content creation, coding assistance, and data annotation.
- Build simple AI-driven applications using prompt-based techniques.

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

CO1	Design effective prompts to generate meaningful and context-aware responses from AI systems.
CO2	Utilize AI tools for content generation, transformation, and analysis across different domains.
CO3	Apply prompt engineering techniques in real-world applications such as chatbots, coding, and media generation.
CO4	Analyze and improve AI-generated outputs for accuracy, efficiency, and relevance.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	2	3	1	3	-	-	-	1	2	2	2	2	2
CO2	2	2	2	2	3	-	-	-	1	2	2	2	2	2
CO3	2	3	3	2	3	1	-	-	2	2	2	2	2	2
CO4	3	3	2	3	2	1	-	-	1	2	3	2	2	2

UNIT-I

Introduction: Understanding Prompting and Prompt Techniques, Five Principles of Prompting, Fundamentals of AI and Language Models, Constructing Effective AI Prompts, Types of Prompts, Components of a Prompt, Challenges and Limitations of Using Prompts Tools & Techniques - Getting Set Up ChatGPT, How Does ChatGPT Sound Human, Understanding ChatGPT Capabilities and Limitations, Training ChatGPT.

UNIT-II

The Art of Text Data Generation with GenAI: Standard Practices for Text Generation, Generating Lists, Universal Translation Through LLMs, Ask For Context, Text Style Unbundling, Identifying the Desired Textual Features, Generating New Content with the Extracted Features, Role Prompting. Generating Text with AI for Content Creation, Using AI for Copy Writing, Creating Social Media Posts. Writing Video Scripts, Using AI for Personalized Messaging, Creating Engaging and Tailored Content with AI, Techniques for Crafting Effective Prompts for Surveys, Assessments.

UNIT-III

Modern AI Tools: Introduction to AI Tools, General AI Assistants: ChatGPT, Creative AI Tools, AI Coding Tools, Productivity Tools, Audio & Voice Tools, Automation Tools, Emerging Trends and Ethics.

UNIT-IV

Building AI Powered Applications: AI Blog Writing, Topic Research, Expert Interview, Generate Outline, Text Generation, Writing Style, Title Optimization, AI Blog Images, User Interface, Ethical Considerations of Using AI for Text and Image Generation.

List of Experiments:

1. Write prompts to generate simple text responses (e.g., greetings, summaries) and Compare outputs when prompts are vague vs. specific
2. Input a paragraph and prompt the AI to rewrite it in different styles (formal, casual, poetic). Observe how prompt wording affects tone.
3. Use prompts to generate structured lists (e.g., top 10 algorithms in machine learning, project ideas). Evaluate completeness and accuracy.
4. Use modern AI tools for generating PPT's
5. Generate social media posts, blog titles, or video script outlines using AI tools.
6. Build a small application (e.g., chatbot for FAQs) using prompt-based interactions.
7. Present prompts with options, prompting the AI to analyze and select the most appropriate answer based on its understanding of the context using modern AI tools.
8. Prompt the AI to analyse existing code and suggest improvements for efficiency, readability, or performance.

9. Craft prompts that describe the desired image in detail, including objects, scenery, lighting, and style, to generate realistic and high-quality images. 10. Use Label studio platform for data labelling. 11. Provide the AI with code containing errors and prompt it to identify and suggest potential solutions for the identified issues. 12. To practice and understand orange tool for data Annotation.

Text Books:	1. Timothy Krimmel. *AI Prompt Engineering: The Engineer's Handbook*. 1 edition, 2023. ISBN: 9798851359514
References:	1. James Phoenix and Mike Taylor. *Prompt Engineering for Generative AI*. O'Reilly, 2024.
NPTEL Course Links:	1. URL https://www.promptingguide.ai/

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DRONE TECHNOLOGY

III B. Tech. – V Semester (Code: 24EE505/JO1B)

Lectures	2	Tutorial	0	Practical	2	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basics of Mathematics.

Course Objectives: To make the students

- To understand the basics of drone concepts
- To learn and understand the fundaments of design, fabrication and programming of drone
- To impart the knowledge of a flying and operation of drone
- To know about the various applications of drone and understand the safety risks and guidelines of fly safely

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

CO1	Know about various types of drone technology, drone fabrication and programming.
CO2	Execute suitable operating procedures for functioning a drone.
CO3	Select appropriate sensors and actuators for Drones.
CO4	Develop a drone mechanism for specific applications and create programs for various drones.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	3	2	-	-	-	-	-	-	3	3	2	2
CO2	3	3	3	2	2	-	-	3	2	2	3	3	2	2
CO3	3	3	3	2	3	-	-	3	2	3	3	3	3	3
CO4	3	3	3	2	3	-	-	3	2	3	3	3	3	3

UNIT-I

Introduction to Drone Technology: Drone Concept - Vocabulary Terminology- History of drone - Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses-Drone business through entrepreneurship- Opportunities/applications for entrepreneurship and employability.

UNIT-II

Drone Design, Fabrication And Programming: Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts -Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations -The methods of programming drone- Download program Install program on computer- Running Programs- Multi rotor stabilization- Flight modes -Wi-Fi connection.

UNIT-III

Drone Flying and Operation: Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment Drone controls Flight operation –management tool –Sensors-Onboard storage capacity Removable storage devices- Linked mobile devices and applications.

UNIT-IV

Drone Commercial Applications: Choosing a drone based on the application -Drones in the insurance sector- Drones in delivering mail, parcels and other cargo- Drones in agriculture- Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing.

Future Drones and Safety: The safety risks- Guidelines to fly safely -Specific aviation regulation and standardization- Drone license- Miniaturization of drones- Increasing autonomy of drones -The use of drones in swarms.

List of Experiments:

1. Identification of Drone Components and Terminology
2. Study of Types of Drones Based on Propulsion Systems
3. Case Study on Drone Applications in Business and Industry
4. Assembly and Disassembly of a Quadcopter Drone
5. Flight Controller Setup and Sensor Calibration
6. Installation and Execution of Drone Control Software
7. Basic Drone Flight Operation (Take-off, Hovering, Landing)
8. Study of Flight Modes and Stabilization Techniques
9. Analysis of Drone Sensors, Communication (Wi-Fi), and Mobile App Integration
10. Drone Survey Operation and Safety Guidelines as per Directorate General of Civil Aviation.

Text Books:	1. Daniel Tal and John Altschuld, "Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation", 2021 John Wiley & Sons, Inc. 2. Terry Kilby and Belinda Kilby, "Make: Getting Started with Drones", Maker Media, Inc, 2016.
References:	1. John Baichtal, "Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs", Que Publishing, 2016 2. Zavrsnik, "Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance", Springer, 2018.
NPTEL Course Links:	1. https://onlinecourses.nptel.ac.in/noc25_ae30/preview 2. https://nptel.ac.in/courses/101108661

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FUNDAMENTALS OF EV TECHNOLOGY
III B. Tech. – V Semester (Code: 24EE505/JO1C)

Lectures	2	Tutorial	0	Practical	2	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Electrical Machines-I, Electrical Machines-II, Power Electronics.

Course Objectives: To make the students

- Understand the concept of Vehicle Fundamentals.
- Identify the Operation of Electric and Hybrid drive-train topologies.
- Categorize the configuration and control of different motor drives.
- Distinguish the Operation of different types of energy storage systems and interface the vehicle to grid system.

Course Outcomes: After completion of this course, Students will be able 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 operation of different types of energy storage and management systems and interface the vehicle to grid system.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	3	3	1	-	-	-	-	-	2	3	2	2
CO2	3	3	3	3	1	-	-	2	2	2	2	3	2	2
CO3	3	3	3	3	1	-	-	2	2	2	2	3	2	2
CO4	3	3	3	3	1	-	-	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 and control of DC Motor drives - Configuration and control of Induction Motor drives-Configuration and 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 vehicle with 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:	1. 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. 2. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
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.

