PERIYAR CENTENARY POLYTECHNIC COLLEGE

Periyar Nagar, Vallam – 613 403, Thanjavur

AUTONOMOUS INSTITUTION

NBA Accredited (ECE, EEE, MECH & COMPUTER – upto 2026)

DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING

SYLLABUS

EEE/23/00

SEMESTER SYSTEM

E- SCHEME

PERIYAR CENTENARY POLYTECHNIC COLLEGE

PERIYAR NAGAR, VALLAM – 613 403, THANJAVUR

Department of Electrical and Electronics Engineering

Programme Advisory Committee (PAC)

Syllabus Revision

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PERIYAR CENTENARY POLYTECHNIC COLLEGE

Periyar Nagar - Vallam - 613 403 - Thanjavur, Tamil Nadu

VISION

Periyar Centenary Polytechnic College aspires to be recognized as one of the leaders in imparting quality technical education and strives to prepare rural students with excellent technical and life skills for the benefit of the stakeholders and society at large.

MISSION

M1: To impart quality technical education to the students and equip them with knowledge, skills and attitudes that will lead to successful employment in industry/business, entrepreneurship and higher education.

M2: To provide conducive learning environment and adopt well structured teaching – learning practices to make the students technically competent.

M3: To strengthen the collaboration with industry and community for career development, placement and extension services.

M4: To develop the personality of the students and identify themselves as good individuals, professionals and responsible citizens with ethical values.

M5: To inculcate lifelong learning skills to face challenges with innovations.

PROGRAMME OUTCOMES (POs)

1. **Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
2. **Problem analysis:** Identify and analyse well-defined engineering problems using codified standard methods.
3. **Design/ development of solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
4. **Engineering Tools, Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.
5. **Engineering practices for society, sustainability and environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.
6. **Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
7. **Life-long learning:** Ability to analyse individual needs and engage in updating in the context of technological changes.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

Produce competent Engineers to excel in the field of Electrical and Electronics Engineering by providing necessary knowledge and skills with diverse and stimulating environment to meet the challenges in career.

MISSION

M1: To provide quality education and training, emphasis on engineering fundamentals through comprehensive curriculum.

M2: To provide a conducive learning environment and equip students with well structured Teaching learning practices.

M3: To strengthen soft skills especially for rural students through co curricular and extra curricular activities.

M4: To awake young minds to acquire knowledge continuously and learn to apply it.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Our Diploma graduates will be able to apply the knowledge, skills and competency to work in industry, organization and society at large.

PEO2: Our Diploma graduates will have the ability to engage in design of systems, tools and applications in the field of Electrical Engineering and allied Engineering Industries.

PEO3: Our Diploma graduates will be able to exhibit professionalism, ethical attitude communication skills, team work and adapt to current trends by engaging in lifelong learning.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Understand the circuits design systems, components and processes related to Electrical Engineering.

PSO2: Apply principles of engineering and laboratory skills for testing, operation and maintenance of electrical systems, electrical machines, power and energy systems.

PSO3: Ability to work professionally in Power systems engineering, Electrical machinery and design.

OUTCOME BASED EDUCATION (OBE)

Our institution is practicing Outcome Based Education (OBE) which is a student centered instruction model that focuses on measuring student performance through outcomes. Outcomes include knowledge, skills and attitudes.

In the OBE model, the required knowledge and skill sets for a particular diploma programme is predetermined and the students are evaluated for all the required parameters (Outcomes) during the course of the program.

The OBE model measures the progress of the graduate in four parameters, which are

- Program Educational Objectives (PEO)
- Program Specific Outcomes (PSO)
- Program Outcomes (PO)
- Course Outcomes (CO)

Program Educational Objectives (PEOs) are broad statements that describe the career and professional accomplishments that the program is preparing the graduates to achieve. PEO's are measured 4-5 years after graduation.

Program Specific Outcomes (PSOs) are the statements that describe what the graduates of specific engineering program should be able to do.

Program Outcomes (POs) are narrower statements that describe what students are expected to know and be able to do by the time of graduation.

Course Outcomes (COs) are the measurable parameters which evaluates each students performance for each course that the student undertakes in every semester. The teaching learning process and assessment are being carried out in accordance with the revised Bloom's Taxonomy. According to revised Bloom's taxonomy, the levels in cognitive domain are as follows:

Level	Descriptor	Level of attainment
1	Remembering	Recalling from memory of previously learned material
2	Understanding	Explaining ideas or concepts
3	Applying	Using information in another familiar situation
4	Analyzing	Breaking information into part to explore Understandings and relationships
5	Evaluating	Justifying a decision or course of action
6	Creating	Generating new ideas, products or new ways of Viewing things.

DIPLOMA PROGRAMME IN ENGINEERING / TECHNOLOGY

(Implemented from 2023 -2024)

E SCHEME

RULES AND REGULATIONS

Objective :

To retain and further strengthen the quality of the human capital produced by our higher technical education at the diploma level as they play a major force behind the state's social, cultural, and economic pre-eminence.

To seed & nurture agents of change & transformation for the digital future with enduring skills and capabilities by cultivating technological capabilities through a skill-centred approach.

Admission :

Candidates seeking admission to the first semester of the Diploma program:

Should have passed the SSLC Examinations prescribed by the Government of Tamil Nadu or any examination of any other board or authority recognized by the Board of Secondary Education as equivalent thereto with eligibility for Higher Secondary Education in Tamil Nadu.

Lateral entry admission:

The candidates who possess a pass is the HSC [Academic] or equivalent prescribed in the Higher Secondary Schools in Tamil Nadu affiliated to the Tamil Nadu Higher Secondary Board, with a pass in at least three of the following subjects: Physics / Chemistry / Mathematics / Computer Science / Electronics / Information Technology / Biology / Informatics Practices / Biotechnology / Technical Vocational Subjects / Agriculture / Engineering Graphics / Business Studies / Entrepreneurship are eligible to apply for Lateral entry admission to the third semester of Diploma programs, as per the rules fixed by the Government of Tamil Nadu. (or) The candidates who possess a pass in 2-year ITI with appropriate grade or equivalent examination.

There is no age limit prescribed for admissions to Diploma programs.

The medium of instruction is English for all courses, examinations, seminar presentations and project work reports, except for the programs offered in Tamil Medium.

Structure of the Program :

The Redesigning and revamp of the Diploma program in the State of Tamil Nadu will focus on improving the employability and entrepreneurship outcomes of the campuses through skill-centric and industry allied curriculum and syllabi. The following structure is being proposed for the new curriculum.

Pathways for Progressive Learning Experience

The program offers 4 different pathways for progressive learning. Entrepreneurs, Higher Education, Technocrats and Technologists have different pathways from which the students will pick one of these pathways that they find fascinating and work to ameliorate their knowledge base over the desired pathway.

There are courses offered for the specific pathways in their final semesters that will aid them to choose their career in their specific pathways. Pathway direction for the students can be assisted by faculty mentors from time to time.

- **Entrepreneur:**

  Students who aspire to transform opportunity into reality, and create social and economic value for themselves and for others.
- **Higher Education:**

  Students with aspirations of pursuing higher education to acquire higher-order skills and competencies in the domain of interest.
- **Technocrats:**

  Students who aspire to acquire mastery of technical tools and methods to manage people who manage the processes.
- **Technologists:**

  Students who aspire to gain leadership in a particular discipline / technology to evolve into Problem Solvers & Innovators.

Various Dimensions for Transformation :

Today's world is rapidly changing and increasingly interconnected, and the future talent pipeline to be sourced from the campuses needs to adapt to changes that will keep accelerating in the future. The new diploma program focuses on equipping learners with skills that will enable them to cope with the foreseeable social and economic changes and manage often unpredictable realities. The various dimensions of transformation are designed to nurture skills towards holistic human development. Such skills are acquired not only on formal courses but in a variety of contexts throughout the academic curriculum.

Four broad dimensions of skills to ensure holistic human development: (1) Personal, (2) Professional, (3) Interpersonal and (4) Advanced Industrial Technologies skills and competencies.

Integrated Curriculum :

An integrated curriculum is based on learning experiences that lead to the acquisition of disciplinary knowledge and its application in a professional environment interwoven with the teaching of personal, interpersonal, and professional skills, and ways in which the integration of emerging technological skills and multidisciplinary connections are made.

Course Levels :

A course is a component (a paper/subject) of a program. All the courses need not carry the same weightage. The course should have defined Course Objectives and Course Outcomes. A course may be designed to involve lectures / tutorials / laboratory work/project work / Internships / seminars or a combination of these, to effectively meet the teaching and learning needs and the credits may be assigned suitably.

The programs consist of various levels of courses, structured as (F) Foundation, (C) Concentration and the (S) Specialization courses for a greater understanding of the core concepts of the fundamentals in the initial year of learning and thereby moving towards the specialization areas by choice.

- **Foundation (F) | Year I:** Foundation courses build strong fundamental requirements across mathematics, statistics, science, engineering domain, advanced technologies, social sciences and humanities.
- **Concentration (Cn) | Year II:** Concentration courses shall deliver domain-specific knowledge and technological skills. They are offered as core and electives to provide the requisite mandatory working knowledge of the chosen domain.
- **Specialisation (S) | Year III:** Specialization courses are focused on a particular area of study leading to a specific pathway. Some of the courses can also be beyond the program, leading to skills and competencies in emerging technology domains.

Course Types :

Every diploma program shall have a curriculum with syllabi comprising Theory, Practicum and Practical courses with well-defined Program Outcomes (POs) as per the Outcome Based Education (OBE) model. The content of each course is designed based on the intended Course Outcomes (COs). Every program shall have a distinct curriculum with syllabi consisting of courses broadly categorized under:

- **Core(C)/Elective (E) –** Core / Elective courses are offered to students of a particular program to gain basic and specialized knowledge/skills in a selected field. Core courses are mandatory to complete the program and shall not be exempted or provided with credit equivalence. Elective Courses may be grouped into different domains / streams / specialisations to enable the students to have at least 3 to 5 options. At least 20 students need to express their willingness, for the case of an elective course, to be offered.

- **Practicum (P)** – Integrated course taught in a hands-on learning environment. This may be offered wherever theoretical concepts are to be learned simultaneously with relevant practical sessions. Such courses shall be offered only if sufficient laboratory facilities are available to conduct such courses, and both laboratory and theory components shall be considered for continuous assessment. Final evaluation based on the proportion of the credit awarded for the respective component.
- **Lab (L)** - Practical Courses taught in a designated lab. This may be offered when conceptual learning has to be augmented by practical experiments and also to bring focus on acquiring skills through doing. Such courses shall be offered only if sufficient laboratory facilities are available to conduct such courses.
- **Field Study(FS)** – Offered as a special / curriculum-enriching component to understand certain practical issues/work practices / hands-on training/immersion project/market survey. Field Study, if it forms a part of the course, then credit(s) shall be assigned accordingly, otherwise, such course(s) may be specified in the Grade Sheet without grades.
- **Certification (Cer)** – Industry-driven course shall be offered, jointly with an industry that would result in learning the emerging trends / employment potential topics / solving real-time problems. The contents of the course shall be jointly designed by an industry expert and a suitable faculty member, with relevant assessment and evaluation. Hybrid/Online learning options shall be available. Students are permitted to complete these courses through MOOCs / Professional Certification and credit equivalence (Program Elective or Open Elective), to a maximum of 6 credits.
- **In-House Projects (InP)** – Capstone Project shall be offered once a student completes >95% of the core courses related to the Diploma program. The Capstone Project is expected to involve concepts from fundamentals to recent developments and may be restricted to one domain or multidomains / multi-disciplines. Capstone Project shall be offered only after completing all the fundamental courses and offered during the final semester. It shall also focus on Environment, Society, Sustainability, Entrepreneurship and Project Management. In the case of a multidisciplinary project, a suitable co-supervisor shall be opted for the students from the relevant Department for successful completion. Capstone Project may be offered in phases, i.e. Phase I and Phase II (single topic or two different topics). Students are encouraged to submit the softcopy of the

complete report for evaluation and abstract in the printed form during the final presentation.

- **Fellowship (Fs) –** Up to 6 Months for professional and/or academic development offered by an external organisation identified and nominated by DoTE in India or abroad. Students shall be shortlisted for the same under sponsorship/scholarship by competent authorities and approved by the Head of the Institution.

- **Boot Camp (B) –** 2-to-5-day training camps for imparting knowledge and skills in emerging areas. It may be offered jointly by a team of faculty members / external experts with course content that includes interdisciplinary topics from different domains, thereby enhancing the Professional Knowledge & Skills of the students. However, such courses shall not have any significant repetition of other courses offered in that particular diploma program. If a student fails to complete such a course on the first attempt or lacks attendance requirements, they may opt for a different course in the subsequent semester and meet the minimum credit requirements of the program or may redo the same course whenever offered.

- **Hackathon (H)** - 3 to 6 days of problem-solving and building a solution for real-world problems in an intensive/accelerated manner. It may be considered as one of the course types in situations where multiple solutions are expected to a problem or multiple problems are expected to be solved, in a particular industry/research laboratory. Such a course shall be essentially a Practicum and may be offered in a workshop mode. Credit allocation, Assessment and Evaluation shall be based on the respective syllabi designed for the same.

- **Internship (I) –** Internship is offered as a credit course with the Industry/Research Laboratories/ other Universities in India or abroad. Credit allocation, Assessment and Evaluation shall be based on the procedures given. Every student is encouraged to gain Credits through an Internship.

- **Audit Courses** are optionally registered by a student to understand certain basic/advanced concepts in his / her own discipline or other disciplines offered by the college. In this case, if a candidate fails in an Audit Course, it is not mandatory to repeat that course and these courses shall not be considered for eligibility for awarding the Diploma. Grades shall be awarded as “Completed”.

Dentition of Credit

Credit is a kind of weightage given to the contact periods* to teach the prescribed syllabus, which is in a modular form. The credit distribution for theory, laboratory and project courses are mentioned in the table below.

Theory (L) - 15 periods	**1 credit**
Tutorial (T) - 15 periods	**1 credit**
Practical (P) – 30 periods	**1 credit**
Internship (I) - 30 periods	**1 credit**
Project (J) - 30 periods	**1 credit**

* 1 period = 50 minutes of class

Curriculum Structure

Every program shall have a distinct curriculum with syllabi consisting of courses broadly categorized under Basic Sciences, Basic Engineering, Professional Core, Program Electives, Open Electives, and Certification Courses. Credit distribution for various categories of the courses will follow the guidelines given below, subject to minor variations, as may be suggested by the respective Boards of Studies.

Category	**Credit Range**
Humanities and social sciences	11
Basic Science Courses	17-20
Engineering Sciences	6-13
Program core	40-51
Program Elective	9-12
Open elective	10
Industrial Training / Project work	14
Audit Course	0
Integrated Learning Experiences	
Induction program	Non-Credits Course
I & E / Club Activity / Community Initiatives	Non-Credits Course
Shop Floor Immersion	Non-Credits Course
Health & Wellness	Non-Credits Course
Student-Led Initiative	Non-Credits Course
Special Interest Groups *(Placement Training)*	Non-Credits Course
Emerging technology seminars	Non-Credits Course

Each program will consist of Basic Science (BS), Engineering Sciences (ES), Professional Core (PC), Program Electives (PE), Open Electives (OE), Audit Courses and In-House Project/Internships/Fellowships.

1. **Basic Sciences:** This course is common to all programs to develop fundamental knowledge of science and mathematics; it also enhances the reasoning and analytical skills amongst students.

2. **Engineering Sciences:** Engineering Science shall create awareness of different specializations of engineering studies. The goal of these courses is to create engineers of tomorrow, who possess the knowledge of all disciplines and can

apply their interdisciplinary knowledge in every aspect. It could be any branch of engineering - Civil, Computer Science and Engineering, Electrical, Mechanical, etc.

3. **Program Core:** This includes core courses designed in the program, which are major courses of the discipline, are required to attain desired outcomes and to ignite critical thinking skills amongst students.

4. **Program Elective:** This includes elective courses that can be chosen from a pool of courses which may be very specific or specialized or advanced or supportive to the program of study or nurtures the candidate's proficiency/skill. This is called a program elective course.

5. **Open Electives:** An elective course chosen generally from another discipline/ subject, to seek interdisciplinary exposure is called an open elective. While choosing the electives, students shall ensure that they do not opt for courses with syllabus contents which are similar to that of their departmental core/elective courses.

6. **Audit Courses:** An audit course is one in which the student attends classes, does the necessary assignments and takes exams. The Institute encourages students towards extra learning by auditing for the additional number of courses. The results of audit courses shall not be considered for the prescribed "carry over courses" limit.

7. **Humanities and Social Science:** Basic courses offered across language, communication and social science subjects, including any management skills and shall be categorized as Humanities and Social science.

8. **In-House Project/Internships/Fellowships:** Every student must do one major project in the Final year of their program. Students can do their major project in Industry or R&D Lab or in-house or a combination of any two or a fellowship in a reputed organization.

Outcome-Based Education

Outcome-based education aims to create a clear expectation of results that students must achieve. Here, the outcome includes skills, knowledge and attitude. Outcomes inform both the way students are evaluated on a course and the way a course will be organised. Effective learning outcomes are student-centred, measurable, concise, meaningful, achievable and outcome-based (rather than task-based). To identify achievable learning goals and develop plans to meet them, revised Bloom's Taxonomy framework is introduced to allow educators to assess learning on an ongoing basis, encouraging students to reflect on their progress.

All the programs offered should adopt Outcome Based Education (OBE) in order to enhance the opportunities for the students with respect to their career track (through a student-centric approach). The Program Outcomes (POs) of the respective program of study are achieved through the Course Outcomes (COs). Necessary remedial actions are taken at regular intervals to ensure the proper attainment of outcomes by the students. The evaluation procedures outlined are to be followed by the departments before arriving at the data for the Outcome attainment analysis.

1. OBE is an approach to education in which the decisions about the curriculum instruction and assessment are driven by the learning outcomes that the students should display at the end of a program or course.
2. The vision and mission statements are the guiding forces behind an institute / department. The vision statement provides insight into what the department focuses to achieve or become in the future. The mission statement communicates the process involved in achieving the vision. An effective vision statement should be concise, unambiguous, futuristic, and realistic. aspirational, and inspirational. Furthermore, it shouldn't be generic but rather focus on outcomes specific to the department. A good mission statement should focus on the ways to achieve the vision of the department. It should be brief, clear, informative, simple, and direct.
3. Graduate Attributes (GAs) represent the standard abilities to be looked for in a graduate of any diploma program. They form the Program Outcomes (POs) that reflect the skills, knowledge, and abilities of diploma graduates regardless of the field of study. At the same time, POs are necessarily independent of disciplinary knowledge; rather, these qualities may be developed in various disciplinary contexts. POs are composite statements made-up of multiple aspects relevant to a broader outcome like domain knowledge, design, analysis, etc. They also ensure the holistic development of the students by covering aspects like communication, ethics, project management, etc.,
4. Assessments are designed to measure the POs, and POs give useful guidance at the program level for the curriculum design, delivery, and assessment of student learning. However, they represent fairly high-level generic goals that are not directly measurable. Real observability and measurability of the POs at the course level are very difficult. To connect high-level learning outcomes (POs) with course content, course outcomes and assessments are designed, they are necessary to bring further clarity and specificity to the program outcomes.
5. For each PO, the skills and competencies implied generally require a different assessment methodology. This helps us to create a shared understanding of the competencies that students want to achieve.

6. Course Outcomes (COs) are specific, measurable statements that help the learners to understand the capabilities to be attained by them at the end of the course. COs should highlight what the learner can attain by studying the course and undergoing the evaluation of outcomes prepared for the same. It includes the knowledge to be gained, skills to be acquired and the application of the same towards solving problems specific to the context. The topics for the course should be decided based on the course outcomes in such a way that the specific topics alone do not map to the specific course outcomes.

7. Revised Bloom's Taxonomy for Assessment Design: It attempts to divide learning into three types of domains (cognitive. affective, and behavioural) and then defines the level of performance for each domain. Conscious efforts to map the curriculum and assessment to these levels can help the programs to aim for higher-level abilities which go beyond remembering or understanding, and require application, and analysis, evaluation or creation.

8. CO-PO course articulation matrix should indicate the correlation between the CO and PO based on the extent to which the CO contributes to the PO. This is mapped at three levels 1, 2 or 3 representing low, medium and high respectively. This also ensures that every PO is covered across the courses offered as a part of the program. The matrix will be adopted for all the courses run by the department.

9. The attainment of COs of any course can be assessed from the performance of the students through continuous and final assessments. The goal of continuous assessment is to understand/realise the critical information about student comprehension throughout the learning process and provides an opportunity for the facilitator to improve their pedagogical approach and for students to improve learning outcomes. The goal of the final assessment is to evaluate student learning outcomes at the end of the course instruction. According to the new regulation, 40% weightage is for the continuous assessment, and 60% weightage is for the final assessment.

10. The POs assessment should be carried out by both direct and indirect assessment. The assessment can be estimated by giving 80% weightage to direct assessment and 20% weightage to indirect assessment. Direct assessment is purely based on COs attainment through the course Assessment Method, and indirect assessment is through the feedback taken from the relevant stakeholders of the system. Indirect assessment can be done in the form of a graduate exit survey where the student is required to answer a questionnaire that reflects their satisfaction with respect to the attainment of POs. The questionnaire should be carefully designed so as to not have the POs themselves as direct questions.

11. Each PO attainment corresponding to a specific course can be determined from the attainment values obtained for each course outcome related to that PO and the

CO-PO mapping values. The threshold value of 60%, shall be set for the POs and the same can be modified with due approval of the Authorities.

12. The gap identified in the attainment of the COs and POs can be addressed by organising talks from the industry, bridge courses, organising workshops, arranging field visits (industrial visits) with respect to the course, improving the student performance under the innovative teaching-learning process of the institution, etc.,

Academic and Curriculum Flexibility

Academic and curriculum flexibility enhance a student's learning experience by providing various options such as adjusting the timeframe of courses, horizontal mobility, interdisciplinary opportunities, and other benefits through curricular transactions. The types of Academic and curriculum flexibilities are listed below.

1. Break of Study
2. Course Add / Drop
3. Course Withdrawal
4. Credit Equivalence
5. Credit Transfer
6. Examination Withdrawal
7. Fast-Track Option
8. Flexi-Credit System
9. Bridge Course

Break of Study

If a student intends to take a break / temporarily discontinue the program in the middle of a semester/year, during the period of study, for valid reasons (such as Internships, accident or hospitalization due to prolonged ill health) and wishes to re-join the program in the next academic year, student shall intimate stating the reasons.

Break of study is permitted only once during the entire period of the degree program for a maximum period of one year. The student is permitted to rejoin the program after the break and shall be governed by the rules and regulations in force, at the time of rejoining. The break shall be notified in the grade sheet. If a student is detained for want (shortage) of attendance or disciplinary issues, the period spent in that semester shall not be considered a permitted Break of Study.

Course Add / Drop

Subject to resource availability, a student has the option to add additional courses within a week after the regular semester begins. Furthermore, a student can drop registered courses before completing the first Continuous Assessment (CA) test in a semester, limited to a maximum of 6 credits. These dropped courses will not be considered as arrears, but the student will need to retake them when they are offered by the institution. In order to carry out these actions, students must obtain permission from the head of the institution.

Credit Equivalence

It is an option that can be exercised by a student under the following circumstances –

(i) credits earned through Extra and Co-curricular Activities (only against program elective / open elective – Global)

(ii) credits earned through online courses (only against Open Electives - Technical and Global and program electives)

(iii) credits accumulated through Capsule courses, One-Credit courses Such courses and credits earned shall be presented in the Academic Board.

Credit Transfer

Credits earned by a student through Credit Equivalence (as said above) and credits earned by attending and completing the courses successfully, offered by other approved Universities / Institutions / Professional Bodies (only against Technical and Global Open Electives and program electives) shall be considered as "Transferred Credits (specified in the Grade Sheet)" and considered for the calculation of CGPA.

Examination Withdrawal

A student may be permitted to withdraw from appearing for the end semester examination in any course or courses for valid reasons (medically unfit / unexpected family situations / sports approved by the Physical Director / HOD/Principal).

This privilege can be availed ONLY ONCE during the entire program. Valid documents, for medically unfit / unexpected family situations, shall be submitted by the student within seven days before the commencement of the examination in that course or courses and also recommended by the Head of the Department, approved by the Head of the Institution.

Special cases under extraordinary conditions will be considered on the merit of the case if any student applies for withdrawal, notwithstanding the requirement of mandatory seven days' notice.

Those students who withdraw from any course or courses during the program are eligible for the award of first class and first class with distinction as per the requirement in this regard.

Withdrawal is permitted for the end semester examinations in the final semester, only if the period of study, the student concerned, does not exceed 1 semester after the regular period of 3 years so that his eligibility for distinction is considered.

The final approval for withdrawal will depend on the merit of the case and will be decided by the Head of the Institution.

Fast-Track

This option enables a student to complete the minimum credit requirements of a program, to enable

(i) his / her own entrepreneurial venture (start-up),
(ii) an internship in industry/research laboratories / fellowship.

This option is currently available for students to complete the two elective papers offered in Semester 6 in advance [Recommended to be completed in Semester 4 or 5] to avail the last semester for internship/fellowship/do his own start-up/enterprise/project outside the campus. However, such an option shall not be exercised to pursue higher education elsewhere. The duration of the study shall remain the same as per the prescribed syllabi for the fast-track option also.

Flexi-Credit System

It offers a student to earn additional credits than that specified (minimum credits) to a program for which student has enrolled. Such additional credits earned shall be mentioned in the Grade Sheet, as ‘Additional Credits Earned’. Credits earned through Flexi-Credit System shall not be considered for the calculation of SGPA or CGPA.

Bridge Course

This is specifically designed for Lateral Entry (LE) students who join the Diploma Program in 2nd year (3rd Semester). This course will be a 40 period in which the faculty gives the gist of important topics that the LE students may have missed in the first year of the program specific to the department concerned.

Integrated Learning Experience

Integrated learning experiences encompass activities that foster the acquisition of disciplinary knowledge, personal and interpersonal skills, and technological proficiency. These experiences promote active engagement in meaningful real-life situations and establish connections between different curricula, co curricular activities, and extracurricular pursuits across diverse disciplines. Integrated learning experiences are concatenated in the academic curriculum for each semester enabling the students to learn, adapt and transform through experiential learning pedagogy.

This approach enriches the curriculum by incorporating dynamic and up-to-date co-curricular courses and activities that may not be directly aligned with the students' program of study. It prioritizes the holistic development of students, fostering their growth and well-roundedness.

1. Innovation & Entrepreneurship
2. Peer 2 Peer Learning
3. Growth Lab
4. Shop Floor Immersion
5. Health & Wellness
6. Induction Program
7. Special Interest Groups
8. Club Activity
9. Community Initiatives
10. Emerging Tech Seminars
11. Student Led Initiative
12. Industry-Specific Training

Innovation Track

They are offered to the student, to bring awareness on start-up / entrepreneurial ventures through a series of courses/activities. Based on the inputs gained, students can select their electives, specialisation, capstone project and deferred placement option.

Peer to Peer Learning

PTP learning involves interactions between students from senior classes, leading to valuable additions and deepening the understanding of certain concepts. This may happen as a part of a scheduled time-table or after instructional hours in a day, by Peers (from senior classes), leading to value addition, enriching the understanding of certain concepts and implementing practically (developing models, prototypes, proofs of-concept) for learning satisfaction, participating in competitions / competitive examinations. These efforts are expected to improve teamwork, communication, understanding of societal needs, project management and life-long learning activities.

Growth Lab

Growth labs play an integral role to stimulate and develop a student’s personality & skills in various fields of life. It also teaches about a growth mindset to tackle real-world problems and life challenges. It brings self-confidence and empowerment to transform the inter-personality of the student. The process brings the progression to achieve higher goals in life.

Shop floor immersion

This introduces new ideas, inspires participants to further explore them on their own or may illustrate and promote actual process practice through seminars, workshops, Industrial Visits etc that results in learning hands-on skills as it gives the students an opportunity to try out new methods and fall in a safe environment.

Health & Wellness

This aims to teach students about various aspects of health and fitness, including exercise, nutrition, yoga, mental health, and substance awareness.

Induction Program

It shall be organised to all the students, admitted into first year, to offer the course on Universal Human Value, awareness sessions on campus facilities, academic regulation and curriculum, highlight the culture, values and responsibilities of an Engineer in the Society and the Nation as a whole, besides Institutional infrastructure and facilities and student support systems. Awareness of domain-specific requirements to be organised in the second year of induction.

Special Interest Groups

The training is especially based on the placements on campus. Concepts required for aptitude tests, group discussions, resume building, personal interviews, industry-specific orientation and Business Case Competition are taught to the students.

Club Activity

A small community that attracts people who share the same interests such as music, arts, or sports working on a common goal to develop a sense of unity and teamwork, learning how to work with others in reaching the same goals.

Community Initiatives

Community Initiatives involve activities that aim to define values, cultivate empathy, foster social skills, and enhance students' understanding of their community. Through these initiatives, students have the opportunity to build meaningful relationships, gain insights into different perspectives, and engage with diverse cultures. This engagement enables the development of crucial interpersonal skills.

Emerging Tech Seminars

A technical presentation made by the Students & the cross-functional Members of the Faculty to showcase the technology adopted in the Industry. This collaborative teaching-learning session between the student & the faculty results in a better understanding of the use of technology in various applications.

Student-Led Initiative

A student-led session will help students to acquire and share knowledge on emerging industrial technologies that will comprehend & introduce the emerging technology to the students. This includes student-led Tech talk series & other initiatives.

Industry - Specific Training

Gaining information about the industry's way of working and understanding the process. This enables one to understand the various non-technical skills & competencies required for the transformation from a student to a professional.

Duration of the Program

- A student is ordinarily expected to complete the Diploma program in 6 semesters (for SSLC students) and four semesters (for Lateral Entry students) but in any case, not more than 12 Semesters for SSLC (or equivalent) students and not more than 10 semesters for Lateral Entry students.
- Each semester shall normally consist of 15 weeks with periods of 50 minutes each. The Head of the Institution shall ensure that every faculty imparts instruction as per the number of periods specified in the syllabus and that the faculty teaches the full content of the specified syllabus for the course being taught.
- The Head of the Institution may conduct additional classes for improvement, special coaching, conduct model tests etc., over and above the specified periods.
- The End Semester Examination will normally follow immediately after the last working day of the semester as per the academic schedule prescribed from time to time.
- The total period for completion of the program from the commencement of the first semester to which the student was admitted shall not exceed the maximum period specified irrespective of the period of break of study in order that student may be eligible for the award of the diploma. The minimum and maximum period of study shall be,

Diploma Programme	Min. Period	Max. Period
Full Time	3 Years	6 Years
Full Time [Lateral Entry]	2 Years	5 Years
Sandwich	3.5 Years	6.5 Years
Part Time	4 Years	7 Years

Attendance Requirements

A student who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester.

- Ideally every student is expected to attend all classes of all the courses and secure 100% attendance.

- However, in order to make provision for certain unavoidable reasons such as medical / participation in sports, the student is expected to attend at least 75% of the classes.
- Therefore, the student shall secure not less than 75% (after rounding off to the nearest integer) of overall attendance for each semester.
- However, a student who secures overall attendance between 65% and 74% in the current semester due to medical reasons (prolonged hospitalization / accident / specific illness) / participation in sports events may be permitted to appear for the current semester examinations, subject to the condition that the student shall submit the medical certificate / sports participation certificate attested by the Head of the Institution.
- Students who secure less than 65% overall attendance shall not be permitted to write the end semester examination and not permitted to move to the next semester. They are required to repeat the incomplete semester in the next academic year, as per the norms prescribed.
- Candidates who have earned more than 50% attendance but fall short of the basic requirement of 65% attendance (in all subjects of the current semester put together) shall be permitted to proceed to the next semester, only one time during the course of study by considering all the papers in that current semester as absent and to complete the program of study. For such candidates by default, the classification of class shall be Second class on successful passing of course.

Class Committee

Every class shall have a class committee consisting of faculty of the class concerned, student representatives and a chairperson, who is not teaching the class. It is like the 'Quality Circle' (more commonly used in industries) with the overall goal of improving the teaching learning process. The functions of the class committee include:

- Solving problems experienced by students in the classroom and in the laboratories. Clarifying the regulations of the diploma program and the details of rules therein.
- Informing the student representatives, the academic schedule including the dates of assessments and the syllabus coverage for each assessment.
- Informing the student representatives the details of regulations regarding weightage used for each assessment. In the case of practical courses (laboratory / drawing / project work / seminar etc.) the breakup of marks for each experiment / exercise / module of work, should be clearly discussed in the class committee meeting and informed to the students.
- Analysing the performance of the students of the class after each test and finding the ways and means of solving problems, if any.
- Identifying the slow-learners, if any, and requesting the faculty concerned to provide some additional help or guidance or coaching to such students.

- The class committee for a class under a particular branch is normally constituted by the Head of the Department. However, if the students of different branches are mixed in a class (like the first semester which is generally common to all branches), the class committee is to be constituted by the Head of the Institution.
- The class committee shall be constituted within the first week of each semester. At least 4 student representatives (usually 2 boys and 2 girls) shall be included in the class committee, covering all the elective courses.
- The chairperson of the class committee may invite the class counsellor and the Head of the Department to the class committee meeting.
- The Head of the Institution may participate in any class committee meeting of the institution.
- The chairperson is required to prepare the minutes of every meeting, submit the same to the Head of the Institution within two days of the meeting and arrange to circulate it among the students and faculty concerned. If there are some points in the minutes requiring action by the management, the same shall be brought to the notice of the Head of the Institution.
- The first meeting of the class committee shall be held within one week from the date of commencement of the semester, in order to inform the students about the nature and weightage of assessments within the framework of the regulations.
- Two or three subsequent meetings may be held in a semester at suitable intervals.
- During these meetings the student members representing the entire class, shall meaningfully interact and express the opinions and suggestions of the other students of the class in order to improve the effectiveness of the teaching-learning process.