	5. Ali Emadi, Advanced Electric Drive Vehicles, CRC Press, 2014.
NPTEL Course Links:	1. **https://nptel.ac.in/courses/108/103/108103009/** 2. **https://nptel.ac.in/courses/108/106/108106182/** 3. **https://nptel.ac.in/courses/108/102/108102121/**

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SOFT SKILLS

III B.Tech – V Semester (Code: 24EEL501)

Lectures	1	Tutorial	0	Practical	2	Credits	2
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None

Course Objectives: To make the students

- To make the engineering students aware of the importance, the role and the content of soft skills through instruction, knowledge acquisition, demonstration and practice.
- To know the importance of interpersonal and intrapersonal skills in an employability setting.
- Actively participate in group discussions / interviews and prepare & deliver Presentations.
- Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of teamwork, Inter-personal relationships, stress management and leadership quality.

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

CO1	Use appropriate body language in social and professional contexts.
CO2	Demonstrate emotional intelligence and life skills by managing stress, setting goals, and effectively organizing time in real-life situations.
CO3	Develop and deliver structured presentations using appropriate visual and oral techniques while applying cognitive skills for innovative thinking.
CO4	Utilize employability skills to perform effectively in group discussions, interviews, and team environments.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

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

LIST OF EXPERIMENTS

1. Body Language & Habitual Intelligence

a. Facial Expressions – Kinesics – Oculesics- Proxemics

b. Appearance and Grooming

c. Habit Science Fundamentals
d. Four Laws of Behaviour Change (Applied to Communication Skills)

2. Emotional Intelligence & Life Skills

a. Self-Awareness through Johari Window and SWOC analysis
b. Self-Motivation
c. Attitude & Personality Traits
d. Managing Stress
e. Goal Setting
f. Time Management

3. Business Presentations and Cognitive Skills

a. Preparing effective Presentations
b. Power Point Presentations
c. Poster Presentation/image presentation
d. Oral Presentation
e. Cognitive Skills: Lateral and Creative Thinking.

4. Employability Skills

a. Group Discussion
b. Team Building and Leadership Qualities
c. Resumé writing and Interview skills

References :	1. Personality Development and Soft skills (Second Edition), Barun K. Mithra. Oxford University Press: 2016 2. The Definitive Book of Body Language, Allan & Barbara. Pease International:2004 3. Working with Emotional Intelligence, Daniel Goleman. Bloomsbury:1998 4. English for Jobseekers, Lina Mukhopadhyay. Cambridge University Press:2013 5. The 7 Habits of Highly Effective People, Stephen R. Covey. St. Martin's Press:2014 6. Clear, James. *Atomic Habits: An Easy & Proven Way to Build Good Habits & Break Bad Ones*. Random House India, 2018. 7. De Bono, Edward. *Six Thinking Hats*. Revised ed., Penguin Books, 2000.

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MICROPROCESSORS AND MICROCONTROLLERS LAB
III B. Tech. – V Semester (Code: 24EEL502)

Lectures	0	Tutorial	0	Practical	2	Credits	1
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Digital Logic Design.

Course Objectives: To make the students

- To understand the architecture and instruction set of 8086, 8051, and ARM Cortex-M3 processors and develop assembly language programs.
- To design and implement programs for arithmetic, logical, and data manipulation operations using different addressing modes.
- To gain practical knowledge of interfacing microprocessors/microcontrollers with peripherals such as ADC, DAC, stepper motor, LCD, sensors, and displays.
- To develop skills in embedded system design using timers, counters, interrupts, and serial communication protocols.

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

CO1	**Write and execute** assembly language programs for 8086, 8051, and ARM processors to solve real-time problems.
CO2	**Interface** microprocessors/microcontrollers with external hardware modules like ADC, DAC, stepper motors, LCD, and sensors.
CO3	**Analyze and implement** timing operations, interrupts, and communication protocols such as UART in embedded applications.
CO4	**Design and test** embedded system applications using modern development tools (e.g., KEIL, EDA tools) and hardware kits.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	2	2	1	-	2	-	2	2	3	2	2
CO2	3	3	2	2	2	1	-	2	2	2	2	3	2	2
CO3	3	3	2	2	2	1	-	2	2	2	2	3	2	2
CO4	3	3	2	2	2	1	-	2	2	2	2	3	2	2

List of Experiments:

PART- A: (Minimum of 5 Experiments has to be performed) 8086 Assembly Language Programming and Interfacing

1. Programs for 16 -bit arithmetic operations (using Various Addressing Modes).
   a. Addition and subtraction of n-BCD numbers.
   b. Multiplication and Division operations.
   c. Addition of an array of numbers with overflow detection.
2. Program for sorting an array.
3. Program for Factorial of given n-numbers.
4. Study of Programmable peripheral interface 8255.
5. Interfacing ADC to8086
6. Interfacing DAC to8086.
7. Interfacing stepper motor to8086.
8. Interfacing Seven-Segment display to 8086

PART-B: (Minimum of 3 Experiments has to be performed) 8051 Assembly Language Programming and Interfacing

1. Finding number of 1's and number of 0's in a given 8-bit number
2. Average of n-numbers.
3. Program and verify Timer/ Counter in8051.
4. Interfacing Traffic Light Controller to8051.
5. UART operation in8051
6. Interfacing LCD to8051.
7. Interfacing temperature sensor (LM 35) with 8051
8. Stepper motor control with 8051

PART-C (Minimum of 2 Experiments has to be performed) Conduct the following experiments using ARM CORTEX M3 PROCESSOR USING KEIL MDK ARM

1. Write an assembly program to multiply of 2 16-bit binary numbers.
2. Write an assembly program to find the sum of first 10 integers numbers.

3. Write a program to toggle LED every second using timer interrupt.
4. PWM signal generation
5. Analog signal measurement (ADC)
6. Interfacing with serial communication (UART)

Note: Minimum 10 experiments should be conducted.

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ELECTRICAL MACHINES LAB-II
III B.Tech.– V Semester (Code: 24EEL503)

Lectures	0	Tutorial	0	Practical	3	Credits	1.5
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Electrical Machines-I, Electrical Machines-II,

Course Objectives: To make the students

- To provide hands on experience to evaluate the performance parameters of Induction motors
- To understand the working of special machines like stepper motor, switched reluctance motor, BLDC motor & PMSM
- To simulate closed loop operation of BLDC motor.
- To design the controller for special machines.

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

CO1	Acquire hands on experience of performance indices using standard analytical as well as graphical methods to understand the importance of single and three phase Induction motors
CO2	Ability to acquire knowledge on separation of losses of three-phase Induction Motor.
CO3	Ability to analyze the dynamic performance of special electrical machines
CO4	Ability to understand the operation and characteristics of another special electrical machine

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	3	-	-	-	3	2	-	2	3	3	2
CO2	3	3	2	3	2	2	-	3	2	2	2	3	3	2
CO3	3	3	2	3	2	2	-	3	2	2	2	3	3	2
CO4	3	3	2	3	2	2	-	3	2	2	2	3	3	2

List of Experiments

1. No-Load and Blocked-rotor test on a three-phase Induction Motor.
2. Load test on a three-phase squirrel–Cage Induction Motor.