Course Committee for Common Courses

Each common theory course offered to more than one discipline or group, shall have a "Course Committee" comprising all the faculty teaching the common course with one of them nominated as the course coordinator. The nomination of the course coordinator shall be made by the Head of the Department / Head of the Institution depending upon whether all the faculty teaching the common course belong to a single department or to several departments. The 'Course Committee' shall meet in order to arrive at a common scheme of evaluation for the test and shall ensure a uniform evaluation of the tests. Wherever feasible, the Course Committee may also prepare a common question paper for the internal assessment test(s).

Assessment and Examination

Performance in each course of study shall be evaluated for a maximum of 100 marks based on one of the following:

(i) Continuous Assessment [40%]:

- Continuous assessment shall be carried out for 100 marks [summation of multiple CAs] for all types of courses and converted to 40 marks.
- Every subject shall have its own framework for continuous assessment designed by the course committee and approved by the academic board as part of the curriculum. The continuous assessment shall be awarded as per the assessment proposed in respective syllabi.
- For One credit courses and Advanced Skill Certification programs, no end semester examination shall be conducted, and final grade will be awarded based on continuous assessment only for 100 marks.

(ii) End Semester Examination [60%]:

- The End Semester Examination will be conducted for 100 marks and shall be converted to 60 marks in the final results.
- The End Semester Examinations (Theory, Practical, Project) of three hours duration will be conducted.
- For Practicum courses, the end semester examination will be conducted as a theory or a practical or a project examination based on the credits for each component, the decision on the mode of exam could be based on the recommendation by the internal committee duly forwarded and approved by Head of the Institute.
- Every practical exercise/experiment shall be evaluated based on conduct of exercise / experiment and records to be maintained, students shall submit a record work duly completed and signed by faculty in charge and the Head of the Department.
- For the project works, the Department will constitute a three member faculty committee to monitor the progress of the project and conduct reviews regularly.
- If the projects are done in-house, the students must obtain the bonafide certificate for project work from the project guide and Head of the Department, at the end of the semester. Students who have not obtained the bonafide certificate are not permitted to appear for the project Viva Voce examination.
- For the projects carried out in Industry, the students must submit a separate certificate from Industry apart from the regular bonafide certificate mentioned above. For Industry related projects there must be one Mentor / Supervisor from Industry (External), this is in addition to the regular faculty supervision.
- The final examination for project work will be evaluated based on the final report submitted by the project group (of not exceeding four students), and the viva voce by an external examiner.

- The split up of marks for Internal and End Semester Viva Voce can follow the below mentioned rubrics,

Internal Mark Split (40 Marks)			End Semester (60)		
Review 1 (10 Marks)	**Review 2 (15 Marks)**	**Review 3 (15 marks)**	**Record (20 Marks)**	**Presentation (20 Marks)**	**Viva Voce (20 Marks)**
Committee: 5 Supervisor: 5	Committee: 7.5 Supervisor: 7.5	Committee: 7.5 Supervisor: 7.5	External: 10 Internal: 5 Supervisor: 5	External: 10 Internal: 5 Supervisor: 5	External: 10 Internal: 5 Supervisor: 5

- Students who are unable to complete the project work at the end of the semester can apply for an extension to the Head of the Department, with the recommendation from the project guide for a period of a maximum of two months. For those students who extend the project work for two months, Viva Voce will be carried out and results will be declared separately. If the project report is not submitted even beyond the extended time, then students are not eligible to appear for Project Viva Voce Examination.
- The performance of each student in the project group would be evaluated in a viva voce examination conducted by a committee consisting of an external examiner and the Department project coordinator as an internal examiner.
- If a student indulges in malpractice in any of the End Semester Examination / Internal Examinations, student will be liable for punitive action as prescribed by the college from time to time.

Passing Requirement for Award of Diploma

A student who secures not less than 40% of total marks prescribed for the course [Internal Assessment + End semester Examinations] with a minimum of 35% of the marks prescribed for the end semester examination, shall be declared to have passed the course and acquired the relevant number of credits. This is applicable for both theory and laboratory courses (including project work).

(i) No Minimum marks for continuous assessment (Internal). (ii) Minimum Marks to be secured in end semester exam is 35 out of 100, (iii) Those who secure minimum mark (35) in end semester examination need to secure minimum of 19 out of 40 in continuous assessment to achieve overall pass percentage of 40% in that particular subject.

If a student fails to secure a pass in a theory course / laboratory course / elective course (same elective course), the student shall register and appear only for the end semester examination in the subsequent semester. In such cases, the internal assessment marks obtained by the student in the first appearance shall be retained and considered valid for all subsequent attempts till the student secures a pass. However, from the third attempt onwards if a student fails to obtain pass marks (Internal Assessment + End

Semester Examination), then the student shall be declared to have passed the examination if the student secures a minimum of 35% marks prescribed for the end semester examinations alone.

If any other Elective course is opted by the student, the previous registration is cancelled and henceforth it is to be considered as a new Elective course. The student has to register and attend the classes, earn the continuous assessment marks, fulfil the attendance requirements and appear for the end semester examination.

If a student is absent during the viva - voce examination, it would be considered a failure. If a student fails to secure a pass in Project Work, the student shall register for the course again in the subsequent semester and can do Project Work.

The passing requirement for the courses which are assessed only through purely internal assessments, the passing requirement is 50% of the internal assessment (continuous assessment) marks only.

A student can apply for revaluation of the student's semester examination answer paper in a theory course, as per the prescribed fee along with prescribed application to the COE (Controller of Examination) through the Head of the Institution.

The COE will arrange for the revaluation and the results will be intimated to the student. Revaluation is not permitted for laboratory courses and projects.

Award of Grades

The award of letter grades will be decided using relative grading principle. The performance of a student will be reported using letter grades, each carrying certain points as detailed below:

Letter Grade	Grade Points	Marks
0 (Outstanding)	10	91-100
A+ (Excellent)	9	81-90
A (Very Good)	8	71-80
B+(Good)	7	61-70
B (Average)	6	51-60
C (Satisfactory)	5	40-50
RA (Re-Appearance)	0	<40
SA (Shortage of Attendance)	0	0
W (Withdrawal)	0	0

A student is deemed to have passed and acquired the corresponding credits in a particular course if the student obtains any one of the following grades: “O”, “A+”, “A”, “B+”, “B”, “C”.

‘SA’ denotes shortage of attendance and hence prevents students from writing the end semester examinations. ‘SA’ will appear only in the result sheet.

“RA” denotes that the student has failed to pass in that course. “W” denotes withdrawal from the exam for the particular course. The grades RA and W will figure both in the Grade Sheet as well as in the Result Sheet. In both cases, the student has to appear for the end semester examinations as per the regulations.

If the grade RA is given to Theory Courses/ Laboratory Courses it is not required to satisfy the attendance requirements, but has to appear for the end semester examination and fulfill the norms to earn a pass in the respective courses.

If the grade RA is given to courses which are evaluated only through internal assessment, the student shall register for the course again in the subsequent semester, fulfilling the norms as to earn a pass in the course. However, attendance requirements need not be satisfied.

For the Audit Course and Integrated Learning Experience, on its successful completion a ‘completed’ certificate will be issued by the head of the institute. Every student needs a minimum of 75% attendance in the Audit / integrated Learning experience compulsorily. However, for valid reasons, the Head of the Institution may permit a student to exempt/complete this requirement in the subsequent years. Successful completion of these courses is compulsory for the award of Diploma. These courses will be monitored by the central committee constituted by Autonomous. The grades O, A+, A, B+, B, C obtained for the one/two credit course (not the part of curriculum) shall figure in the Grade Sheet under the title ‘Value Added Courses/Internship/Industrial training’.

The courses for which the grades obtained are SA will not figure in the Grade Sheet.

Grade Sheet

After results are declared, Grade Sheets will be issued to each student which will contain the following details: The college in which the student has studied, the list of courses registered during the semester and the grade scored. The Grade Point Average (GPA) for the semester and the Cumulative Grade Point Average (CGPA) of all courses enrolled from the first semester onwards. GPA for a semester is the ratio of the sum of the products of the number of credits acquired for courses and the corresponding points to the sum of the number of credits acquired for the courses in the semester. CGPA will be calculated in a similar manner, considering all the courses registered from the first semester. RA grades will be excluded for calculating GPA and CGPA.

$$CGPA = \frac{\sum_{i=1}^{n} C_i \ GP_i}{\sum_{i=1}^{n} C_i}$$

where Ci is the number of Credits assigned to the course

GPi is the point corresponding to the grade obtained for each course

n is number of all courses successfully cleared during the particular semester in the case of GPA and during all the semesters in the case of CGPA.

Award of Diploma

A student shall be declared to be eligible for the award of the Diploma provided the student has,

- Successfully gained the required number of total credits as specified in the curriculum corresponding to the student's program within the stipulated time.
- Successfully completed the course requirements, appeared for the end semester examinations and passed all the subjects within the period as prescribed.
- Successfully passed any additional courses prescribed whenever the student is readmitted under E - Scheme from the earlier regulations.
- Successfully completed the Integrated Learning Experience requirements.
- No disciplinary action pending against the student.
- The award of Diploma must have been approved by the Board of Examinations.

Classification of Diploma Awarded

FIRST CLASS WITH DISTINCTION

A student who satisfies the following conditions shall be declared to have passed the examination in First class with Distinction:

- Should have passed the examination in all the courses of all the six semesters (4 semesters in the case of Lateral Entry) in the student's First Appearance. The duration of the program shall be extended up to one additional semester in case of any withdrawals from end semester examination. Withdrawal from examination will not be considered as an appearance.
- Should have secured a CGPA of not less than 8.50.
- One-year authorized break of study (if availed of) shall be permitted within the four years period (three years in the case of lateral entry) for award of First class with Distinction.

- The candidates should NOT have been prevented from writing the end semester examination due to lack of attendance in any semester.

FIRST CLASS

A student who satisfies the following conditions shall be declared to have passed the examination in First class:

- Should have passed the examination in all the courses in all six semesters (4 semesters in the case of Lateral Entry). The duration of the program shall be extended up to one additional semester in case of any withdrawals from end semester examination. Withdrawal from examination will not be considered as an appearance.

- One-year authorized break of study (if availed of) or prevention from writing the end semester examination due to lack of attendance (if applicable) shall be provided with the duration of four years (three years in the case of lateral entry) for award of First class.

- Should have secured a CGPA of not less than 6.50.

SECOND CLASS

All other students who qualify for the award of the Diploma shall be declared to have passed the examination in Second Class.

Discipline

Every student is expected to maintain disciplined and respectable behaviour both within and outside the college premises, refraining from engaging in any activities that may tarnish the reputation of the college.

The Head of the Institution shall constitute a disciplinary committee consisting of the Head of the Institution, Two Heads of Department of which one should be from the faculty of the student, to enquire into acts of indiscipline and notify the authorities about the disciplinary action recommended for approval.

In case of any serious disciplinary action which leads to suspension or dismissal, then a committee shall be constituted.

If a student indulges in malpractice in any of the end semester examinations, student shall be liable for punitive action as prescribed by the Autonomous Examination from time to time. For any malpractices in any continuous assessment, the same shall be reported to the Head of the Institution for disciplinary actions.

ELECTRICAL AND ELECTRONICS ENGINEERING - ANNEXURE - I

E – SCHEME

(Implemented from the Academic Year 2023 – 2024 onwards)

CURRICULUM OUTLINE

THIRD SEMESTER

S. No	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1.	Program Core	Theory	EEE3110	Electrical Machines I	4-0-0	60	4	Theory
2.	Program Core	Theory	EEE3210	Electrical Circuit Theory	4-0-0	60	4	Theory
3.	Program Core	Practicum	EEE3340	Sensors and Measurement	1-0-4	75	3	Practical
4.	Program Core	Practicum	EEE3440	Analog and Digital Electronics	1-0-4	75	3	Practical
5.	Engineering Science	Practicum	EEE3540	Programming in C	1-0-2	45	2	Practical
6.	Program Core	Practical/Lab	EEE3620	Electrical Machines I Practical	0-0-4	60	2	Practical
7.	Open Elective	Advanced Skill Certification	EEE3760	Advanced Skills Certification - 3	0-0-4	60	2	NA
8.	Humanities & Social Science	Integrated Learning Experience	GLE3880	Growth Lab	-	30	0	-
9.	Audit Course	Integrated Learning Experience	ACE3881	Induction Program II	-	16	0	-
10.	Audit Course	Integrated Learning Experience	ACE3882	I&E/ Club Activity/ Community Initiatives	-	16	0	-
11.	Audit Course	Integrated Learning Experience	ACE3883	Shop floor Immersion	-	8	0	-
12.	Audit Course	Integrated Learning Experience	ACE3884	Student-Led Initiative	-	22	0	-
13.	Audit Course	Integrated Learning Experience	ACE3885	Emerging Technology Seminars	-	8	0	-
14.	Audit Course	Integrated Learning Experience	ACE3886	Health & Wellness	0-0-2	30	1	NA
Test & Revisions (60) + Library (15)					-	75	-	-
Total					-	**640**	**21**	-

FORTH SEMESTER

S. No.	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1.	Program Core	Theory	EEE4110	Electrical Machines II	4-0-0	60	4	Theory
2.	Program Core	Theory	EEE4210	Generation, Transmission and Distribution	4-0-0	60	4	Theory
3.	Program Core	Practicum	EEE4340	Microcontroller and Embedded Systems	1-0-4	75	3	Practical
4.	Program Core	Practicum	EEE4440	Electrical CAD Design	1-0-4	75	3	Practical
5.	Program Core	Practicum	EEE4540	Servicing of Electrical Appliances	1-0-2	45	2	Practical
6.	Program Core	Practical/Lab	EEE4620	Electrical Machines II Practical	0-0-4	60	2	Practical
7.	Open Elective	Advanced Skill Certification	EEE4760	Advanced Skills Certification - 4	0-0-4	60	2	NA
8.	Audit Course	Integrated Learning Experience	ACE4882	I&E/ Club Activity/ Community Initiatives	-	30	0	-
9.	Audit Course	Integrated Learning Experience	ACE4883	Shop floor Immersion	-	8	0	-
10.	Audit Course	Integrated Learning Experience	ACE4884	Student-Led Initiative	-	24	0	-
11.	Audit Course	Integrated Learning Experience	ACE4885	Emerging Technology Seminars	-	8	0	-
12.	Audit Course	Integrated Learning Experience	ACE4886	Health & Wellness	-	30	0	-
13.	Audit Course	Integrated Learning Experience	ACE4887	Special Interest Groups (Placement Training)	-	30	0	-
Test & Revisions (60) + Library (15)					-	75	-	-
				Total	-	640	20	-

FIFTH SEMESTER

S. No.	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1.	Program Core	Theory	EEE5110	Power System Protection and Utilization	3-0-0	45	3	Theory
2.	Program Core	Theory	EEE5210	Electric Vehicle Technology	3-0-0	45	3	Theory
3.	Program Core	Practicum	EEE5340	Power Electronics	1-0-4	75	3	Practical
4.	Program Core	Practicum	EEE5440	PLC and Automation	1-0-4	75	3	Practical
5.	Program Elective	Practicum	EEE554X	Elective -1	1-0-4	75	3	Practical
6.	Humanities & Social Science	Practicum	EEE5654	Innovation and Start-ups	1-0-2	45	2	Project
7.	Project / Internship	Project/Internship	EEE5773	Industrial Training* [Summer Vacation - 90 Hours]	-	-	2	Project
8.	Open Elective	Advanced Skill Certification	EEE5860	Advanced Skills Certification - 5	0-0-4	60	2	NA
9.	Audit Course	Integrated Learning Experience	ACE5981	Induction program III	-	40	0	-
10.	Audit Course	Integrated Learning Experience	ACE5984	Student-Led Initiative	-	30	0	-
11.	Audit Course	Integrated Learning Experience	ACE5986	Health & Wellness	-	30	0	-
12.	Audit Course	Integrated Learning Experience	ACE5987	Special Interest Groups (Placement Training)	-	40	0	-
Test & Revisions (60) + Library (15)					-	75	0	-
Total					-	**635**	**21**	-

SIXTH SEMESTER

S. No.	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1.	**Program Elective**	**Theory**	EEE611X	**Elective - 2 (Pathway)**	**3-0-0**	**45**	**3**	**Theory**
2.	Program Elective	Practicum	EEE623X	Elective - 3 (Specialization)	2-0-2	60	3	Theory
3.	Program Elective	Practicum		Internship/Fellowship /in –house project	-	540	12	Project
Test & Revisions					-	20	-	-
				Total	-	**665**	**18**	-
3	Project / Internship	Project/Internship	EEE6351	Internship	-	540	12	Project
3	Project / Internship	Project/Internship	EEE6353	Fellowship	-	540	12	Project
3	Project / Internship	Project/Internship	EEE6374	In-house Project	-	540	12	Project

ELECTIVE-I								
#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1.	Program Elective	Practicum	EEE5541	IoT And Application	1-0-4	75	3	Practical
2.	Program Elective	Practicum	EEE5542	Computer Hardware and Networking	1-0-4	75	3	Practical
3.	Program Elective	Practicum	EEE5543	Control of Electrical Machines	**1-0-4**	**75**	**3**	**Practical**
4.	Program Elective	Practicum	EEE5544	Auto Mechatronics	1-0-4	75	3	Practical
5.	Program Elective	Practicum	EEE5545	Mechanical Engineering	1-0-4	75	3	Practical
6.	Program Elective	Practicum	EEE5546	Estimation, Standards and Regulations	**1-0-4**	**75**	**3**	**Practical**
7.	Program Elective	Practicum	EEE5547	Inter discipline course #	1-0-4	75	3	Practical

ELECTIVE-II (Pathway)								
#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1.	Elective | Higher Education	Theory	EEE6111	Advanced Engineering Mathematics	3-0-0	45	3	Theory
2.	Elective | Entrepreneurship	Theory	EEE6112	Entrepreneurship	3-0-0	45	3	Theory
3.	Elective | Technocrats	Theory	EEE6113	Project Management	3-0-0	45	3	Theory
4.	Elective | Technocrats	Theory	EEE6114	Finance Fundamentals	3-0-0	45	3	Theory
5.	Elective | Technocrats	Theory	EEE6115	Industrial Management And Safety	3-0-0	45	3	Theory
6.	Elective | Technocrats	Theory	EEE6116	Battery Management System	3-0-0	45	3	Theory
7.	Elective | Technocrats	Theory	EEE6117	Industrial Automation	3-0-0	45	3	Theory
8.	Elective | Technocrats	Theory		Online Elective Courses $	3-0-0	45	3	Theory

ELECTIVE - III (Specialization)								
S. No.	**Course Category**	**Course Type**	**Code**	**Course Title**	**L-T-P**	**Period**	**Credit**	**End Exam**
1.	Program Elective	Practicum	EEE6231	HVAC (R & AC)	2-0-2	60	3	Theory
2.	Program Elective	Practicum	EEE6232	PCB Design and Assembly	2-0-2	60	3	Theory
3.	Program Elective	Practicum	EEE6233	Electronics Product Design	2-0-2	60	3	Theory
4.	Program Elective	Practicum	EEE6234	Renewable Energy Systems	2-0-2	60	3	Theory
5.	Program Elective	Practicum	EEE6235	Energy Conservation and Auditing	2-0-2	60	3	Theory
6.	Program Elective	Practicum	EEE6236	Electrical Drives and Controls	2-0-2	60	3	Theory

ANNEXURE – II
SCHEME OF EXAMINATIONS
Electrical and Electronics Engineering(Full Time)

THIRD SEMESTER

S.No.	Course Code	Course	Examination Marks		Total Marks	Min. For Pass	Duration of Exam Hours	End Exam
			Internal Assessment Marks	Autonomous Exam Marks#				
1	EEE3110	Electrical Machines I	40	60	100	40	3	Theory
2	EEE3210	Electrical Circuit Theory	40	60	100	40	3	Theory
3	EEE3340	Sensors And Measurement	40	60	100	40	3	Practical
4	EEE3440	Analog And Digital Electronics	40	60	100	40	3	Practical
5	EEE3540	Programming in C	40	60	100	40	3	Practical
6	EEE3620	Electrical Machines I Practical	40	60	100	40	3	Practical
7		Advanced Skills Certification - 3						NA
8		Growth Lab						NA
9		Induction Program II						**
10		I&E/ Club Activity/ Community Initiatives						**
11		Shop floor Immersion						**
12		Student-Led Initiative						**
13		Emerging Technology Seminars						**
14		Health & Wellness						**
	TOTAL		**240**	**360**	**600**	**-**	**-**	**-**

Autonomous Examinations will be conducted for 100 marks and will be converted to 60 marks.

ANNEXURE – II

SCHEME OF EXAMINATIONS

Electrical and Electronics Engineering(Full Time)

FOURTH- SEMESTER

S. No.	Course Code	Course	Examination Marks		Total Marks	Min. For Pass	Duration of Exam Hours	End Exam
			Internal Assessment Marks	Autonomous Exam Marks#				
1	EEE4110	Electrical Machines II	40	60	100	40	3	Theory
2	EEE4210	Generation, Transmission and Distribution	40	60	100	40	3	Theory
3	EEE4340	Microcontroller and Embedded Systems	40	60	100	40	3	Practical
4	EEE4440	Electrical CAD Design	40	60	100	40	3	Practical
5	EEE4540	Servicing of Electrical Appliances	40	60	100	40	3	Practical
6	EEE4620	Electrical Machines II Practical	40	60	100	40	3	Practical
7		Advanced Skills Certification - 4						NA
8		I&E/ Club Activity/ Community Initiatives						**
9		Shop floor Immersion						**
10		Student-Led Initiative						**
11		Emerging Technology Seminars						**
12		Health & Wellness						**
13		Special Interest Groups (Placement Training)						**
	TOTAL		**240**	**360**	**600**			

Autonomous Examinations will be conducted for 100 marks and will be converted to 60 marks.

ANN7EXURE – II

SCHEME OF EXAMINATIONS

Electrical and Electronics Engineering (Full Time)

FIFTH- SEMESTER

S. No.	Course Code	Course	Examination Marks		Total Marks	Min. For Pass	Duration of Exam Hours	End Exam
			Internal Assess ment Marks	Autono mous Exam Marks#				
1	EEE5110	Power System Protection and Utilization	40	60	100	40	3	Theory
2	EEE5210	Electric Vehicle Technology	40	60	100	40	3	Theory
3	EEE5340	Power Electronics	40	60	100	40	3	Practical
4	EEE5440	PLC and Automation	40	60	100	40	3	Practical
5	**Elective–1**		40	60	100	40	3	Practical
	EEE5541	IoT And Application						
	EEE5542	Computer Hardware and Networking						
	EEE5543	Control of Electrical Machines						
	EEE5544	Auto Mechatronics						
	EEE5545	Mechanical Engineering						
	EEE5546	Estimation, Standards and Regulations						
	EEE5547	Inter discipline course #						
6	EEE5860	Advanced Skills Certification–5						NA
7	EEE5654	Innovation &Startup						Project
8	EEE5773	Industrial Training* [SummerVacation-90Hours]						Project
9	**	Induction program III						**
10	**	Special Interest Groups(Placement Training)						**
11	**	Health &Wellness						**
12	**	Student-Led Initiative						**
	TOTAL		**200**	**300**	**500**			

Autonomous Examinations will be conducted for 100 marks and will be converted to 60 marks

ANNEXURE – II
SCHEME OF EXAMINATIONS
Electrical and Electronics Engineering (Full Time)

SIXTH SEMESTER

S. No.	Course Code	Course	Examination Marks: Internal Assessment Marks	Examination Marks: Autonomous Exam Marks#	Total Marks	Min. For Pass	Duration of Exam Hours	End Exam
1	**Elective-2(Pathway)**		40	60	100	40	3	Theory
	EEE6111	Advanced Engineering Mathematics						
	EEE6112	Entrepreneurship						
	EEE6113	Project Management						
	EEE6114	Finance Fundamentals						
	EEE6115	Industrial Management And Safety						
	EEE6116	Battery Management System						
	EEE6117	Industrial Automation						
		Online Elective Courses $						
2	**Elective-3(Specialization)**		40	60	100	40	3	Theory
	EEE6231	HVAC (R & AC)						
	EEE6232	PCB Design and Assembly						
	EEE6233	Electronics Product Design						
	EEE6234	Renewable Energy Systems						
	EEE6235	Energy Conservation and Auditing						
	EEE6236	Electrical Drives and Controls						
3		Internship//Fellowship/In-house Project/ Industrial Training(SW)	40	60	100	40	3	Project

Autonomous Examinations will be conducted for 100 marks and will be converted to 60 marks.

EEE3110- ELECTRICAL MACHINES I

L	T	P	C
4	0	0	4

Programme Name : EEE
Course Code : EEE3110
Semester : III SEMESTER
Course Title : ELECTRICAL MACHINES I
Course Type : THEORY

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Electrical Machines I	4	60	40	100*	100	3 Hrs

***Examinations will be conducted for 100 marks and will be converted to 60 marks**

TOPICS AND ALLOCATION OF HOURS

Unit	Topics	Time (Hrs)
I	Dc generators	12
II	Dc motors	12
III	Single phase transformers	12
IV	Three phase transformer	12
V	Maintenance of dc machines and transformers	12
	Total	**60**

COURSE DESCRIPTION:

A solid foundation in Electrical Engineering is crucial for all engineers. It's important for them to have a deep understanding of the basic principles, construction, and operation of D.C machines, Transformers, and specialized machines. For students to develop the required psychomotor skills in this field, it's essential that they not only grasp the concepts but also apply them effectively.

COURSE OBJECTIVES

The objective of this course is to enable the student to

- Comprehend operation, types and characteristics of DC Generator.
- Comprehend operation, types, characteristics and speed control of DC Motor.

- Learn the operation, types, EMF Equation, phasor diagrams, efficiency and parallel operation of single phase transformer.
- Study parallel operation, cooling & tap changers of transformer.
- Emphasize preventive and breakdown maintenance, resolve sparking, maintain transformer oil and understand earthing.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to	
E3110.1	Understand the significance and operation of DC Generator.
E3110.2	Understand the significance and operation of DC Motor.
E3110.3	Describe Principles and applications of single-phase transformer
E3110.4	Describe the construction of three-phase transformer and its accessories.
E3110.5	Apply maintenance strategies for electrical equipment.

Pre-requisite

- Basics of Science and basic Algebra
- Basics of Electrical and Electronics Engineering

CO/PO & PSO Mapping Matrix:

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E3110.1	3	2	2	3	3	-	2	3	2	3
E3110.2	3	2	2	3	3	-	2	3	2	3
E3110.3	3	2	2	3	3	-	2	3	2	3
E3110.4	3	2	2	3	3	-	2	3	2	3
E3110.5	3	2	2	3	3	-	2	3	2	3
Total	**15**	**10**	**10**	**15**	**15**	**-**	**10**	**15**	**10**	**15**
Correlation level	3	2	2	3	3	-	2	3	2	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Unit 1 & 2)	Written test (Unit 3 & 4)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative schedule	6th Week	12th Week	13-14th Week	16th Week	

CONTINUOUS ASSESSMENT

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 10 Marks for the internal assessment.

CA1 and CA2, Assessment test should be conducted for two units as below

- PART A: (5 X 10 Marks = 50 Marks).
- Eight questions will be asked, students should write five questions. Four questionscan be asked from each unit.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 10 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. Themarks should be converted to 10 marks for the internal assessment.

Question Pattern:

- Answer Ten questions by selecting two questions from each unit. Each question carries10 marks.
- Four questions will be asked from every unit. Students should write any two questions.

Question Pattern - Model Examination and End Semester Examination Theory Exam

PART- A (5 X2X 10 Marks = 100 Marks)

Note: Answer Ten questions by selecting two questions from each unit.
Eachquestion carries 10 marks.

Sample:

I	1.
	2.
	3.
	4.
II	5.
	6.
	7.
	8.
III	9.
	10.
	11.
	12.
IV	13.
	14.
	15.
	16.
V	17.
	18.
	19.
	20.

QUESTION PAPER SETTING:

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **Ap**-Apply	**An**- Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

EEE3110 - ELECTRICAL MACHINES I

L	T	P	C
4	0	0	4

THEORY

Unit I : DC GENERATORS	**[12Hrs]**
Basics of Electromagnetism	[1Hr]
Overview of DC Generator	[1Hr]
Importance of DC generators in power generation and various industries	[1Hr]
Types of DC generators	[1Hr]
EMF equation - Simple Problems	[1Hr]
Internal and External characteristics – Applications	[1Hr]
Process of building up of EMF - Critical field resistance	[1Hr]
Causes of failure to build up voltage and remedies	[1Hr]
Analysis of armature reaction effects - Commutation process	[2 Hrs]
Methods of improving commutation.	[2 Hrs]
Unit II : DC MOTORS	**[12 Hrs]**
Overview of DC Motors	[1Hr]
Significance of DC Motors in various industries and automation	[1Hr]
Types of DC Motors	[1Hr]
Torque equation – Simple problems	[2 Hrs]
Load characteristics – Torque - Speed characteristics – Applications	[2 Hrs]
Necessity of starters - 3 point and 4 point starters - Speed Control of DC Motors – Losses	[2 Hrs]
Efficiency and regulation of DC Motors - simple problems	[1Hr]
Special DC Machines: BLDC Motor, Servomotor, PMDC Motor, Stepper motor.	[2 Hrs]
UNIT III : SINGLE PHASE TRANSFORMERS	**[12 Hrs]**
Introduction to Transformers - Transformer Ratings, Applications	[1Hr]
EMF equation – Problems – Ideal Transformer	[2 Hrs]
No-load and Load Phasor Diagrams at Varying Power Factors	[1Hr]
Determination of equivalent circuit constants - Voltage Regulation,	[2 Hrs]
Losses and Efficiency- simple problems	[1Hr]
Condition for maximum efficiency – All day efficiency- problems	[1Hr]
parallel operation of single-phase Transformer	[1Hr]
Auto Transformer	[1Hr]
Comparision between two winding transformer and Auto transformer.	[2 Hrs]
UNIT IV: THREE PHASE TRANSFORMER	**[12Hrs]**
Three Phase Transformer – Construction	[2 Hrs]
types of connection of transformer	[2 Hrs]
Parallel operation and grouping of three phase transformers - applications	[2 Hrs]
Cooling of transformers – Various cooling arrangements	[2 Hrs]
Transformer accessories – conservator, breather, explosion vent, bucholz relay	[2 Hrs]
ON load and OFF loadtap changer	[2 Hrs]

UNIT V : MAINTENANCE OF DC MACHINES AND TRANSFORMER	[12 Hrs]
Importance of Maintenance - Preventive and Breakdown Maintenance	[1Hr]
Causes of Sparking in Commutator – Defects in Commutator and Remedies	[2 Hrs]
Resurfacing of Commutator and Brushes	[1Hr]
Defects in DC Armature winding	[2 Hrs]
Maintenance of Transformer Oil	[1Hr]
Transformer oil tester	[1Hr]
Acidity test, BDV test – Earthing	[2 Hrs]
Measurement of earth resistance.	[2Hrs].
TOTAL	**60 hrs**

Suggested List of Students Activity

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application

REFERENCE BOOKS:

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Electrical Technology volume-II (AC and DCMachines)	B. L. Theraja and A. K. Theraja,	Multi colour Edition, S. Chand & Co.,2005
2.	Electrical Machines	S.K.Bhattacharya	Third Edition, McGraw Hill Education, 2008.
3.	Electric Machines	Ashfaq Husain, Haroon Ashfaq,	Third Edition, Dhanpat Rai & Co. (P) Ltd., 2016.
4.	Principles of Electrical Machines	V.K. Mehta & Rohit Mehta	Second Edition, S. Chand & Co.,2019

Web-based/Online Resources

S.No	Websites
1.	NPTEL (Website): The National Programme on Technology Enhanced Learning (NPTEL) offers free online courses on Electrical Machines and other Electrical Engineering topics. NPTEL Electrical Engineering.
2.	MIT Open Course Ware (OCW) Electrical Engineering and Computer Science - Provides free course materials for electrical engineering topics, including electrical machines.
3.	Khan Academy - Offers tutorials on basic electrical engineering concepts that can reinforce understanding of electromagnetism and circuit analysis.
4.	IEEE Xplore Digital Library - For advanced research articles and materials on specific electrical machines and their applications

MODEL QUESTION PAPER

EEE3110- ELECTRICAL MACHINES 1

Time : 3 Hrs. **Max.Marks : 100**

PART – A (5 X 2 X 10 = 100 MARKS)					
Note : Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.					
S. No	**QUESTIONS**	**UNIT**	**BLOOM'S LEVEL**	**CO**	**PO**
I	1) Explain with diagram the construction of DC generator?	I	R	E3110.1	PO2,PO5, PO7
	2) Derive the EMF equation of DC generator?	I	U	E3110.1	PO2,PO5, PO7
	3)Explain briefly types of winding s used in DC Generator?	I	R	E3110.1	PO2,PO5, PO7
	4)A 6 pole DC generator has 1200 conductors and is lap wound If the flux per pole is 0.02web and the speed is 1000 rpm calculate the EMF generated?	I	R	E3110.1	PO2,PO5, PO7
II	5)Torque equation of DC motor?	II	U	E3110.2	PO2,PO5, PO7
	6) Explain speed control of dc shunt motor?	II	R	E3110.2	PO2,PO5, PO7
	7)A DC motor takes an armature current of 100A at 400 volts the machine has 6 poles and the armature is lap wound with 864 conductors. The flux per pole is 0.05 weber .Calculate the torque developed in kgm.	II	R	E3110.2	PO2,PO5, PO7
	8)Draw and explain the working of four point starter?	II	R	E3110.2	PO2,PO5, PO7
III	9)Explain the constructional details of single phase transformer?	III	U	E3110.3	PO2,PO5, PO7
	10)Derive the EMF equation of transformer?	III	U	E3110.3	PO2,PO5, PO7
	11)Write shorts notes on all day efficiency?	III	R	E3110.3	PO2,PO5, PO7
	12) Explain the difference between Two winding transformer and auto transformer?	III	An	E3110.3	PO2,PO5, PO7
IV	13) Explain the different connection of three phase transformer?	IV	U	E3110.4	PO2,PO5, PO7
	14)Discuss about the grouping of transformers?	IV	R	E3110.4	PO2,PO5, PO7
	15)Explain about any three method of cooling of transformers?	IV	R	E3110.4	PO2,PO5, PO7
	16)Explain the operation of (i)conservator (ii)Breather (iii)Explosion vent	IV	U	E3110.4	PO2,PO5, PO7
	17) Explain about preventive maintenance?	V	R	E3110.5	PO2,PO5, PO7

V	18) Explain the resurfacing process of commutator in DC machine?	V	R	E3110.5	PO2,PO5, PO7
	19) Explain with neat sketch the working of transformer oil tester?	V	U	E3110.5	PO2,PO5, PO7
	20) Explain how acidity of transformer oil is determined by conducting acidity test?	V	U	E3110.5	PO2,PO5, PO7

QUESTION PAPER SETTING :

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, U-Understand, Ap-Apply	An- Analyse, E-Evaluate, C-Create
% to be included	90 %	10 %

EEE3210 - ELECTRICAL CIRCUIT THEORY

Programme Name : EEE
Course Code : EEE3210
Semester : III SEMESTER
Course Title : ELECTRICAL CIRCUIT THEORY
Course Type : THEORY

L	T	P	C
4	0	0	4

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Electrical Circuit Theory	4	60	40	100*	100	3 Hrs

*Examinations will be conducted for 100 marks and will be converted to 60 marks

TOPICS AND ALLOCATION OF HOURS

Unit	Topics	Time (Hrs)
I	Basic circuit analysis	12
II	Network theorems	12
III	Single phase ac series circuits	12
IV	Single phase ac parallel circuit & resonance	12
V	Three phase circuits	12
Total		**60**

COURSE DESCRIPTION:

Electrical circuits are very important to all engineering disciplines either because there are electric circuits in those disciplines or because the underlying physical ideas are easily translated to other disciplines. The two most important laws in circuit analysis are the two Kirchhoff's Laws which are just another form of the conservation laws of physics. These laws are ALWAYS valid in every situation. Circuit theory is the cornerstone of electrical engineering, providing the rules and methods for analyzing electrical circuits. Electric circuit theory is one of the most vital aspects of electrical engineering.