3. Load test on a three-phase slip-ring Induction Motor.
4. Equivalent circuit of a single-phase Induction Motor.
5. Load test on a single-phase squirrel–Cage Induction Motor.
6. Separation of core losses of a three-phase Induction Motor.
7. Speed Torque Characteristics of Repulsion Motor.
8. Load test on Universal Motor.
9. Speed-torque characteristics of a Hysteresis Motor.
10. Speed-Torque characteristics, transfer functions, and speed control of AC and DC servo motors.
11. Speed control, and torque characteristics of a PMSM under various loads.
12. Load Test on BLDC motor.
13. Speed, direction, its step angle and torque characteristics on Stepper Motor.
14.Speed Torque characteristics of a Switched Reluctance Motor (SRM) Motor

Note: Student Minimum 10 experiments should be carried out in above list.

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CONTROL SYSTEMS LAB
III B.Tech.– V Semester (Code: 24EEL504)

Lectures	0	Tutorial	0	Practical	3	Credits	1.5
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: 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 to

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 Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	3	2	-	-	2	-	-	2	3	3	2
CO2	3	3	2	3	2	2	-	2	-	-	2	3	3	2
CO3	3	3	2	3	2	2	-	3	2	2	2	3	3	2
CO4	3	3	2	3	2	2	-	3	2	2	2	3	3	2
CO5	3	3	3	3	3	3	-	3	3	2	3	3	3	2

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 system.
8. Stepper motor control.
9. Temperature controller using PID
10. P, PI, PD, PID control using Op-Amps.
11. Frequency response of first and second order systems.
12. PLC Programming for Sequential Control
13. PLC-Based Traffic Light Control System
14. PLC-Controlled Star–Delta Starter
15. PLC-Based Lift Control System
16. PLC-Based Automatic Light Switching and Oven Control System

Note: Minimum 10 experiments should be conducted.

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SUMMER INTERNSHIP-I III B. Tech. – V Semester (Code: 24EEL505/INT1)							
Lectures	0	Tutorial	0	Practical	0	Credits	2
Continuous Internal Evaluation			-	Semester End Examination			100

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 must submit 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 must submit the report along with certificate.
Final Assessment in the college premises	50M	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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TECHNICAL PAPER WRITING & IPR
III B.Tech. V Semester (Code: 24EE506 / MC03)

Lectures	:	2	Tutorial	:	0	Practical	:	0
CIE Marks	:	40	SEE Marks	:	0	Credits	:	0

Pre-Requisite: None

Course Objectives: Students will

➢	To develop an understanding of the structure, style, and ethics of technical and scientific writing.
➢	To train students in effective academic communication, including research paper, thesis, and project report writing.
➢	To create awareness about various forms of intellectual property and the process of securing IP rights.
➢	To provide foundational knowledge on patents, copyrights, trademarks, and design rights

Course Outcomes: After studying this course, the students will be able to

CO1	Understand the fundamentals and importance of technical communication in engineering and research contexts.
CO2	Apply the standard procedures involved in the submission of research manuscripts to journals and conferences.
CO3	Prepare effective abstracts, posters, and oral presentations for communicating research outcomes.
CO4	Identify and differentiate various categories of IPR, including patents, copyrights, trademarks, trade secrets, and industrial designs.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

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

UNIT-1

Fundamentals of Technical Writing: Basics of technical communication, Types of technical documents: research papers, project reports, theses, Structure and components of a technical paper (Abstract, Introduction, Methods, Results, Discussion), Clarity, precision, and language usage in scientific writing, Ethics inwriting: plagiarism, data falsification, multiple submissions

UNIT-2

Writing for Publication: Selection of journal/conference, understanding journal impact factor, indexing, and scope, Manuscript preparation and formatting guidelines, Submission process and peer

review system, Responding to reviewers and revisions	
UNIT-3	
Presentation and Dissemination: Preparing abstracts, posters, and oral presentations, Tools for formatting and referencing (LaTeX, MS Word, EndNote, Mendeley, Zotero), Best practices for graphical and tabular data representation, Collaboration and authorship ethics, Copyright and open-access publishing.	
UNIT-4	
Introduction to IPR: Definition and need for Intellectual Property, Categories: Patents, Copyrights, Trademarks, Trade Secrets, Industrial Designs, Basic principles of patentability: novelty, non-obviousness, utility, National and international IPR organizations (WIPO, IPO, USPTO, EPO), IPR protection mechanisms in India, Sample Patent filing.	
Text Books:	1. M. Ashok Kumar & R. Murugesan, Research Methodology and IPR, Charulatha Publications. 2. R. N. Khandare, Research Methodology & IPR, S. Chand Publishing. 3. Michael Alley, The Craft of Scientific Writing, Springer, 4th Edition,2018.
Reference Books:	1. B.L. Wadehra, Law Relating to Intellectual Property, Universal Law Publishing Co,5th edition, 2016. 2. Day & Gastel, How to Write and Publish a Scientific Paper, Cambridge University Press, 8th edition, 2017.

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POWER SYSTEM PROTECTION
III B. Tech. – VI Semester (Code: 24EE601)

Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Power Systems, Basics of Circuit Theory.

Course Objectives: To make the students

- Develop adequate knowledge of the requirements 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 the 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 Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	1	3	1	-	-	-	1	2	2	2	3	2
CO2	3	2	1	3	3	-	-	-	1	2	3	3	3	3
CO3	3	2	1	2	2	2	-	-	2	2	3	3	3	3
CO4	3	2	1	3	2	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 and Microprocessor Relays: 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‖, 3rd Edition, Tata Mc-Graw Hill education, 2022. 2. Sunil S Rao, Switchgear Protection and Power Systems (Theory, Practice & Solved Problems)‖, 14th Edition, Khanna Publishers, 2022.
References:	1. T.S. Madhava Rao, Power system protection and Static relays‖, 3rd Edition, Tata Mc-Graw Hill education, 2025. 2. Ravindranath B and M Chander, Power system protection and switchgear‖ ,2nd Edition, New Age International ,2025. 3. U. A. Bakshi , Dr. M. V. Bakshi, switchgear And Protection‖,2nd Edition, Technical publications,2021. 4. Y.G. Paithankar & S.R.Bhide, Fundamentals of Power System Protection‖, 2nd Edition, PHI, 2010.

	5. Bhuvanesh Oza, Nirmal-Kumar Nair, Rashesh Mehta and Vijay Makwana, Power system protection & switchgear, 2nd Edition, Tata Mc-Graw Hill education, 2022.
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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ELECTRICAL DRIVES

III B.Tech.–VI Semester (Code: 24EE602)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Electrical machines–I, Electrical machines-II, Power Electronics.

Course Objectives: To make the students

- Understand the fundamentals of electrical drives, load characteristics, speed control methods, and motor rating selection for industrial applications.
- Understand the operation, control, starting, braking, and speed regulation methods of DC motor drives using rectifiers and choppers.
- analyze the operation, control, starting, braking, and speed regulation of single-phase and three-phase induction motor drives using VSI and CSI techniques.
- To develop knowledge on the performance and control of synchronous and special motor drives used in industrial and renewable energy applications.