COURSE OBJECTIVES:

The objective of this course is to enable the student to

- Maintain electrical systems applying AC and DC circuit fundamentals
- Impart knowledge on solving circuit equations using network theorems

- Learn the concept of single phase AC Series Circuits for different load condition.
- Learn the phenomenon of single phase AC Parallel circuit and resonance circuits.
- Introduce Phase diagrams and analysis of three phase circuit.

COURSE OUTCOMES

On successful completion of this course, the student will be able to	
E3210.1	Apply principles of circuit analysis to solve electric circuits.
E3210.2	Apply network theorems to solve electric circuits.
E3210.3	Solve the problems related to single phase A.C Series circuits.
E3210.4	Solve the problems related to single phase A.C Parallel circuits and Resonance circuits.
E3210.5	Solve the problems related to three phase circuits.

Pre-requisites

Knowledge of basic Mathematics

CO/PO & PSO Mapping Matrix:

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E3210.1	3	2	2	3	3	-	2	3	2	3
E3210.2	3	2	2	3	3	-	2	3	2	3
E3210.3	3	2	2	3	3	-	2	3	2	3
E3210.4	3	2	2	3	3	-	2	3	2	3
E3210.5	3	2	2	3	3	-	2	3	2	3
Total	**15**	**10**	**10**	**15**	**15**	**-**	**10**	**15**	**10**	**15**
Correlation level	**3**	**2**	**2**	**3**	**3**	**-**	**2**	**3**	**2**	**3**

Legend: 3-HighCorrelation, 2-Medium Correlation, 1-LowCorrelation

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice- activity strategy throughout the course to ensure outcome-driven learning and employability.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Unit 1 & 2)	Written test (Unit 3 & 4)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	-

CONTINUOUS ASSESSMENT

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 10 Marks for the internal assessment.

CA1and CA2, Assessment test should be conducted for two units as below

- PART A: (5 X 10 Marks = 50 Marks).
- Eight questions will be asked, students should write five questions. Four questions can be asked from each unit.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 10 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 10 marks for the internal assessment.

Question Pattern:

- Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.
- Four questions will be asked from every unit. Students should write any two questions.

Question Pattern - Model Examination and End Semester Examination Theory Exam

PART- A (5 X2X10 Marks = 100 Marks)

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.

Sample:

I 1.
2.
3.
4.
II 5.
6.

	7.
	8.
III	9.
	10.
	11.
	12.
IV	13.
	14.
	15.
	16.
V	17.
	18.
	19.
	20.

QUESTION PAPER SETTING :

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **Ap**-Apply	**An**- Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

EEE3210 - ELECTRICAL CIRCUIT THEORY

L	T	P	C
4	0	0	4

THEORY

Unit I - BASIC CIRCUITS ANALYSIS	**[12 Hrs]**
Resistive elements - Ohm's Law , Kirchhoff's laws Resistors in series parallel circuits Source of transformation Star/delta and delta/star transformation Definition of Network-Node- Branch – Mesh analysis Node AnalysisProblems on all the above topics.	[1Hr] [1Hr] [1Hr] [1Hr] [2Hrs] [6Hrs]
Unit II- NETWORK THEOREMS	**[12Hrs]**
Superposition Theorem Thevenin's Theorem Norton's Theorem Maximum Power Transfer Theorem Problems on all the above topics.	[1Hr] [1Hr] [1Hr] [1Hr] [8 Hrs]
Unit III- SINGLE PHASE A.C SERIES CIRCUITS	**[12Hrs]**
Sinusoidal voltage and current - Instantaneous, peak Values Average and effective values Form Factor - Peak factor - Pure resistive circuits Inductive and capacitive circuits RL,RC series circuits, RLC series circuits Impedance – Phase angle – Phasor diagram – Power and Power factor Power triangle – Apparent power – Active Power - Reactive power Problems using RL, RC, and RLC series circuits.	[1Hr] [1Hr] [1Hr] [1Hr] [2Hrs] [2Hrs] [4 Hrs]
Unit IV - SINGLE PHASE A.C PARALLEL CIRCUITS & RESONANCE	**[12 Hrs]**
J Notations – Rectangular and polar coordinates - Parallel circuits (two branches only) Conductance - Susceptance – Admittance - Problems using two branch parallel circuits. Series Resonance: Effects of varying inductance and capacitance in series RLC circuit Selectivity – 'Q' factor - Resonance Frequency – Bandwidth Half power frequencies- Problems on all the above topics. Parallel Resonance : Two branch parallel circuits, Q Factor - Resonance Frequency – Bandwidth -Resonance circuit- applications – comparison series parallel resonance Problems on all the above topics.	[1Hr] [2 Hrs] [1Hr] [2Hrs] [1Hr] [1Hr] [4 Hrs]
Unit V- THREE PHASE CIRCUITS	**[12 Hrs]**
Significance of 3 phase circuits – Advantages of three phase supply Star, Delta connections – Phase sequence – Balanced load Relation between voltages, currents of line and phase values in star and delta connection Problems in balanced loads of star and delta connections	[1 Hr] [2 Hrs] [2 Hrs] [3 Hrs]

Measurement of 3 phases power using two wattmeter method (Derivation and Problems) Star and Delta connected unbalanced loads (No problems) Symmetrical components (No problems).	[2 Hrs] [1 Hr] [1 Hr]
TOTAL	**60 Hrs**

Suggested List of Students Activity:

- Prepare power point presentation on source transformation, star delta transformation, mesh and nodal analysis and give presentation in the class room.
- Select suitable components for the given circuit and prepare the same on bread board to verify the following theorems practically and theoretically: Superposition theorem, thevenin's theorem, maximum power transfer theorem and Norton theorem.
- Design different kinds of circuits that you will study in your class and assemble them using the relevant components, for example:
- Circuit to measure the value of an unknown resistance using a meter bridge
- Circuit to compare e.m.f. of two cells using a potentiometer, etc.
- Measure the voltmeter and ammeter readings for different rheostat settings and verify if the ratio of potential difference across the resistor to the current through it is constant. Modify the circuit using two resistors which may either be connected in series or in parallel.
- Make a study of different battery eliminators, dc sources (cells, batteries) in the laboratories.

Text Books:

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Electric Circuit Theory	Dr. M. Arumugam & N. Premakumaran	KhannaPublishers, 2017
2.	A Text Book of Electrical Technology Volume - I	B.L. Theraja, A.K. Theraja,	S Chand & Co.,2014.
3.	Problems and Solutions of Electrical Circuit Analysis	Rajendra Prasad	PHI LearningPrivate Limited, 2014.
4	Fundamentals of electrical engineering	Rajendra prasad	PHI Learning private Limited 2014

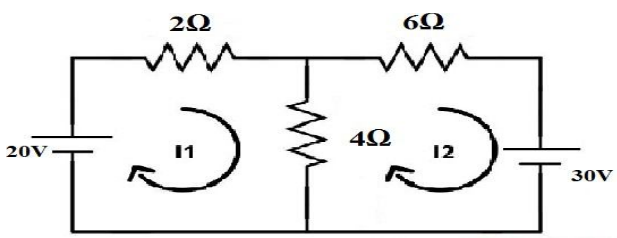
Web-based/Online Resources

S.No	Websites
1.	II Year diploma level book as per aicte model curriculum (based upon outcome based education as per new education policy 2020) available in AICTE website.
2.	https://ekumbh.aicte-india.org/userdiplomabook.php
3.	https://www.khanacademy.org/science/electrical-engineering/ee-circuit-analysis-topic/circuit-elements/v/ee-ideal-sources
4.	https://onlinecourses.nptel.ac.in/noc20_ee64/preview

MODEL QUESTION PAPER

EEE3210-ELECTRICAL CIRCUIT THEORY

Time : 3 Hrs. **Max.Marks : 100**

PART – A (5X2X10=100 MARKS)					
Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.					
S. No	QUESTIONS	UNIT	BLOOM'S LEVEL	CO	PO
I	1) Defined electric current, voltage, resistance, power,and energy?	I	R	E3210.1	PO2,PO5 ,PO7
	2) State and explain kirchhoffs law's ?	I	U	E3210.1	PO2,PO5 ,PO7
	3) Derive and expression of three resistors are connected in series and in parallel?	I	An	E3210.1	PO2,PO5 ,PO7
	4)Determine the current through the 4 ohm resistor using Mesh Current Method 	I	R	E3210.1	PO2,PO5 ,PO7
II	5)State and explain super position therom?	II	U	E3210.2	PO2,PO5 ,PO7
	6)Explain Thevenins Therom	II	R	E3210.2	PO2,PO5 ,PO7
	7)Explain nortann's therom	II	R	E3210.2	PO2,PO5 ,PO7
	8)Maximum power transfer therom	II	R	E3210.2	PO2,PO5 ,PO7
III	9) Explain effective value, average value, form factor,and peakfactor?	III	U	E3210.3	PO2,PO5 ,PO7
	10) Derive the expression of RLC series circuit?	III	U	E3210.3	PO2,PO, PO7
	11) Define phase ,angle power triangle,active power,reactive power,apparent power?	III	R	E3210.3	PO2,PO, PO7
	12)A series circuit consisting of resistance 20 ohm on inductance 0.2H and capacitance of 100 MFD is connected to 200 volt,50 hz supply.Find the power consumed in the circuit?	III	R	E3210.3	PO2,PO5 ,PO7

IV	13)Define conductance susceptance, admittance Selectivity and Qfactor?	IV	U	E3210.4	PO2,PO5 ,PO7
	14)Two impedance Z1=6+j8ohm,Z2=8-j16ohm are connected in parallel across a voltage of 250 volt. Find the circuit current and the branch current?	IV	R	E3210.4	PO2,PO5 ,PO7
	15)Derive the expression of RLC parallel resonance circuit ?	IV	R	E3210.4	PO2,PO5 ,PO7
	16)Compare Series and Parallel Resonance.	IV	An	E3210.4	PO2,PO5 ,PO7
V	17)Define phase sequence, balanced load and unbalanced load in star and delta?	V	An	E3210.5	PO2,PO5 ,PO7
	18)Derive the expression relation between line current and phase current in delta connection?	V	R	E3210.5	PO2,PO5 ,PO7
	19)Explain three phase power and power factor measurement of two wattmeter method?	V	U	E3210.5	PO2,PO5 ,PO7
	20)A balanced star connected load of 8+j6 ohm per phase is connected to a three phase 230 volt supply. Find the line current power factor, power , reactive volt ampere and total volt ampere?	V	U	E3210.5	PO2,PO5 ,PO7

QUESTION PAPER SETTING :

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, U-Understand, AP-Apply	An- Analyse, E-Evaluate, C-Create
% to be included	90 %	10 %

EEE 3340 - SENSORS AND MEASUREMENT

L	T	P	C
1	0	4	3

Programme Name : EEE

Course Code : EEE 3340

Semester : III SEMESTER

Course Title : SENSORS AND MEASUREMENT

Course Type : PRACTICUM

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hrs / Week	Hrs / Semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Sensors and Measurement	5	75	40	60*	100	3 Hrs.

*Examinations will be conducted for 100 marks and it will be reduced to 60 marks.

COURSE DESCRIPTION:

The advancement of science and technology is dependent upon a parallel progress in measurement techniques. Measurement play a significant role in achieving goals and objectives of Engineering because of the feedback information supplied by them. Sensors are needed to measure unknown signals and parameters of an engineering system and its environment. Sensor is a device that when exposed to a physical phenomenon produces a proportional output signal. A diploma holder when employed in automated industrial process controls will be required to know the basics of Sensors and Measurements.

COURSE OBJECTIVES:

The objective of this course is to enable the student to

- Learn the Construction and working of instruments used for Current, Voltage and Resistance Measurements.
- Learn the Construction and working of instruments used for Power and Energy.
- Practice in handling of Earth Tester, Anderson Bridge and Schering Bridge.
- Explain the working of active and passive transducers and their applications.
- Learn the overview of Arduino compatible sensors.

COURSE OUTCOMES:

After successful completion of this course, the students should be able to	
E3340.1	Understand the Terms and characteristics of measuring instruments.
E3340.2	Perform Calibration of Ammeter, Voltmeter and Energy Meter.
E3340.3	Handle Earth tester, Wheatstone, Anderson and Schering bridges.
E3340.4	Experiment with Temperature sensor, Inductive and Capacitive Sensors.
E3340.5	Demonstrate the applications of Arduino compatible sensors.

Pre-Requisites

- Basic Physics
- Basics of Electrical Engineering

CO/PO & PSO Mapping Matrix:

CO-PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E3340.1	3	2	3	2	-	3	3	3	2	3
E3340.2	3	2	3	2	-	3	3	3	2	3
E3340.3	3	2	3	2	-	3	3	3	2	3
E3340.4	3	2	3	2	-	3	3	3	2	3
E3340.5	3	2	3	2	-	3	3	3	2	3
Total	**15**	**10**	**15**	**10**	**-**	**15**	**15**	**15**	**10**	**15**
Correlation Level	**3**	**2**	**3**	**2**	**-**	**3**	**3**	**3**	**2**	**3**

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- It is advised that teachers take steps to pique pupils' attention and boost their curiosity to learn.
- Implement task-based learning activities where students work on specific tasks or projects.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- Incorporate formative and summative assessments to gauge student progress and provide targeted feedback.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices may be followed in the real environment as faras possible.

Assessment Methodology:

	Continuous Assessment (40 Marks)				End Semester Examination (60 Marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Model Practical Examination	Practical Examination
Portion	Ex. 1 to 6	Ex. 7 to 13	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	-

Note:

- **CA1 and CA2:** All the exercises/experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The marks awarded will be converted to 10 Marks for each assessment test.
- Practical document (Hand written document / Notebook consists of Aim, Apparatus Required, Circuit, Tabulation / Graph, Procedure and Result) should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise / experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Circuit Diagram	15
C	Connection	10
D	Execution and Output/Result	20
TOTAL		50
E	Practical Documents (As per the portions)	10
TOTAL		**60**

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 10 Marks for internal assessment. The question setting details are as follows.

	DESCRIPTION	PATTERN	MARKS
PART-A	30 Multiple Choice Questions (MCQ)	30 x 1 Mark	30
PART-B	7 Questions to be answered out of 10 Questions	7 x 10 Mark	70
TOTAL MARKS			**100**

- **CA 4:** All the exercises/experiments should be completed and kept for the Model Practical Examination. The students shall be permitted to select any one by lot for the exam The model practical examination should be conducted as per the End Semester Examination question pattern as given below. The marks awarded should be converted to 10 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination-
Practical Exam

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Circuit Diagram	20
C	Connections	20
D	Execution and Output/Result	25
E	MCQ from Theory Portions	20
F	Viva Voce	10
TOTAL MARKS		**100**

EEE 3340- SENSORS AND MEASUREMENT

L	T	P	C
1	0	4	3

Theory Portion :		
Unit I	**MEASURING INSTRUMENTS**	**[8 Hrs]**
	Definition of Measurement - Definition of True Value, Accuracy, Precision, Error and Error Correction, Instrument Efficiency Classifications of Analog Instruments (Indicating, Recording and Integrating) Operating Forces (Deflecting force, Controlling force & Damping force). Construction, Working and Torque Equation of Permanent Magnet Moving Coil Instrument and Moving Iron Instruments (Repulsion and Attraction type) Extension of Instrument Range using Shunts and Multipliers – CT and PT Construction and Working of Multimeter, Megger and Earth Tester. Construction and Working of: Single Phase Electro Dynamometer type Wattmeter Single Phase Energy Meter – Three Phase Energy Meter - Digital Energy Meter Introduction about Power Factor Meter, Frequency Meter and Phase Sequence Indicator – Block Diagram of CRO.	[1Hr] [1Hr] [1Hr] [1Hr] [1Hr] [1Hr] [1Hr] [1Hr]

Practical Exercises:		
EX.NO	**NAME OF THE EXPERIMENT**	
1	VOLTAGE, CURRENT AND POWER MEASUREMENT IN SINGLE PHASE AC CIRCUIT. Activities to Perform: a) Conduct an experiment to measure voltage, current and power in single phase a.c circuit by using Voltmeter, Ammeter and Wattmeter respectively for different loads. b) Repeat the same experiment by replacing above meters with single Digital Power Monitor. c) Compare and Discuss the observations.	[3 Hrs]
2	CALIBRATION OF AMMETER AND VOLTMETER Activities to Perform: i) Conduct an Experiment to calibrate the given Ammeter and Voltmeterwith corresponding standard meters. ii) Plot the Error Curve.	[3 Hrs]

3	MEASUREMENT OF CURRENT IN THREE PHASE CIRCUIT BY USING SINGLE AMMETER Activities to Perform: i) Connect single Ammeter in three phase circuit through Ammeter SelectorSwitch (ASS) and Current Transformers. ii) Measure current in R, Y and B phases by using single Ammeter for balanced and unbalanced load.	[3 Hrs]
4	CALIBRATION OF WATT METER Activities to Perform: i) Conduct an Experiment to calibrate the given Watt Meter using with corresponding standard meters ii) Plot the Error Curve.	[3 Hrs]
5	CALIBRATION OF ENERGY METER Activities to Perform: i) Conduct an Experiment to calibrate the given Three Phase Energy Meter using Wattmeter and Stop Clock. ii) Plot the Error Curve.	[4 Hrs]
6	MEASUREMENT OF RESISTANCE USING WHEATSTONE BRIDGE Activities to Perform: i) Discuss the theory of Wheatstone Bridge. ii) Conduct an Experiment to measure the value of armature winding resistance using Whetstone Bridge. iii) Compare the observed value of resistance with theoretical / calculated value.	[4 Hrs]
7	MEASUREMENT OF EARTH RESISTANCE BY USING EARTH TESTER. Activities to Perform: i) Discuss the Necessity of maintaining Earth Resistance as Low Value. ii) Discuss the Permissible Earth Resistance Value as per Indian Standard. iii) Conduct an Experiment to measure the Earth Resistance by using Earth Tester.	[4 Hrs]
Theory Portion :		
UNIT II	**SENSORS AND TRANSDUCERS**	**[7 Hrs]**
Resistance and Inductance Sensors: Definition of Transducer		[1Hr]
Classification of Transducers - Resistive Transducer (Linear and Rotary POTs) – Strain Gauge Load Cell – Construction and Operation of LVDT and RVDT.		[1Hr]
Temperature Sensors: Thermocouple – Resistance Temperature Detector – Thermostat. Proximity Sensors: Inductive Proximity Sensor – Capacitive Proximity		[1Hr]
Sensor. Light Sensor: Photodiode – Phototransistor – Photoconductive Cell		[1Hr]
Photovoltaic Cells - Bar Code Reader - Optical Shaft Encoder.		[1Hr]
Overview of Arduino compatible sensors: Ultrasonic Sensor - Moisture Sensor –		[1Hr]
Current Sensor.		[1Hr]
Practical Exercises:		

Ex.No	Name of the Experiment	
8	MEASUREMENT OF INDUCTANCE USING ANDERSON BRIDGE Activities to Perform: i) Discuss the theory of Anderson Bridge. ii) Conduct an Experiment to measure the value of unknown Inductance using Anderson Bridge. iii) Compare the measured value of inductance with theoretical / calculated value.	[4 Hrs]
9	MEASUREMENT OF CAPACITANCE USING SCHERING BRIDGE Activities to Perform: i) Discuss the theory of Schering Bridge. ii) Conduct an Experiment to measure the value of unknown Capacitance using Schering Bridge. iii) Compare the measured value of Capacitance with theoretical / Calculated value.	[4 Hrs]
10	TEMPERATURE MEASUREMENT Activities to Perform: i) Construct a circuit to measure Temperature of Liquid using Thermostat, Thermocouple and RTD (Any 2). ii) Plot the graphical relationship between input and output Parameters.	[4 Hrs]
11	BEHAVIOUR OF PROXIMITY SENSORS Activities to Perform: i) Observe the behavior of Inductive proximity sensor and Capacitive Proximity sensor for different material samples. ii) Interface relay and buzzer with sensors to test the output.	[4 Hrs]
12	LVDT Activities to Perform: i) Construct a circuit for Measurement of Linear Displacement using LVDT. ii) Plot the graphical relationship between input and output parameters.	[4 Hrs]
13	PERFORMANCE OF ULTRASONIC AND MOISTURE SENSORS Activities to Perform: i) Interface Ultrasonic sensor with Arduino and measure the distance of the object. ii) Interface Moisture sensor with Arduino and measure the moisture content in the soil. iii) Discuss the applications of Ultrasonic sensor and Moisture Sensor.	[4 Hrs]
	Students Activity ,Test & Revision	12 Hrs
	TOTAL	**75 Hrs**

Suggested List of Students Activity

1. Activity 1: Submit the assignment of the following: Draw the symbols to represent Nature of Measured Quantity and Number of Measuring Elements, Safety, Position of Use, Accuracy Class and Principle of Operation in Analog Instruments. (Refer TextbookNo.1).
2. Activity 2: Four students can be grouped as a batch and practice an additional experiment to interface any one of the Arduino compatible sensors (LM35 Temperature sensor, Force Sensor, Gas Sensor, Current Sensor, Voltage Sensor, Humidity Sensor, Rain Sensor, Acceleration sensor, magnetic sensor, Infrared sensor etc.,) with Arduino and observe the behaviour of sensors.
3. Activity 3: Draw the block diagram of Digital Voltmeter and Explain its construction and Working. Submit this as assignment.
4. Activity 4: Submit the assignment of the following: Derive the expression for measurement of resistance using Wheatstone bridge, measurement of inductance using Anderson Bridge and measurement of capacitance using Schering Bridge.

Text and Reference Books:

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	A Course in Electrical and Electronics measurements andinstrumentation	A.K. Sawhney Puneet Sawhney	Dhanpat Rai & Co.,(Pvt) Ltd., 2012.
2.	Sensors and Transducers, Multicolour Edition, Second Edition,	D. Patranabis, PHILearning	Private Limited., 2013
3.	Transducers and Instrumentation, Second Edition	D.V.S. Murty	PHI Learning Pvt Ltd., 2012.

Web-based/Online Resources

S.No	Websites
1.	https://archive.nptel.ac.in/courses/108/108/108108147/
2.	https://archive.nptel.ac.in/courses/108/105/108105153/

List Of Equipment /Required for a batch of 30students

S. No	Name of the Equipment’s	Quantity Required
1	MI Voltmeter (0-250V), MI Ammeter (0-5A), ED Wattmeter 300V/5A,Digital Power Monitor 10A, 1KW Load Bank	Each 1 No
2	MC/MI Voltmeter (0-250V), MC/MI Ammeter (0-5A), Standard Voltmeter (0-250V), Ammeter (0-5A), 1KW Load Bank	Each 1 No
3	MI Ammeter (0-5A), Ammeter Selector Switch, 10/5A CT for each phase.	Each 1 No
4	Three Phase Energy Meter 250V/10A, Suitable Wattmeter and Stop Clock	Each 1 No
5	Wheatstone Bridge	1 No
6	Earth Tester with necessary connecting leads and rods	1 No
7	Anderson Bridge	1 No
8	Schering Bridge	1 No
9	Temperature Measurement using Thermocouple / Thermistor / RTD Kit (any two)	Each 1 No
10	Inductive and Capacitive Proximity Sensors, Relay, Buzzer, Suitable Power Supply Unit	Each 1 No
11	LVDT Trainer Kit	1 No
12	Arduino Shield, Arduino compatible Ultrasonic Sensor and Moisture sensor, Desktop Computer/Laptop	Each 1 No

MODEL QUESTION PAPER

EEE 3340- SENSORS AND MEASUREMENT

Duration: 3 Hours **Max. Marks: 100**

S.No	Experiments	CO	PO
1.	Conduct an experiment to measure voltage, current and power in single phase a.c circuit by using Voltmeter, Ammeter and Wattmeter respectively for different loads.	E3340.1	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
2.	Conduct an Experiment to calibrate the given Ammeter and Voltmeter with corresponding standard meters.	E3340.1	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
3.	Conduct an Experiment to measure current in three phase circuit by using single ammeter.	E3340.2	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
4.	Conduct an Experiment to calibrate the given Watt Meter using with corresponding standard meters	E3340.2	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
5.	Conduct an Experiment to calibrate the given Three Phase Energy Meter using Wattmeter and Stop Clock.	E3340.2	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
6.	Conduct an Experiment to measure the value of armature winding resistance using Whetstone Bridge.	E3340.2	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
7.	Conduct an Experiment to measure the Earth Resistance by using Earth Tester.	E3340.2	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
8.	Conduct an Experiment to measure the value of unknown Inductance using Anderson Bridge.	E3340.2	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
9.	Conduct an Experiment to measure the value of unknown Capacitance using Schering Bridge.	E3340.2	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
10.	Construct a circuit to measure Temperature of Liquid using Thermostat, Thermocouple and RTD. (Any 2 transducer).	E3340.2	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
11.	Construct a circuit and Observe the behavior of Inductive proximity sensor and Capacitive Proximity sensor for different material samples.	E3340.2	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
12.	Construct a circuit for Measurement of Linear Displacement using LVDT.	E3340.2	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
13.	Develop and Execute Arduino Program to obtain the performance of Ultrasonic sensor and Moisture Sensors.	E3340.2	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7

EEE 3440- ANALOG AND DIGITAL ELECTRONICS

L	T	P	C
1	0	4	3

Progrmme Name : EEE

Course Code : EEE 3440

Semester : III SEMESTER

Course Title : ANALOG AND DIGITAL ELECTRONICS

Course Type : PRACTICUM

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hrs / Week	Hrs / Semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Analog And Digital Electronics	5	75	40	60*	100	3 Hrs.

***Examinations will be conducted for 100 marks and it will be reduced to 60 marks.**

COURSE DESCRIPTION:

This course on Analog and digital Electronics has been designed primarily as a core course for diploma level students and, as a refresher course for master level students and circuit designers working in industry. It starts with basic circuit components and circuit concepts and then, gradually moves to practical building blocks of analog electronic systems . The discussed circuits can be constructed in a diploma level laboratory class and their measured performance can be easily compared with the analytically predicted performance. It helps to build confidence on theory.

COURSE OBJECTIVES:

The objective of this course is to enable the student to

- Understand the VI Characteristics of basic Semiconductor Devices.
- Learn the features of Operational amplifiers and IC 555 Timers.
- Demonstrate the applications of Op-Amp IC 741.
- Learn the concept of Number System, Logic Gates and Arithmetic Circuits.
- Understand the working of Combinational circuit and Sequential circuits

COURSE OUTCOMES:

On successful completion of this course, the student will be able to	
E3440.1	Construct DC Power Supply Unit using Rectifier, Filter and Voltage Regulator.
E3440.2	Construct Astable Multivibrator circuit using IC 555.
E3440.3	Develop Amplifier, Summer and Zero crossing detector using Op-Amp IC 741.
E3440.4	Interpret various Number Systems and Logic Gates used in Digital Circuits.
E3440.5	Demonstrate Combinational circuit and Sequential circuits.

Pre-requisites:

- Basic Electrical and Electronics Engineering.

CO/PO & PSO Mapping Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E3440.1	3	3	3	3	3	3	3	3	3	3
E3440.2	3	3	3	3	3	3	3	3	3	3
E3440.3	3	3	3	3	3	3	3	3	3	3
E3440.4	3	3	3	3	3	3	3	3	3	3
E3440.5	3	3	3	3	3	3	3	3	3	3
Total	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**
Correlation Level	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- It is advised that teachers take steps to pique pupils' attention and boost their curiosityto learn.
- Implement task-based learning activities where students work on specific tasks or projects.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- Incorporate formative and summative assessments to gauge student progress and provide targeted feedback.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices may be followed in the real environment as far as possible.

Assessment Methodology:

	Continuous Assessment (40 Marks)				End Semester Examination (60 Marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Model Practical Examination	Practical Examination
Portion	Ex. 1 to 5	Ex. 6 to 13	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	-

- **CA1 and CA2:** All the exercises/experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the exam **.**The marks awarded will be converted to 10 Marks foreach assessment test.
- Practical document (Hand written document / Notebook consists of Aim, Apparatus Required, Circuit, Tabulation / Graph, Procedure and Result) should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise / experiment. The total marks awarded should be convertedto 10 Marks for the pratical test as per the scheme of evaluation as below

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Circuit Diagram	15
C	Connection	10
D	Execution and Output/Result	20
TOTAL		50
E	Practical Documents (As per the portions)	10
TOTAL		**60**

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 10 Marks for internal assessment. The question setting details are as follows.

	Description	Pattern	Marks
PART-A	30 Multiple Choice Questions (MCQ)	30 x 1 Mark	30
PART-B	7 Questions to be answered out of 10 Questions	7 x 10 Mark	70
TOTAL			**100**

- **CA 4:** All the exercises/experiments should be completed and kept for the Model Practical Examination. The students shall be permitted to select any one by lot for the exam. The model practical examination should be conducted as per the End Semester Examination question pattern as given below. The marks awarded should be converted to 10 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical and End Semester Examination- Practical Exam

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Circuit Diagram	20
C	Connections	20
D	Execution and Output/Result	25
E	MCQ from Theory Portions	20
F	Viva Voce	10
TOTAL		**100**

EEE 3440- ANALOG AND DIGITAL ELECTRONICS

L	T	P	C
1	0	4	3

TOPICS AND ALLOCATION OF HOURS

Theory Portion		
Unit I	**SEMICONDUCTOR DEVICES**	**[4 Hrs]**
Construction and V-I characteristics of : Diode, Zener Diode, BJT, FET, UJT, SCR, TRIAC, DIAC – Applications Half Wave Rectifier With & Without filter - Full Wave Rectifier With & Without filter Zener Diode as Voltage Regulator - Common Emitter, Common Base and Common Collector Configuration of BJT.		[1Hr] [1Hr] [1Hr] [1Hr]
Practical Exercises:		
Ex.No	**Name of the Experiment**	
1	Construct the circuit and Obtain the VI Characteristics of PN Junction Diode and Zener Diode.	[4Hrs]
2	Construct the circuit and Obtain the Input and Output Characteristics of BJT in CE Configuration.	[3Hrs]
3	Construct the circuit and Obtain the VI Characteristics of FET & UJT.	[4Hrs]
4	Construct the circuit and Obtain the Input and output Wave forms of Half Wave Rectifier with and without filter.	[3Hrs]
5	Construct the circuit and Obtain the Input and output Wave forms of Full Wave Rectifier with and without filter.	[3Hrs]
6	Construct the circuit and Obtain the Input and output Wave forms of Bridge Rectifier with and without filter.	[3Hrs]
Theory Portion		
Unit II	**OP-AMP IC 741 and TIMER IC 555**	**[4Hrs]**
Operational Amplifiers - Introduction (block diagram approach) - characteristics of ideal and practical op amps concept of virtual ground – parameters of op amp (listing and definitions) - Symbol and Pin diagram of Op-Amp IC 741. IC 555 Timer Pin diagram - IC Voltage Regulators Positive IC Voltage Regulators:78XX - Negative IC Voltage Regulators: 79XX.		[1Hr] [1Hr] [1Hr] [1Hr]
Practical Exercises		
Ex.No	**Name of the Experiment**	
7	Construct Inverting Amplifier and Non-Inverting amplifier using Op-amp IC 741 and Test its performance.	[4Hrs]
8	Construct Summing Amplifier and Difference amplifier usingOp-amp IC 741 and Test its performance.	[4Hrs]
9	Construct Zero Crossing Detector and Voltage Comparator using Op amp IC 741 and Test its performance.	[4Hrs]

10	Construct Astable Multivibrator circuit using IC 555 and Test its performance.	[4Hrs]
11	Test the performance of IC Voltage Regulator Power Supplies using IC 7805, IC 7912.	[4Hrs]
Theory Portion		
Unit III	**LOGIC GATES AND COMBINATIONAL CIRCUITS**	**[4 Hrs]**
Number Systems: Decimal – Binary – Octal – Hexadecimal – BCD – Conversion from one number system to other. Boolean Algebra – Basic laws and Demorgan's Theorems. Logic Gates: Symbol and Truth table of OR Gate, AND Gate, NOT Gate, NAND Gate, NOR Gate and Ex-OR Gate.		[1Hr] [1Hr] [1Hr] [1Hr]
Unit IV	**SEQUENTIAL CIRCUITS**	**[3 Hrs]**
SR, D, JK, T Flip Flops: Symbolic Representations Truth tables List of Applications.		[2Hrs] [1Hr]
Practical Exercises		
Ex.No	**Name of the experiment**	
12	Realization of basic gates using NAND & NOR Gates.	[4Hrs]
13	Construct Half Adder and Full Adder circuit using Discrete IC's and Test its performance.	[4Hrs]
	Students Activity, Test & Revision	12 Hrs
	TOTAL	**75 Hrs**

Suggested List of Students Activity:

1. Presentation/Seminars by students on any recent technological developments based on thecourse.
2. Periodic class quizzes to be conducted on a weekly/fortnightly based on the course.
3. Viva Voce to be conducted before conducting each experiment.