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

CO1	Distinguish electrical drive performance and select suitable motors and control methods for different operating conditions.
CO2	Evaluate and design DC motor drive control strategies under various operating conditions using different speed control and braking techniques.
CO3	Apply the PWM-based VSI and CSI control methods for the performance improvement of induction motor drive systems under various operating conditions
CO4	Implement control techniques for synchronous and special motor drives under different industrial and renewable energy applications.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	2	-	-	2	-	1	1	2	2	2
CO3	3	3	3	2	2	2	-	2	-	2	3	3	3	2
CO4	3	3	3	3	2	2	-	2	-	3	3	3	3	3

UNIT-I
Introduction: Electric drives - advantages-Parts of Electrical Drives. Fundamental Torque Equation-Multi quadrant operation - Equivalent values of drive parameters-Components, nature and classification of load torques-time and energy loss in transient operation-steady state stability-load equivalisation- Modes of operation - Speed control and drive classification-closed-loop control of drives-Thermal model of motor-Determination of Motor Rating.
UNIT-II
DC Motor Drives: DC motors and their performance–Starting, Braking-Transient Analysis-Speed control methods of DC drives with single phase three phase rectifiers and choppers-Multi quadrate operations- closed loop control of DC drive.
UNIT-III
Induction motor drives: Three phase induction motor- Operation with unbalanced source voltages and single phasing, unbalanced rotor impedance, Analysis with non-sinusoidal Voltage supply- Starting, Braking, Speed Control and Transient analysis of single phase and three phase Induction Motor-Closed loop speed control of induction motor using VSI, CSI methods. PWM VSI and CSI induction motor drive.
UNIT-IV
Synchronous and special motor drives: Synchronous Motors-Operation from fixed frequency supply-Synchronous motor variable speed drives-variable frequency control of multiple synchronous motors, load commuted inverters, Sinusoidal PMAC motor drive, BLDC motor drive, Stepper motor and switched reluctance motor drives, closed loop speed control of SRM motor, Solar powered pump drives, Load Commutated inverter fed synchronous motor drives.

Text Books:	1. G.K.Dubey, Fundamentals of Electric drives, Narosa Publishers,2nd Edition,2020. 2. Vedam Subramanyam: Electric Drives Concepts & Applications –Tata McGraw Hill Edn. Pvt.Ltd, Second Edition, 2017.
References:	1. R.Krishnan, Electric Motor Drives Modeling, Analysis and control, Pearson Education India, 2015. 2. Werner Leonhard: Control of Electric Drives, Springer international edition 2001. 3. Nisit K. De and Swapan K. Dutta: Electric Machines and Electric Drives, PHI learning Pvt. Ltd, 2011.

NPTEL Course Links:	1.https://nptel.ac.in/courses/108108077 2. https://nptel.ac.in/courses/108104140

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COMPUTER AIDED POWER SYSTEMS

III B. Tech. – VI Semester (Code: 24EE603)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Mathematics-I, Power System-I, Power Systems-II, Numerical Methods & Advanced Calculus, Generation and Transmission, Power System Analysis.

Course Objectives: To make the students

- Develop the ability to form incidence matrices, primitive impedance and admittance matrices, and network matrices with and without mutual coupling.
- Apply numerical methods from applied mathematics to solve load flow problems and compare different solution techniques.
- Introduce mathematical formulation of power systems for short-circuit analysis and enable analysis of contingency conditions in power system networks.
- Provide an understanding of transient stability analysis in power systems.

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

CO1	**Construct** incidence, impedance, admittance, and network matrices for power systems with and without mutual coupling.
CO2	**Solve** load flow problems using various numerical methods and evaluate their performance.
CO3	**Solve** short-circuit problems for symmetrical and unsymmetrical faults and assess contingency scenarios in power system networks.
CO4	**Evaluate** the transient stability of power systems under different operating conditions.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	3	2	2	2	-	-	2	-	2	3	2	3
CO2	3	3	3	2	2	2	-	-	2	-	2	3	2	3
CO3	3	3	3	2	2	2	-	-	2	-	2	3	2	3
CO4	3	3	3	2	2	2	-	-	2	-	2	3	2	3

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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. **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.	
UNIT-II	
Formulation of Load Flow Problem: Introduction – nonlinear equations - Power Flow Solution algorithm 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	
Short Circuit Studies: Representation of three phase network elements for balanced and unbalanced systems. Short circuit calculations for symmetrical and unsymmetrical faults using Bus Impedance matrix. **Security Analysis:** Basic Concepts, Static Security Analysis at Control Centres, Contingency Analysis, Importance of contingency analysis, Contingency Selection**.**	
UNIT-IV	
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, Medtech scientific international, ISBN-10: 9388716159, 2019 2. L.P. Singh, Advanced Power System Analysis and Dynamics, New Age International Private Limited, 6th edition, 2012.
References:	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 Course Links:	1. NPTEL :: Electrical Engineering - NOC: Computer Aided Power System Analysis 2. NPTELComputer Aided Power System Analysis

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SWITCHED MODE POWER SUPPLY
III B. Tech. – VI Semester (Code: 24EE604/PE2A)

Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Power Electronics.

Course Objectives: To make the students

- Classify of various Switched Mode Power Supply components.
- Outline the Modeling and control aspects of converter.
- Illustrate various Soft-switching DC - DC Converters
- Assess the Nonlinear phenomena of Pulse Width Modulated Rectifiers.

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

CO1	Illustrate various SMPS topologies, reactive elements, and input filter design in power electronic systems.
CO2	Classify different modelling techniques and control strategies used for DC–DC converters.
CO3	Illustrate various soft-switching and resonant DC–DC converter topologies and their modes of operation.
CO4	Assess the performance of Pulse Width Modulated rectifiers and nonlinear Phenomena in switched mode power converters.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	2	-	-	-	-	-	-	-	1	3	2	-
CO2	3	3	2	2	-	-	-	-	-	-	1	3	2	-
CO3	3	3	2	2	2	-	-	-	-	-	2	3	3	-
CO4	3	3	2	2	2	-	-	-	-	-	2	3	2	-

UNIT-I

Basics of SMPS and Converters: Introduction to SMPS, advantages over linear power supplies, applications, basic building blocks, overview and steady-state analysis of DC-DC converters like Buck, Boost, Buck-Boost, Cuk, SEPIC, CCM and DCM operation.

Design of Reactive Components and Filters: Design of inductors, transformers, and capacitors for SMPS, high-frequency considerations, ripple and losses, input filter design, and EMI considerations.

UNIT-II
Modelling and Transfer Functions: Small signal modelling using state-space averaging, linearization of converters, derivation of control-to-output transfer functions, frequency response and stability analysis. **Control Methods of SMPS:** Voltage mode control, current mode control (peak and average), frequency programmed control, critical conduction mode control, and design of feedback compensators.
UNIT-III
Soft Switching Techniques: Limitations of hard switching, switching losses and EMI, Zero Voltage Switching (ZVS), Zero Current Switching (ZCS), basic implementation of soft-switching converters. **Resonant Converter Topologies:** Series and parallel resonant converters, load resonant and multi-resonant converters, advantages, efficiency improvement, and thermal considerations.
UNIT-IV
PWM Rectifiers and Power Factor Control: Properties of ideal rectifiers, realization of near-ideal rectifiers, control of input current waveform, power factor correction, single-phase and three-phase PWM rectifiers. **Applications and Nonlinear Phenomena:** Design examples of SMPS (adapters, battery chargers), harmonic reduction techniques, nonlinear phenomena such as subharmonic oscillations, bifurcation, and chaos in converters.

Text Books:	1. Erickson R. W. & Maksimović D., Fundamentals of Power Electronics, Springer, 3rd Edition, 2020. 2. Corradi L., Maksimović D. & Zane R. "Digital Control of High-Frequency Switched-Mode Power Converters" John Wiley & Sons, 1st Edition, 2015.
References:	1. Pressman A. I., Billings K. & Morey T., Switching Power Supply Design, McGraw-Hill Education, 3rd Edition, 2019. 2. Maniktala S., Switching Power Supply Design and Optimization, McGraw-Hill Education, 1st Edition, 2014. 3. Rashid M. H. (Ed.), Power Electronics Handbook, Elsevier, 5th Edition, 2023. 4. Basso C "Switch-Mode Power Supplies: SPICE Simulations and Practical Designs" McGraw-Hill Education, 2nd Edition, 2021.
NPTEL Course Links:	1. https://onlinecourses.nptel.ac.in/noc21_ee104/preview 2. https://onlinecourses.nptel.ac.in/noc23_ee134/preview 3. https://onlinecourses.nptel.ac.in/noc25_ee167/preview 4. https://onlinecourses.nptel.ac.in/noc20_ee97/preview

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POWER SYSTEM OPERATION CONTROL AND STABILITY
III B.Tech – VI Semester (Code: 20EE604/PE2B)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Mathematics, Power System Analysis, Electrical Machines, Control Systems, Basic Power System Principles

Course Objectives: To make the students

- Understand economic load dispatch under various operational constraints and techniques to solve the problem.
- Modeling of turbines and generators and know the importance of quality of power, P-f, Q-V control loops, AGC.
- To deal with the numerical methods studied in applied mathematics courses to get the solutions of load flow problem and comparison of different methods.
- Discuss the concept of reactive power and voltage control in detail.
- Understand power system stability and voltage stability in operation of power system.

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

CO1	Explain the importance of economic operation of power systems.
CO2	Develop the mathematical models of turbines and governors and know the importance of single area and AGC.
CO3	Develop proper mathematical models for analysis of load flow study.
CO4	Explain the importance and control of reactive power and voltage.
CO5	Explain the stability issues concerned with power system operation.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

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

Quality of power: Importance of keeping voltage and frequency constant in a power system. Two main control loops (P-f and Q-V loops). Load frequency control (LFC), schematic of load frequency and AVR, modelling of generator, loads, prime mover and speed governor, block diagram representation, steady state analysis, dynamic response, AGC in a single area system.

UNIT-III

Reactive power control: Role of excitation system, simplified AVR block diagram.
Voltage control of distribution systems: Tap changing, booster transformers, synchronous phase modifiers, induction regulators, static capacitors.
Transmission line compensation: Series and shunt compensation, TCR, TSC, STATCOM.

UNIT-IV

Power system stability: Introduction, steady state and transient stability, swing equation, equal area criterion, applications, factors affecting stability.
Voltage stability: Introduction, comparison of angle and voltage stability, reactive power flow, voltage collapse, mathematical formulation.

Text Books:	1. Allen J. Wood and Bruce F. Wollenberg, "Power Generation Operation and Control", John Wiley & Sons, 1984. 2. Olle I. Elgerd, "Electric Energy Systems Theory – An Introduction", Tata McGraw Hill Publishing company, 2004. 3. Prabha Kundur, "Power System stability and control", Tata McGraw Hill, 2006.
References:	1. Economic Operation of Power System by L.K. Kirchmeyer, Wiley India, 2009. 2. Power System Analysis by T.K. Nagsarkar & M.S. Sukhija, Oxford University Press, 2014. 3. Kothari, D. P. and Nagrath, I. J., "Modern Power System Analysis", Tata McGraw Hill Publishing Company, 2003. 4. L. K. Kirchmayer, "Economic operation of Power System", John Wiley & Sons, 1953.
NPTEL Course Links:	1. NPTEL :: Electrical Engineering - NOC: Power Systems Operation and Control 2. NPTEL :: Electrical Engineering - NOC: Power Systems Analysis

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HVDC & FACTS **III B. Tech. – VI Semester (Code: 24EE604/PE2C)**							
Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Power Electronics, Generation &Transmission.

Course Objectives: To make the students

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

CO1	Discuss various types of DC links in HVDC converter and inverter operation.
CO2	Describe various methods for the control of HVDC systems and to perform power flow analysis in AC/DC systems.
CO3	Explain concept of FACTS controller for the specific application based on system requirements and types of facts controllers.
CO4	Illustrate the objectives of shunt controllers, series controllers &combined controllers.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	**POs**											**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	2	2	2	-	2	2	-	-	-	2	3	-	-
CO2	3	3	3	3	2	2	2	-	-	-	2	3	-	-
CO3	3	3	2	2	2	2	3	-	-	-	2	3	-	-
CO4	3	3	2	2	2	2	3	-	-	-	2	3	-	-

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UNIT-I
HVDC transmission: HVDC Transmission system: Introduction, comparison of AC and DC systems, applications of DC transmission, types of DC links, Layout of HVDC Converter station and components of HVDC system. Line commutated converter and voltage source converter based systems.
UNIT-II
Control of HVDC system: Principles of control, desired features of control, converter control characteristics, power reversal, Ignition angle control, current and extinction angle control. Harmonics introduction, generation, ac filters and dc filters. Introduction to multi terminal DC systems and applications, comparison of series and parallel MTDC systems.
UNIT-III
FACTS concepts: Reactive power control in electrical power transmission, principles of conventional reactive power compensators. Introduction to FACTS, flow of power in AC parallel paths and meshed systems, basic types of FACTS controllers, definitions of FACTS controllers, brief description of FACTS controllers.
UNIT-IV
Static Shunt, Series and Combined Compensators: Shunt compensation–objectives of shunt compensation, static VAR compensators–SVC, STATCOM, SVC and STATCOM comparison. Series compensation–objectives of series compensation, thyristor switched series capacitors (TCSC), static series synchronous compensator (SSSC), power angle characteristics. Unified power flow controller (UPFC)–Introduction, operating principle, Inter line power flow controller (IPFC)– Introduction, operating principle.

Text Books:	1. KR Padiyar, "Hvdc Power Transmission Systems New Age Publishers; Third edition (2017) 2. NarainG.Hingorani ,LaszloGyugyi,Understanding Facts: Concepts and Technology of Flexible AC Transmission Systems, Wiley India Pvt Ltd (2011).
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 Course Links:	1. https://nptel.ac.in/courses/108106160 2. https://nptel.ac.in/courses/108104013 3. https://nptel.ac.in/courses/108107114 4. https://onlinecourses.nptel.ac.in/noc25_ee183/preview

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MACHINE LEARNING

III B. Tech. – VI Semester (Code: 24EE605/JO2A)

Lectures	2	Tutorial	0	Practical	2	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None

Course Objectives: To make the students

- to understand a Linear, Polynomial, Ridge and Lasso regression models.
- To comprehend a Supervised Learning Model.
- To understand Ensemble methods for improving the performance of a Learning Model.
- To describe the K-Means, Hierarchical and Gaussian Mixture Model clustering methods.

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

CO1	Describe the steps, applications and challenges involved in building Linear, Polynomial, Ridge and Lasso regression models.
CO2	Describe the steps, applications and challenges involved in building Generative and Discriminative Classifiers
CO3	Describe the ensemble methods Bagging, Pasting and Boosting for building strong classifiers.
CO4	Describe the K-Means, Hierarchical and Gaussian Mixture Model clustering methods. algorithms.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	3	2	2	2	-	-	2	-	2	3	2	3
CO2	3	3	3	2	2	2	-	-	2	-	2	3	2	3
CO3	3	3	3	2	2	2	-	-	2	-	2	3	2	3
CO4	3	3	3	2	2	2	-	-	2	-	2	3	2	3

UNIT-I

Machine Learning Basics: What is machine learning?, Key terminology, Types of Machine Learning Systems, How to choose the right algorithm, Steps in developing a machine learning application, Main Challenges of Machine Learning Essential Python Libraries: Scikit-learn,

NumPy, matplotlib, Pandas. A First Application: Classifying iris species using Sci-kit learn. **Linear Regression**: Simple linear regression. Optimization of model parameters using Batch gradient decent algorithm, Mini batch gradient decent algorithm and Stochastic gradient descent algorithm, Multiple linear regression, Locally weighted linear regression, Polynomial Regression. Regularized Linear Models- Ridge Regression and Lasso Regression **Regularization:** Bios Variance tradeoff, L1 and L2 regularization.