Text Books

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Principles of Electronics	V K Mehta, Rohit Mehta,	12th Edition, S. Chand & Co., 2020
2.	Applied Electronics	R.S. Sedha	Multicolour Edition, S Chand & Co., 2019
3.	Op-amps and Linear Integrated Circuits	Ramakant A. Gayakwad	Revised FourthEdition, Pearson Education, 2021.
4.	Digital Principles and Applications	Donald Donald P. Leach, Albert Paul Malvino, Goutam Saha	Eight Edition, Mc Graw-Hill Education, 2014.

Web-based/Online Resources

S.No	Websites
1.	NPTEL/SWAYAM: Analog: https://nptel.ac.in/courses/117/103/117103063
2.	https://nptel.ac.in/courses/108/105/108105158
3.	https://nptel.ac.in/courses/108/102/108102112
4.	https://nptel.ac.in/courses/108/105/108105113
5.	NPTEL/SWAYAM: Digital circuits .https://nptel.ac.in/courses/108/105/108105132
6.	https://nptel.ac.in/courses/117/106/117106086

List of Equipment /Required for a batch of 30 students

S.No	Name of the Equipment's	Quantity Required
1.	DC Regulated Power Supply: 0 – 30V, 1A	5 Nos
2.	IC Voltage Power Supply: 0 – 5V, 1A & 15-0-15V, 1A	Each 5 Nos
3.	Signal Generator 1 MHZ	4 Nos
4.	Dual Trace CRO / DSO	5 Nos
5.	Digital Trainer	10 Nos
6.	DC Voltmeter (Analog/Digital) – Different Ranges	5 Nos
7.	DC Ammeter (Analog/Digital) – Different Ranges	5 Nos
8.	Desktop Computer	1 No
9.	Discrete Components: PN Junction Diodes, Zener Diode, FET, UJT, BJT, Resistors and Capacitors	As required
10.	Logic Gate ICs : NAND and NOR Gate	As required
11.	IC 741, IC 555 , IC78XX and IC79XX	As required
12.	Flip Flop ICs, Half Adder and Full Adder IC's	As required

MODEL QUESTION PAPER

EEE 3440- ANALOG AND DIGITAL ELECTRONICS

Duration: 3 Hours **Max. Marks: 100**

S.No	Experiments	CO	PO
1	Construct the circuit and Obtain the VI Characteristics of PN Junction Diode and Zener Diode.	E3440.1	PO1,PO2,PO3,PO4,PO5,PO6,PO7
2	Construct the circuit and Obtain the Input and Output Characteristics of BJT in CE Configuration.	E3440.1	PO1,PO2,PO3,PO4,PO5,PO6,PO7
3	Construct the circuit and Obtain the VI Characteristics of FET & UJT.	E3440.2	PO1,PO2,PO3,PO4,PO5,PO6,PO7
4	Construct the circuit and Obtain the Input and output Wave forms of Half Wave Rectifier with and without filter.	E3440.2	PO1,PO2,PO3,PO4,PO5,PO6,PO7
5	Construct the circuit and Obtain the Input and output Wave forms of Full Wave Rectifier with and without filter.	E3440.2	PO1,PO2,PO3,PO4,PO5,PO6,PO7
6	Construct the circuit and Obtain the Input and output Wave forms of Full Wave Rectifierwith and without filter.	E3440.2	PO1,PO2,PO3,PO4,PO5,PO6,PO7
7	Construct Inverting Amplifier and Non-Inverting amplifier using Op-amp IC 741 and Test its performance.	E3440.2	PO1,PO2,PO3,PO4,PO5,PO6,PO7
8	Construct Summing Amplifier and Difference amplifier using Op-amp IC 741 and Test its performance.	E3440.2	PO1,PO2,PO3,PO4,PO5,PO6,PO7
9	Construct Zero Crossing Detector and Voltage Comparator using Op-amp IC 741 and Test its performance.	E3440.3	PO1,PO2,PO3,PO4,PO5,PO6,PO7
10	Construct Astable Multivibrator circuit using IC 555and Test its performance.	E3440.3	PO1,PO2,PO3,PO4,PO5,PO6,PO7
11	Construct a circuit to test the performance of IC Voltage Regulator Power Supplies using IC 7805, IC 7912.	E3440.3	PO1,PO2,PO3,PO4,PO5,PO6,PO7
12	Construct a circuit for Realization of basic gates using NAND & NOR Gates.	E3440.4	PO1,PO2,PO3,PO4,PO5,PO6,PO7
13	Construct Half Adder and Full Adder circuit using Discrete IC’s and Test its performance.	E3440.4	PO1,PO2,PO3,PO4,PO5,PO6,PO7

EEE 3540- PROGRAMMING IN C

Programme Name : EEE
Course Code : EEE 3540
Semester : III SEMESTER
Course Title : PROGRAMMING IN C
Course Type : PRACTICUM

L	T	P	C
1	0	2	2

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hrs / Week	Hrs / Semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Programming In C	3	45	40	60*	100	3 Hrs.

* Examinations will be conducted for 100 marks and will be converted to 60 marks.

COURSE DESCRIPTION:

This course is designed to provide students with a comprehensive understanding of the fundamentals of programming. Through a structured curriculum, students will delve into the history of programming languages, master algorithmic thinking, learn to represent logic through flowcharts, and gain practical programming skills using the C language.

COURSE OBJECTIVES:

The objective of this course is to enable the student to

- Learn the concepts of Programming
- Know the basics and the fundamentals of C Language such as variables, data types andcontrol structures.
- Use of Controls Statements and Looping Statements.
- Learn about arranging data in Arrays and String manipulations.
- Gain grasp of programming fundamentals such Ability to design programs using functions and structures.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to	
E3540.1	Understand about the Programming concepts.
E3540.2	Store different data types and variables.
E3540.3	Control the program order and repeating sequences of the program.
E3540.4	Implement Arrays and Strings in your C program.
E3540.5	Apply code reusability with functions and storing different Data types using Structures.

Pre-requisites

- Digital Skills
- Knowledge on Handling Computer

CO/PO & PSO Mapping Matrix:

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E3540.1	3	3	2	1	-	-	3	3	3	3
E3540.2	3	1	2	1	-	-	3	3	3	3
E3540.3	3	3	3	3	-	-	3	3	3	3
E3540.4	3	3	3	3	-	-	3	3	3	3
E3540.5	3	3	3	3	-	-	3	3	3	3
Total	**15**	**14**	**13**	**11**	**-**	**-**	**15**	**15**	**15**	**15**
Correlation level	**3**	**3**	**3**	**2**	**-**	**-**	**3**	**3**	**3**	**3**

Legend:3-HghCorrelation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy:

- It is advised that teachers take steps to pique pupils' attention and boost their curiosityto learn.
- Implement task-based learning activities where students work on specific tasks or projects.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- Incorporate formative and summative assessments to gauge student progress and provide targeted feedback.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices may be followed in the real environment as far as possible.

Assessment Methodology:

	Continuous Assessment (40 Marks)				**End Semester Examination (60 Marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Model Practical Examination	Practical Examination
Portion	Ex. 1 to 5	Ex. 6 to 10	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to	10	10	10	10	60
Marks	10	10	10	10	60
Internal Marks	40				60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	-

- **CA1 and CA2:** All the exercises/experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the exam. The marks awarded will be converted to 10 Marks for each assessment test.

- Practical document (Hand written document / Notebook consists of Aim, Apparatus Required, Program, Printout, Procedure and Result) should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise / experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Program	15
C	Execution	10
D	Output/Result	20
TOTAL		50
E	Practical Documents (As per the portions)	10
TOTAL		**60**

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 10 Marks for internal assessment. The question setting details are as follows.

	Description	Pattern	Marks
PART-A	30 Multiple Choice Questions (MCQ)	30 x 1 Mark	30
PART-B	7 Questions to be answered out of 10 Questions	7 x 10 Mark	70
TOTAL			**100**

- **CA 4:** All the exercises/experiments should be completed and kept for the Model Practical Examination. The students shall be permitted to select any one by lot for the exam. The model practical examination should be conducted as per the End Semester Examination question pattern as given below. The marks awarded should be converted to 10Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical and End Semester Examination

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Program	20
C	Execution	20
D	Output/Result	25
E	MCQ from Theory Portions	20
F	Viva Voce	10
TOTAL		**100**

EEE 3540- PROGRAMMING IN C

TOPICS AND ALLOCATION OF HOURS

Theory Portion		
Unit I	**INTRODUCTION TO C PROGRAMMING**	**[3Hrs]**
Introduction C - Features of C - Structure of C program – Compiling - Link & run a C program C character set – Tokens – Constants - Key words - Identifiers and Variables Data types and storage - Data type Qualifiers - Declaration of Variables - Assigning values to variables.		[1Hr] [1Hr] [1Hr]
Practical Exercises		
Ex.No	**Name of the Experiment**	
1	Write and Execute a C program to implement Ohm's Law.	[3Hrs]
2	Write and Execute a C program to calculate total resistance of 3 resistors connected in series and in parallel.	[3Hrs]
Theory Portion		
Unit II	**C LANGUAGE BASICS**	[3Hrs]
DATA TYPES IN C – C Operators – Operators and Associativity Arithmetic Expression –Evaluation of Expressions Type Cast Operators – I/O Statements – scanf and printf		[1Hr] [1Hr] [1Hr]
Practical Exercises		
3	Write and Execute a C program to calculate Power using Voltage and Current, Voltage and Resistance, Current and Resistance.	[3Hrs]
4	Write and Execute a C Program to calculate sum and average of 5 numbers.	[3Hrs]
Theory Portion		
Unit III	**STATEMENTS**	**[3Hrs]**
Branching: Introduction – Simple if statement if–else statement – Switch statement goto statement – Simple programs.		[1Hr] [1Hr] [1Hr]
Practical Exercises		
5	Write and Execute a C program to Check Largest of Three Numbers.	[3Hrs]
6	Write and Execute a C Program to calculate total capacitance of 3 capacitors connected in series and in parallel using switch case.	[3Hrs]
Theory Portion :		
Unit IV	**ARRAYS and STRINGS**	**[3Hrs]**
Array: Definition – Declaration – Initialization of one dimension array. Strings: Introduction – Declaring and Initializing string variables – Reading strings – Writing strings – String handling functions – strlen() , strcpy() and strrev().		[1Hr] [1Hr] [1Hr]

Practical Exercises		
7	Write and Execute a C program to accept 10 numbers and print them.	[3Hrs]
8	Write and Execute a C Program to perform string functions strlen, strcmp and strrev.	[3Hrs]
Theory Portion		
Unit V	**FUNCTIONS AND STRUCTURES**	**[3Hrs]**
Function Definition: Built-in functions – Math Function – pow() – sqrt() – min() Userdefined Function: Declaration – Defining and function call. Structures: Definition – Initialization (Concepts only).		[1Hr] [1Hr] [1Hr]
Practical Exercises		
9	Write and Execute a C program to find power and square root using Math Functions.	[3Hrs]
10	Write and Execute a C Program to calculate Electrostatic Force (Coulomb's Law) using function.	[3Hrs]
	TOTAL PERIODS	**45 Hrs**

Suggested List of Students Activity:

- Download and learn the Basic code for Various C Programming.
- Presentation / Seminar by students on any technological development Programming.
- Periodic class quizzes conducted on monthly.

Text Books

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	C: The Complete Reference	Herbert Schildt	Fourth Edition, McGraw Hill Education,2017
2.	Programming In ANSI C	E. Balagurusamy	Eight Edition, McGraw Hill, 2019.
3.	Modern C Programming Language Advance	Vinod Sri	Publisher: Vinod Yadav, 2021.

Web-based/Online Resources

S.No	Websites
1.	https://archive.nptel.ac.in/courses/106/104/106104128/

List of Equipment /Required for a batch of 30students

S.No	LIST OF EQUIPMENTS	QUANTITY REQUIRED
1	Desktop Computer	30 Nos
2	C Compiler	30 Nos
3	5KVA UPS with Battery Backup	1 No

MODEL QUESTION PAPER

EEE 3540- PROGRAMMING IN C

Duration: 3 Hours **Max. Marks: 100**

S.No	Experiments	CO	PO
1	Write and Execute a C program to implement Ohm's Law.	E3540.1	PO1,PO2,PO3, PO4,PO5,PO6, PO7
2	Write and Execute a C program to calculate total resistance of 3 resistors connected in series and in parallel.	E3540.1	PO1,PO2,PO3, PO4,PO5,PO6, PO7
3	Write and Execute a C program to calculate Power using Voltage and Current, Voltage and Resistance, Current andResistance.	E3540.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
4	Write and Execute a C Program to calculate sum and average of 5 numbers.	E3540.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
5	Write and Execute a C program to Check Largest of Three Numbers.	E3540.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
6	Write and Execute a C Program to calculate total capacitance of 3 capacitors connected in series and in parallel using switch case.	E3540.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
7	Write and Execute a C program to accept 10 numbers and print them.	E3540.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
8	Write and Execute a C Program to perform string functions strlen, strcmp and strrev.	E3540.3	PO1,PO2,PO3, PO4,PO5,PO6, PO7
9	Write and Execute a C program to find power and square root using Math Functions.	E3540.3	PO1,PO2,PO3, PO4,PO5,PO6, PO7
10	Write and Execute a C Program to calculate Electrostatic Force (Coulomb's Law) using function.	E3540.3	PO1,PO2,PO3, PO4,PO5,PO6, PO7

EEE3620- ELECTRICAL MACHINES I PRACTICAL

L	T	P	C
0	0	4	2

Programme Name : EEE

CourseCode : EEE3620

Semester : III SEMESTER

CourseTitle : ELECTRICAL MACHINES I PRACTICAL

Course Type : PRACTICAL

TEACHING AND SCHEME OF EXAMINATION

No. of weeks/ Semester: 15 weeks

Course	**Instructions**		**Examination**			
	Hrs / Week	**Hrs / Semester**	**Marks**			**Duration**
			Internal Assessment	**Autonomous Examination**	**Total**	
Electrical Machines I Practical	4	60	40	60	100	3 Hrs.

*****Examinations will be conducted for 100 marks and it will be reduced to 60 marks.

COURSE DESCRIPTION:

To provide students with a comprehensive understanding of various aspects of electrical machines and transformers, including their characteristics, performance evaluation methods, control techniques, and maintenance procedures. This knowledge is essential for engineers working in fields such as power generation, distribution, industrial automation, and electric vehicle technology.

OBJECTIVES:

The objective of this course is to enable the student to

1. Comprehend the behavior and characteristics of DC Shunt Generator and DC Series Generator
2. Perform load tests on DC Shunt motor and DC Series Motor and compound motor interpret data.
3. Evaluate the regulation, efficiency, and losses in single-phase and three-phase transformer atvarious loads.
4. Conduct breakdown and acidity tests on transformer oil and interpret reliability and longevity.
5. Learn the characteristics of stepper motor and servo motor.

COURSE OUTCOMES:

Course	**EEE3620 ELECTRICAL MACHINES I PRACTICAL**
After successful completion of this course, the students should be able to	
E3620.1	Perform Load tests on DC Shunt Generator, DC Series Generator and compound generator and interpret characteristic curves.
E3620.2	Perform load tests on DC Shunt Motor and DC Series Motor and explore armature and field control methods for speed modulation.

E3620.3	Conduct OC Test, SC Test and Load tests on single-phase transformers to evaluate their performance characteristics.
E3620.4	Perform breakdown test and acidity tests on Transformer oil.
E3620.5	Test the performance of stepper motor and servo motor drive.

Pre-requisites:

Electrical Machines –I Theory

CO- POs & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E3620.1	3	1	2	3	-	-	2	3	2	3
E3620.2	3	2	2	3	-	--	2	3	2	3
E3620.3	3	2	3	3	-	-	3	3	2	3
E3620.4	3	2	2	3	-	-	2	3	2	3
E3620.5	3	2	-	3	1	-	-	3	2	3
Total	**15**	**11**	**9**	**15**	**1**	**-**	**9**	**15**	**10**	**15**
Correlation level	**3**	**3**	**2**	**3**	**1**	**3**	**2**	**3**	**2**	**3**

CO/PO & PSO Mapping Matrix:

Legend:3-HighCorrelation, 2-MediumCorrelation, 1-LowCorrelation

Instructional Strategy:

- It is advised that teachers make the learning experience more engaging by introducing innovative and interesting ways of teaching.
- The teachers need to expose the student to material in multiple modes help them learn it faster and retain it longer.
- Theory Lectures: Cover the fundamental principles of electromagnetism, the construction of DC machines, and their working principles.
- Demonstrations: Use models or simulations to demonstrate how DC generators produce electricity and how motors convert electrical energy into mechanical energy.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- Preparation: Before each class, ensure all equipment is functional and safety protocols are in place.