UNIT-II

Generative Classifiers: Classifying with Bayesian decision theory, Bayes' rule, Naïve Bayes classifier.
Discriminative Classifiers: Logistic Regression, Decision Trees: Training and Visualizing a Decision Tree, Making Predictions, Estimating Class Probabilities, The CART Training Algorithm, Attribute selection measures- Gini impurity; Entropy, Regularization Hyperparameters, Regression Trees, Linear Support vector machines.

UNIT-III

Evaluation of a Classifier: Measuring Accuracy Using Cross-Validation, Confusion Matrix, Precision and Recall, Precision/Recall Trade-off, The ROC Curve.
Ensemble Learning: Voting Classifiers, Bagging and Pasting, Random Forests, Boosting-AdaBoost and Gradient Boosting.

UNIT-IV

Computational Learning Theory: Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis spaces.
Unsupervised Learning: K-means clustering algorithm, Hierarchical clustering algorithm, Gaussian mixture model.

Lab Experiments:

1. Write a program to implement the linear regression using stochastic gradient descent (SGD) approach.
2. Write a program to implement the linear regression using Batch gradient descent approach of training.
3. Program to Implement Naïve Bayes Classifier for a CSV Dataset and Evaluate its Performance
4. Program to Implement Logistic Regression Classifier using CSV Dataset and Evaluate its Performance
5. Program to Implement Decision Tree ID3 Algorithm for Classification and Performance Evaluation
6. Program to Implement Support Vector Machine (SVM) Classifier and Evaluate its Performance

7. Program to Implement Random Forest Classifier and Compare its Performance with a Weak Classifier
8. Program to Implement AdaBoost Classifier and Compare its Performance with Random Forest Classifier
9. Program to Implement k-Means Clustering Algorithm and Evaluate Clustering Quality
10. Program to Implement Hierarchical Clustering with Different Linkages and Compare with k-Means Clustering
11. Load Forecasting in Power Systems using Linear Regression
12. Fault Detection in Power Transmission using Decision Trees
13. EV Battery State of Charge (SoC) Prediction using Regression
14. Power Electronics Converter Efficiency Classification using SVM
15. Renewable Energy Source Clustering using K-Means

Text Books:	1. Aurelien Geron. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow. O'Reilly publishers, 2. edition, 2019a. ISBN 9781492032649 2. Peter Harrington. Machine Learning in Action. Manning, 1 edition, 2012. ISBN 9781617290183
References:	3. Andrew Ng. Machine Learning Lecture Notes. Stanford University. URL https://see.stanford.edu/Course/CS229 2. Sebastian Raschka and Vahid Mirjalili. Python Machine Learning. Packt Publishing, 4. edition, 2017. ISBN 9789352136278 5. Andreas C. Müller and Sarah Guido. Introduction to Machine Learning with Python. Oreilly, 1 edition, 2016. ISBN 9781449369415 4. Tom M. Mitchell. Machine Learning. Mc.Graw Hill, 1 edition, 1997. ISBN 0070428077. URL http://www.cs.cmu.edu/~tom/mlbook.html
NPTEL Course Links:	1. Sudeshna Sarkar. Machine Learning. IIT Kharagpur, 2016. URL https://youtu.be/T3PsRW6wZSY?list=PLJ5C_6qdAvBGaabKHmVbtryZW9KpICiHC

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EMBEDDED SYSTEMS

III B. Tech. – VI Semester (Code: 24EE605/JO2B)

Lectures	2	Tutorial	0	Practical	2	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basics of C & Microprocessors

Course Objectives: To make the students

- Understand the architecture of QNX Operating System, including microkernel design, process/thread models, scheduling, and basic IPC mechanisms.
- Apply concepts of process and thread management, synchronization techniques (mutexes, semaphores, condition variables), and various IPC methods such as message passing and shared memory.
- Analyse hardware interaction techniques including I/O access, interrupt handling, DMA-safe memory, and implement timing mechanisms like periodic and one-shot timers.
- Develop and manage QNX boot images and resource managers, including building OS images, loading onto hardware, and implementing shared objects and system resources.

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

CO1	Explain the architecture of QNX Operating System, including microkernel concepts, process/thread models, scheduling, and basic IPC mechanisms.
CO2	Implement process and thread operations, synchronization techniques (mutexes, semaphores, condition variables), and IPC methods such as message passing and shared memory.
CO3	Analyse hardware programming concepts including I/O interfacing, interrupt handling, DMA-safe memory allocation, and timing mechanisms in real-time systems
CO4	Design and develop QNX boot images and resource managers, and demonstrate loading and management of system resources on target hardware.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	2	2	2
CO2	3	3	2	-	2	-	-	-	-	-	-	3	2	2

CO3	3	3	2	2	2	-	-	-	2	2	2	3	2	2
CO4	3	3	3	2	3	-	-	-	2	2	2	3	3	2

UNIT-I

Introduction to QNX OS Architecture: Overview of QNX OS architecture including microkernel, process manager, and standards; protected address spaces; process and thread model; scheduling; introduction to inter-process communication (IPC) and synchronization.

UNIT-II

Processes, Threads, IPC, and Synchronization: Process management including creation, termination, and memory protection; thread management including creation, termination, and synchronization; synchronization techniques such as mutexes, semaphores, and condition variables; IPC methods including message passing, pulses, and shared memory; comparison of IPC methods; hands-on exercises on process/thread creation, synchronization, and IPC.

UNIT-III

Hardware Programming and Timing: Hardware access methods including IO-mapped and memory-mapped IO; interrupt handling and DMA-safe memory allocation; timing architecture including periodic timing, one-shot timing, and timeouts; hands-on exercises on interrupt handling and timing mechanisms

UNIT-IV

Boot Image and Resource Management in QNX: Overview of QNX boot/OS image structure; components of a boot image including startup code, kernel, drivers, and scripts; building and loading boot images onto target hardware; resource managers, shared objects, and their implementation.

Text Books:	1. **Frank Kolnick** Qnx 4 Real-Time Operating System Paperback – import, 1 July 2000 2. Elad Lahav ,Introduction to the QNX RTOS with Raspberry Pi,2023
References:	1. Hands-on RTOS with Microcontrollers, Brian Amos, Packt Publishing, 2020. 2. Operating System Concepts, Abraham Silberschatz, Peter B. Galvin, Greg Gagne, 9th Edition, Wiley, 2018. 3. Programming for Embedded Systems, Michael Barr, O'Reilly Media.
NPTEL Course Links:	1. https://onlinecourses.nptel.ac.in/noc22_cs94/preview 2. https://onlinecourses.nptel.ac.in/noc22_cs94/preview QNX Everywhere page - https://blackberry.qnx.com/en/products/qnx-everywhere 3. QNX Official Training: https://blackberry.qnx.com/en/training

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DESIGN OF SOLAR AND FUEL CELLS **III B. Tech. – VI Semester (Code: 24EE605/JO2C)**							
Lectures	2	Tutorial	0	Practical	2	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Numerical Methods & Advanced Calculus, Generation and Transmission, Power System Analysis.

Course Objectives: To make the students

- **To understand** the fundamental principles of solar cells, including semiconductor behavior, p–n junction operation, and photovoltaic effect.
- **To analyze** the design aspects of solar cells, including efficiency limits, losses, and performance parameters such as fill factor and quantum efficiency.
- **To introduce** the working principles, types, and applications of fuel cells along with their electrochemical foundations.
- **To develop** the ability to design and evaluate fuel cell systems considering efficiency, thermal management, and practical operating conditions.

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

CO1	**Explain** the operation of solar cells and evaluate their I–V characteristics and performance parameters.
CO2	**Analyze** the factors affecting solar cell efficiency and design improved photovoltaic systems.
CO3	**Describe** different types of fuel cells and their working principles for various applications.
CO4	**Design and assess** fuel cell systems considering thermodynamic efficiency, component selection, and system optimization.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	**POs**											**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	3	2	2	2	-	-	2	-	2	3	2	3
CO2	3	3	3	2	2	2	-	-	2	-	2	3	2	3
CO3	3	3	3	2	2	2	-	-	2	-	2	3	2	3
CO4	3	3	3	2	2	2	-	-	2	-	2	3	2	3

UNIT-I
Fundamentals of Solar Cells: Semiconductor materials for solar cells; p–n junction diode and characteristics; operation of p–n junction under illumination; generation of photo-voltage and photocurrent; light-generated current; equivalent circuit of a solar cell; types of solar cells—mono-crystalline, poly-crystalline, thin film and emerging solar cells; I–V equation and characteristics of solar cells; performance parameters of solar cells; applications of solar photovoltaic systems.
UNIT-II
Design of Solar Cells: Upper limits of solar cell parameters—short circuit current, open circuit voltage, fill factor and efficiency; internal and external quantum efficiency; losses in solar cells; effect of series and shunt resistance on performance; influence of solar radiation and temperature on efficiency; design considerations for high short-circuit current, open-circuit voltage and fill factor.
UNIT-III
Fundamentals of Fuel Cells: Introduction and overview of fuel cells; history and need for fuel cells; working principle and electrochemical energy conversion; construction and function of fuel cell components—anode, cathode and electrolyte; classification of fuel cells; types of fuel cells—Proton Exchange Membrane Fuel Cell (PEMFC), Solid Oxide Fuel Cell (SOFC), Phosphoric Acid Fuel Cell (PAFC) and Molten Carbonate Fuel Cell (MCFC); characteristics, advantages, limitations and applications of fuel cells.
UNIT-IV
Fuel Cell Design :Selection of fuel cell type based on application and operating conditions; thermodynamic and electrochemical principles of fuel cells; efficiency and polarization losses; design of membrane, electrodes, gas diffusion layer and bipolar plates; fuel and oxidant supply systems; flow distribution and fuel utilization; thermal and water management in PEM fuel cells; fuel cell stack design and electrical characteristics Along with theoretical knowledge the student will also have to practice/exercise some of the following experiments: 1. Study of V–I characteristics of a solar photovoltaic (PV) cell under different irradiation levels. 2. Determination of solar cell parameters: short-circuit current (Isc), open-circuit voltage (Voc), fill factor and efficiency. 3. Measurement of effect of temperature on the performance characteristics of a solar cell. 4. Measurement of series resistance and shunt resistance of a solar cell using V–I characteristics. 5. Study of solar PV module characteristics under varying load conditions.

6. Experimental determination of maximum power point (MPP) and plotting of P–V characteristics of a solar module. 7. Measurement of solar radiation using pyranometer/lux meter and estimation of PV efficiency. 8. Study of shading effect on the output characteristics of a solar PV module. 9. Simulation of solar cell characteristics using MATLAB Simulink or equivalent software. 10. Study of basic fuel cell operation and constructional features. 11. Determination of polarization characteristics of a PEM fuel cell. 12. Measurement of fuel cell voltage, current and power characteristics under different loads. 13. Study of effect of fuel flow rate and oxidant supply on fuel cell performance. 14. Estimation of fuel cell efficiency and power density. 15. Design and simulation of fuel cell stack characteristics using MATLAB Simulink 16. Performance comparison of different types of fuel cells using simulation.	
Text Books:	1. C.S. Solanki, "Solar Photovoltaics - Fundamentals, Technologies and Applications", Prentice Hall of India.2010 2. Fuel Cell Fundamentals (3rd Edition) by O'Hayre,Ryan/ Colella, Whitney/ Cha, Suk-Won. WileyPublications 3.Weidong Xiao, "Photovoltaic Power System: Modeling, Design, and Control," Wiley.2017 4. Fuel Cells: From Fundamentals to Applications,Supramaniam Srinivasan, Springer
References:	1. Jenny Nelson, "The Physics of Solar Cells," (Imperial College, UK).2003 2. .A. Reinders, P. Verlinden, W. Sark, A. Freundlich, "Photovoltaic Solar Energy: From Fundamentals to Applications", Wiley.2017
NPTEL Course Links:	1. https://www.youtube.com/watch?v=Eb7pv0oOf_k 2. https://www.youtube.com/watch?v=tSD8lgdicNk

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SYSTEM DESIGN THROUGH VERILOG

III B. Tech. – VI Semester (Code: 24EEL601/SEC3)

Lectures	1	Tutorial	0	Practical	2	Credits	2
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basics of Digital Electronics and Programming Concepts

Course Objectives: To make the students

- Understand Verilog HDL fundamentals and modeling techniques
- Design combinational and sequential circuits using Verilog
- Analyze digital systems using simulation and synthesis
- Develop FPGA-based system design skills

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

CO1	Explain Verilog HDL concepts, syntax, and modeling styles (structural, dataflow, and behavioral).
CO2	Design and analyze combinational and sequential digital circuits using Verilog HDL.
CO3	Apply advanced Verilog constructs and synthesis techniques to optimize digital designs.
CO4	Implement, simulate, and verify digital systems on FPGA platforms.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	2	2	-
CO2	3	3	2	-	2	-	-	-	-	2	2	3	2	2
CO3	3	3	2	2	2	-	-	2	2	2	2	3	2	2
CO4	3	3	2	2	2	2	-	2	2	2	2	3	3	2

UNIT-I

Introduction and Gate-Level Modelling: Introduction to Hardware Description Languages and role of Verilog in digital system design; structure of Verilog modules, syntax, data types, and operators; concepts of hardware modelling; gate-level modelling using built-in primitives; representation of combinational logic circuits using gate-level descriptions; relationship between hardware implementation and Verilog code.

UNIT-II

Behavioural Modelling: Behavioural modelling concepts in Verilog; procedural blocks such as always and initial; control statements including if, case, and looping constructs; blocking and non-blocking assignments; design of combinational and sequential circuits using behavioural modelling; writing efficient and synthesizable Verilog code.
UNIT-III
Dataflow and Switch-Level Modeling: Dataflow modelling using continuous assignments and operators; design of combinational circuits using expressions and signal flow representation; introduction to switch-level modelling; MOS transistor representation using switches; CMOS-based modelling concepts; comparison of modelling styles in Verilog.
UNIT-IV
Synthesis of Digital Systems using Verilog: Synthesis of combinational and sequential logic circuits using Verilog; RTL design concepts; conversion of Verilog code into hardware using synthesis tools; introduction to synthesis constraints and optimization techniques; timing considerations; basic verification concepts for digital system design.

Text Books:	1.Design through Verilog HDL-T. R. Padmanabhan and B. Bala Tripura Sundari; WSE, IEEE Press, 2008 2. Advanced Digital Design with Verilog HDL- Michael D. Ciletti, PHI, 2005
References:	1. Stephen Brown & Zvonko Vranesic, *Fundamentals of Digital Logic with Verilog Design*, McGraw-Hill ,2013 2. Peter J. Ashenden, *The Designer's Guide to Verilog*, Morgan Kaufmann 3. Donald E. Thomas & Philip R. Moorby, *The Verilog Hardware Description Language*, Springer 1990 4. Charles H. Roth Jr., *Digital Systems Design using Verilog*, Cengage Learning,2006
NPTEL Course Links:	1.https://onlinecourses.nptel.ac.in/noc21_ee97/preview 2.NPTEL :: Digital System Design with Verilog 3.NPTEL :: FPGA Design Flow

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ELECTRICAL SIMULATION LAB
III B. Tech. – VI Semester (Code: 24EEL602)

Lectures	0	Tutorial	0	Practical	2	Credits	1
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basics of Power Systems, Control Systems, and Power Electronics.

Course Objectives: To make the students

- Discuss the formation of bus matrices (Y-Bus, Z-Bus) and analyse power system networks.
- Deducing load flow and short circuit analysis using modern tools like MATLAB, ETAP, and Mi-Power.
- Outline the performance of control systems using Root Locus and PID controllers through Simulink.
- Study modern applications of power electronics such as PV systems with MPPT, BESS, and EV drives using simulation tools.

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

CO1	Paraphrasing the modelling and analysis of power system networks using Y-Bus, Z-Bus, load flow, and short circuit studies.
CO2	Attributing the performance of power systems using simulation tools like MATLAB, ETAP, and Mi-Power.
CO3	Persuade the analysis and design of control systems using Root Locus and PID controllers in Simulink.
CO4	Illustrate the operation and simulation of modern power electronics systems such as PV with MPPT, BESS, and EV drives.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	1	3	3	-	-	-	2	2	-	2	3	2	2
CO2	3	3	2	3	3	-	-	-	2	2	-	2	3	3	3
CO3	3	3	3	3	3	-	-	-	3	2	-	2	3	3	3
CO4	3	3	3	3	3	-	-	-	2	2	-	2	3	3	3

LIST OF EXPERIMENTS:

1. Formation of Bus Admittance Matrix (Y-Bus) and Bus Impedance Matrix (Z-Bus).

2. Simulation of various Load Flow techniques in power system.
3. Short circuit analysis on Power system for the faults L-G, L-L and LLL.
4. Simulation of FACT Devices (STATCOM / SVC).
5. Stability Analysis of given Transfer function with the adding of poles and zeros using Root Locus (Simulink)
6. Stability Analysis using Bode Plot.
7. Effect of PID Controller Tuning on System Response for the given system.
8. Simulation of DC-DC Boost Converter.
9. Simulation of Single-Phase PWM Inverter.
10. Closed Loop Control of DC Motor using PID Controller.
11. Simulation of Solar PV System with MPPT (Maximum Power Point Tracking).
12. Simulation of Battery Energy Storage System (BESS) with Bidirectional Converter.
13. Simulation of Electric Vehicle (EV) Drive using BLDC Motor.
14. Simulation of Economic Load Dispatch for Optimal Power Generation.
15. Simulation of Two area power system using P, PI & PID Controller

Note: Minimum 10 experiments should be carried out.

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POWER ELECTRONICS LAB
IV B. Tech. – VI Semester (Code: 24EEL603)

Lectures	0	Tutorial	0	Practical	3	Credits	1.5
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basic Electronic Devices, Linear Integrated Circuits, Circuit Theory.

Course Objectives: To make the students

- **Discuss** the thyristor and its family devices, ratings and protection.
- **Deducing** AC to DC Conversion circuits with various loads
- **Outline** the operation of inverters and 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 operation and characteristics of thyristors and related power semiconductor devices, and analyze their ratings and protection methods through practical experimentation.
CO2	**Conduct** the experimentation and **analyze** AC–DC conversion circuits with different types of loads and evaluate their performance parameters.
CO3	**Examine** the operation of single-phase and three-phase inverters along with PWM techniques using hardware-based approaches.
CO4	**Test** the DC–DC choppers and AC voltage controllers to study their performance characteristics and speed/voltage control applications.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	1	3	-	-	-	-	-	-	-	3	2	2
CO2	3	3	2	3	-	-	-	-	-	2	-	3	3	3
CO3	3	3	3	3	3	2	-	3	3	3	2	3	3	3
CO4	3	3	3	3	1	2	-	2	3	3	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. 3-phase Half & Full controlled Rectifier with R, RL and RLE loads.
6. 1-phase Dual converter with R, RL & RLE loads (Circulating and Noncirculating modes).
7. 1-phase Cyclo-converter (Center tapped or Bridge) with R load. verify the result using software.
8. 1-Phase Series Inverter with R Load.
9. 1-Phase Parallel Inverter with R Load.
10. 1- phase IGBT based inverter with R, RL loads.
11. 3-phase IGBT based inverter with R, RL loads.
12. Study of 1-phase full wave Mc-Murray Bedford Inverter with R load.
13. Buck Boost Converter with Motor load.
14. DSP based speed control of BLDC motor.
15. DSP based speed control of 3-phae Induction motor.
16. Multi-level Inverter

Note: Minimum 10 experiments should be carried out.

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CAMPUS RECRUITMENT TRAINING III B. Tech. – VI Semester (Code: 24EE606/MC04)							
Lectures	2	Tutorial	0	Practical	0	Credits	0
Continuous Internal Evaluation			40	Semester End Examination			0

Pre-Requisite: None.

Course Objectives: To make the students

- To enhance linguistic proficiency by developing skills in grammatical correction, contextual vocabulary usage, and the ability to comprehend and reorganize complex textual information.
- To build a strong foundation in proportional reasoning for solving mathematical problems related to business partnerships and chronological age calculations.
- To develop the ability to calculate possibilities using counting principles and probability, and to cultivate analytical skills for extracting insights from various data visualizations.
- To sharpen spatial intelligence and logical deduction through the mental manipulation of shapes, figures, and visual patterns.

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

CO1	Demonstrate effective communication skills by applying verbal, non-verbal, and business communication techniques.
CO2	Apply the principles of ratio and proportion to model and solve real-world quantitative problems involving equitable profit distribution in partnerships and the calculation of chronological age relationships.
CO3	Calculate the likelihood of complex events by applying counting principles (Permutations and Combinations) and utilize Data Interpretation techniques to analyze, visualize, and draw logical conclusions from diverse numerical datasets.
CO4	Apply logical reasoning and mathematical modeling to solve complex problems by integrating visual pattern recognition, combinatorial analysis, and the probabilistic interpretation of data.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

CO	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	2	-	-	-	-	-	2	-	3	2	2	-	-
CO2	2	3	-	2	-	-	-	2	-	3	2	2	-	-
CO3	2	2	2	-	-	-	-	2	2	3	2	2	-	-
CO4	2	2	-	-	-	2	-	2	-	3	2	2	-	-

UNIT-I
Sentence Improvement, Sentence Completion, Reading Comprehension, Cloze Test. Sentence Re-arrangements, Analogy, Industrial Vocabulary, Phrasal Verbs.
UNIT-II
Quantitative Aptitude: Ratios &Proportion. Partnership, Problems on Ages.
UNIT-III
Permutations and Combinations, Probability. Data interpretation: data graphs (bar graphs, pie charts, and other graphs representing data.
UNIT-IV
Analytical Aptitude Logic: Dice, counting figures, Water & Mirror Images, Paper cutting & Folding, Grouping of Figures, Figure Series.

Text Books:	1. Biswajit Das and Ipseeta Satpathy 2009. Business Communication and Personality Development. Excel Books, New Delhi. 2. Jaidka, Kuldip. 2015. Rich Vocabulary Made Easy Mohindra Capital Publishers, Chandigarh. 3. Murphy, Raymond. 2018. Intermediate English Grammar, Cambridge University Press.
References:	1. Shoba, K.N. and Lourdes Jovani Rayen. 2018. Communicative English: A Workbook, Cambridge University Press, New Delhi. 2. Rajiv K. Mishra 2004. Personality Development, Transform Yourself. Rupa Publications, India. 3. Barun K. Mitra 2016. Business Correspondence and Report Writing. Tata McGraw-Hill Publishing Company Limited, New Delhi. 4. Pushpa Lata 2015. Communication skills. Oxford University Press, New Delhi.
NPTEL Course Links:	1. https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr26_ed67