Assessment Methodology:

	Continuous Assessment (40 Marks)				End Semester Examination (60 Marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Practical Document	Model Practical Examination	Practical Examination
Portion	Ex. 1 to 6	Ex. 7 to 13	All Exercises	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	50	50	Each Practical 10 Marks	100	100
Converted to	10	10	10	10	60
Internal Marks	40				60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	-

DETAILED ALLOCATION OF MARKS: CA1, CA2

CA1 and CA2: All the exercises/experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the exam .The practical test should be conducted as per the scheme of evaluation as below. The marks awarded will be converted to 10 Marks foreach assessment test.

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Circuit Diagram	15
C	Connection	10
D	Execution and Output/Result	20
TOTAL		**50**

CA 3: Practical document (Hand written document / Notebook consists of Aim, Apparatus Required, Circuit, Tabulation, Graph, Procedure and Result) should be maintained for every exercise / experiment immediately after completion of the practice. The same should be evaluated for 10 Marks. The total marks awarded should be converted to 10 Marks for the internal assessment. The practical document should be submitted for the Practical Test.

CA 4: All the exercises/experiments should be completed and kept for the Model practical examination. The students shall be permitted to select any one by lot for the test. The model practical examination should be conducted as per the scheme of evaluation as below. The marks awarded should be converted to 10 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical and End Semester Examination- Practical Exam

Part	Description	Marks
A	Aim & Apparatus Required	10
B	Circuit Diagram	25
C	Connections	25
D	Execution and Output/Result	30
E	Viva Voce	10
TOTAL		**100**

List of Equipment /Required for a batch of 30students

S.no	List of equipments	Quantity Required
1.	DC Shunt Motor 3/5 KW (or more) with starting and Loading Arrangements	2 Nos
2.	DC Series Motor 3/5 KW (or more) with starting and Loading Arrangements	1 No
3.	DC Shunt Generator 3/5 KW (or more) coupled with Prime Mover	1 No
4.	DC Series Generator 3/5 KW (or more) coupled with Prime Mover	1 No
5	DC compound motor 3/5 KW (or more) coupled with Prime Mover	1 No
6.	1 Phase Transformer 1KVA (or more) 220V/110V	3 Nos
7.	3 Phase Transformer 1KVA (or more) 440V/220V	1 No
8.	1 Phase Variac 10 amps	3 Nos
9.	3 Phase Variac 15 amps	2 Nos
10.	Single Phase Resistive Load 1.5KW/3/5 KW, 220V	2 Nos
11.	Three Phase Resistive Load 3KW,415V	2 Nos
12.	Tachometer Digital type	3 Nos
13.	Rheostat – Various ranges 50Ω/5A,100 Ω/5A, 300 Ω/2A, 600 Ω/2A (or equivalent)	4 Nos
14	AC Ammeter – Various ranges 0-500mA, 0-1/2A, 0-5/10A,0-10/20A (or equivalent)	8 Nos
15.	DC Ammeter – Various ranges 0-500mA, 0-2A, 0-5A, 0-10A, 0- 15/30A (or equivalent)	8 Nos
16.	DC Voltmeter – 0 - 5/10V, 0 - 30V, 0 - 300V	8 Nos
17.	AC Voltmeter – 0 - 75V, 0 - 150V, 0 - 300V, 0 - 600V	8 Nos
18.	Wattmeter – Various ranges LPF 150/300/600V 2.5A/5A,1/2.5A	6 Nos
19.	Wattmeter – Various ranges UPF 75/150/300,5/10A	6 Nos
20.	Wattmeter – Various ranges UPF 150/300/600V 10/20A	6 Nos
21.	Transformer oil BDV Test kit and Acidity Test kit	Each1no
22.	DC Stepper Motor drive	1 No
23.	DC Servo Motor drive	1 No

EEE3620 ELECTRICAL MACHINES –I PRACTICAL

L	T	P	C
0	0	4	2

LIST OF THE EXPERIMENT

Practical Exercises:		
Ex.No	Name of the Experiment	Period
1	No load and Full Load Characteristics of Self Excited DC Shunt Generator.	5
2	Load Characteristics of Self Excited DC Series Generator.	5
3	a. Load Test on DC Shunt Motor and Draw the Performance Curve. b. Predetermination of Efficiency of DC Machines by Swinburne's Test.	5
4	Load Test on DC Series Motor and Draw the Performance Curve	5
5	Load Test on DC compound Motor and Draw its Performance Curve	5
6	Speed Control of DC Shunt Motor by a) Armature Control Method b) Field Control Method	5
7	Load Test on Single Phase Transformer.	4
8	Load Test on Three Phase Transformer.	4
9	a. Predetermination of Efficiency and Regulation of Single-Phase Transformer by conducting O.C and S.C Tests. b. Finding the Equivalent Circuit Constants of Single-Phase Transformer by conducting O.C and S.C Tests.	5
10	Parallel Operation of two Single Phase Transformers.	4
11	Breakdown Test to determine the Dielectric Strength of Transformer Oil and Also conduct Acidity Test on Transformer Oil.	5
12	Testing of Stepper motor drive.	4
13	Testing of Servo motor drive.	4
TOTAL PERIODS		**60**

Note: Common Test and Revision periods can be used for conducting Continuous Assessment.

Note: During all practical examinations, sub-division in Q.No 03 & 09 will be treated as separate experiment and separate question

Suggested List of Students Activity:

- Engaging in group discussions to delvelope into the theoretical dimensions of DC generators, motors, transformers, and their operation.
- Utilizing simulation tools such as MATLAB/Simulink for dynamic modeling and

analysis, enhancing conceptual visualization and understanding.

- Embarking on research tasks to investigate the latest developments and innovations in DC machinery and transformers, focusing on energy efficiency and advanced materials.
- Presenting lab and project findings to foster knowledge reinforcement and polish communication skills.
- Analyzing industrial case studies to connect theoretical learning with practical applications in real-world scenarios.
- Participating in guest lectures and workshops to gain insights from industry experts and learn about critical diagnostic tests for equipment maintenance
- Encouraging peer teaching and collaborative design projects, aiming at the development of efficient or novel engineering solutions.
- Group Projects: Assign projects to conduct load tests on DC shunt and series motors, encouraging teamwork and problem-solving

Text and Reference Books:

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	A Textbook of Electrical Technology Volume - II (ACand DC Machines)	B. L. Theraja and A. K. Theraja	Multicolour Edition, S. Chand & Co., 2005
2.	Principles of Electrical Machines	V.K. Mehta & Rohit Mehta	Second Edition, S. Chand & Co., 2019
3.	Electrical Machines	S. K. Bhattacharya	Third Edition, McGraw Hill Education, 2008
4.	Electric Machines	Ashfaq Husain, Haroon Ashfaq	Third Edition, Dhanpat Rai & Co. (P)Ltd., 2016.

Web-based/Online Resources:

S.NO	Websites
1.	All About Circuits (https://www.allaboutcircuits.com/)
2.	Electronics Hub (https://www.electronicshub.org/)
3.	Circuit Digest (https://circuitdigest.com/)
4.	MITOpen CourseWare -ElectricalEngineering and Computer Science (https://ocw.mit.edu/courses/electrical-engineering-and-computer science/)
5.	NPTEL - Electrical Engineering (https://nptel.ac.in/course.html)
6.	IEEE Xplore Digital Library (https://ieeexplore.ieee.org/Xplore/home.jsp)
7.	Online simulation tools like Circuit Lab (https://www.circuitlab.com/) and MultisimLive (https://www.multisim.com/).

EEE3620 ELECTRICAL MACHINES -1 PRACTICAL

MODEL QUESTION PAPER

Sl.No	Name of the Experiments	CO	PO
1	Conduct an Experiment to obtain the No load and Full Load Characteristics of Self Excited DC ShuntGenerator.	E3620.1	PO1, PO2, PO3, PO4, PO5, PO6, PO7
2	Conduct an Experiment to obtain the Load Characteristics of Self Excited DC SeriesGenerator.	E3620.1	PO1, PO2, PO3, PO4, PO5, PO6, PO7
3	a.Conduct Load Test on DC Shunt Motor and Draw the Performance Curve.	E3620.1	PO1, PO2, PO3, PO4, PO5, PO6, PO7
	b.Predetermine the Efficiency of DC Machines by Swinburne's Test.	E3620.2	PO1, PO2, PO3, PO4, PO5, PO6, PO7
4	Conduct Load Test on DC Series Motor and Draw the Performance Curve	E3620.2	PO1, PO2, PO3, PO4, PO5, PO6, PO7
5	Conduct Load Test on DC compound Motor and Draw the Performance Curve	E3620.2	PO1, PO2, PO3, PO4, PO5, PO6, PO7
6	Perform Speed Control of DC Shunt Motor by a) Armature Control Method b) Field Control Method	E3620.2	PO1, PO2, PO3, PO4, PO5, PO6, PO7
7	Load Test on DC Series Motor and Draw the Performance Curve	E3620.2	PO1, PO2, PO3, PO4, PO5, PO6, PO7
8	Conduct Load Test on Three Phase Transformer	E3620.3	PO1, PO2, PO3, PO4, PO5, PO6, PO7
9	a.Predetermine the Efficiency and Regulation of Single-Phase Transformer by conducting O.C and S.C Tests.	EE3620.3	PO1, PO2, PO3, PO4, PO5, PO6, PO7
	b.Find the Equivalent Circuit Constants of Single-Phase Transformer by conducting O.Cand S.C Tests.	E3620.3	PO1, PO2, PO3, PO4, PO5, PO6, PO7
10	Perform Parallel Operation of two Single Phase Transformers.	E3620.4	PO1, PO2, PO3, PO4, PO5, PO6, PO7
11	Perform Breakdown Test to determine the Dielectric Strength of Transformer Oil andAcidity Test on Transformer Oil.	E3620.4	PO1, PO2, PO3, PO4, PO5, PO6, PO7
12	Connect Stepper motor with suitable drive / driver circuit and test its operation.	E3620.4	PO1, PO2, PO3, PO4, PO5, PO6, PO7
13	Connect Servo Motor with suitable drive / driver circuit and test its operation	E3620.5	PO1, PO2, PO3, PO4, PO5, PO6, PO7

EEE4110- ELECTRICAL MACHINES – II

Programme Name : EEE
Course Code : EEE4110
Semester : IV SEMESTER
Course Title : ELECTRICAL MACHINES II
Course Type : THEORY

L	T	P	C
4	0	0	4

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Electrical Machines II	4	60	40	100*	100	3 Hrs

*Examinations will be conducted for 100 marks and will be converted to 60 marks

TOPICS AND ALLOCATION OF HOURS

Unit	Topics	Time (Hrs)
I	Alternator principle and construction	13
II	Alternator performance and testing	14
III	Three phase induction motor	13
IV	Single phase motors and maintenance of induction motors	11
V	Synchronous motor and special ac machines	09
Total		**60**

COURSE DESCRPTION:

The Electrical Machines - II course is designed to build upon the foundational knowledge gained in Electrical Machines - I, propelling students into the more advanced aspects of electrical machinery. This syllabus is crafted to deepen understanding and enhance skills in the operation, and application of alternators, induction motors, and a variety of specialized AC machines. Through a blend of theoretical concepts and practical insights, the course aims to equip students with a robust understanding of the principles behind alternating current (AC) machines and their critical role in the modern electrical engineering landscape.

COURSEOBJECTIVES

The objective of this course is to enable the student to:

- Grasp alternator principles, types, construction, windings, cooling, excitation, and EMF equation's impact on performance.
- Explore load analysis, voltage regulation, testing, parallel operation, synchronization, and load sharing in alternators.

- Explore rotating magnetic fields, operation, types, torque-speed characteristics and maintenance of three phase induction motor.
- Examine single-phase motor types, starting methods, principles, and applications. Understand induction motor maintenance and protection practices.
- Understand synchronous motor principles, effects of excitation changes, unique behaviours, applications, and comparative analysis with induction motors. Explore special AC Machines.

COURSEOUTCOMES:

On successful completion of this course, the student will be able to	
E4110.1	Understand alternator principles, construction, types, EMF equation, and applications.
E4110.2	Achieve expertise in voltage regulation, testing,load analysis,andsynchronization of alternator.
E4110.3	Investigate rotating magnetic fields, induction motor principles, construction, characteristics, starting and speed control methods.
E4110.4	Examine single-phase motor types, maintenance practices, and BIS guidelines.
E4110.5	Explore synchronous motor principles, behaviours, applications, and special AC Machines.

Pre-requisites

- Electrical Circuit Theory
- Electrical Machines – I
- Electrical Machines - I Practical

CO/PO & PSO Mapping Matrix:

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E4110.1	3	1	2	3	2	3	3	3	3	2
E4110.2	3	3	2	3	2	3	3	3	3	2
E4110.3	3	3	2	3	2	3	3	3	3	2
E4110.4	3	3	2	3	2	3	3	3	3	2
E4110.5	3	3	2	3	2	3	3	3	3	2
Total	**15**	**13**	**10**	**15**	**10**	**15**	**15**	**15**	**15**	**10**
Correlation level	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**2**

Legend:3-HighCorrelation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy:

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.

- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Unit 1 & 2)	Written test (Unit 3 & 4)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative schedule	6th Week	12th Week	13-14th Week	16th Week	

CONTINUOUS ASSESSMENT

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 10 Marks for the internal assessment.

CA1and CA2, Assessment test should be conducted for two units as below

- PART A: (5 X 10 Marks = 50 Marks).
- Eight questions will be asked, students should write five questions. Four questions can be asked from each unit.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 10 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 10 marks for the internal assessment.

Question Pattern:

- Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.
- Four questions will be asked from every unit. Students should write any two questions.

Question Pattern - Model Examination and End Semester Examination Theory Exam

PART- A (5 X 2X10 Marks = 100 Marks)

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.

Sample:

I	1.
	2.
	3.
	4.
II	5.
	6.
	7.
	8.
III	9.
	10.
	11.
	12.
IV	13.
	14.
	15.
	16.
V	17.
	18.
	19.
	20.

QUESTION PAPER SETTING :

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **Ap**-Apply	**An**- Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

EEE4110- ELECTRICAL MACHINES II

L	T	P	C
5	0	0	4

Unit I	**ALTERNATOR PRINCIPLE AND CONSTRUCTION**	**[13Hrs]**
Basic Principle of Alternators – Stationary Armature Rotating Field		[1 Hr]
Advantages of Rotating Field – Construction details of Alternator		[1 Hr]
Types of Alternators – Salient Pole Rotor – Cylindrical Type Rotor		[1 Hr]
Comparison of Salient pole and Cylindrical pole Alternator		[1 Hr]
Single layer and Double layer Windings		[2 Hrs]
Full Pitched and Short Pitched Windings		[1 Hr]
Effect of Distribution Factor and Pitch Factor (No derivation) EMF Equation		[2 Hrs]
Relation between Frequency, Speed and Number of Poles Problems		[2 Hrs]
Cooling of Alternators working methodology – Excitation and Exciters.		[2 Hrs]
Unit II	**ALTERNATOR PERFORMANCE AND TESTING**	**[14Hrs]**
Load Characteristics of Alternators – Reason for Change in Terminal Voltage Armature Reaction for various Power Factor Loads		[2 Hrs]
Effective Resistance – Leakage Reactance – Synchronous Reactance - Synchronous Impedance		[1 Hr]
Voltage Regulation – Determination of Voltage Regulation of Alternator by Direct Load Test method –OC and SC Test		[2 Hrs]
Predetermination of Regulation of Alternator by Indirect Method (EMF, MMF, and		[2 Hrs]
ZPF) (short notes only)		[1 Hr]
Necessity and conditions for Parallel Operation of Alternators		[2 Hrs]
Synchronizing of Alternators by Dark Lamp Method, Bright Lamp Method, Dark-Bright Lamp Method and Synchroscope Method		[2 Hrs]
Synchronizing Current - Synchronizing Power and Synchronizing Torque		[1 Hr]
Load Sharing of Alternators Infinite Bus Bar.		[1 Hr]
Unit III	**THREE PHASE INDUCTION MOTOR**	**[13Hrs]**
Concept of Rotating Magnetic Field (Short notes only)		[1 Hr]
Principle of Operation of Three Phase Induction Motors – Slip and Slip Frequency		[1 Hr]
Construction of Squirrel cage and Slip Ring Induction motor		[1 Hr]
Comparison between Cage and Slip Ring Induction Motors		[1 Hr]
Expression for Torque in Synchronous Watts Slip-Torque Characteristics –		[1 Hr]
Stable and Unstable Region Power Stages – Determination of Maximum Torque		[1 Hr]
Speed Control of Induction Motors Starters of Induction Motors-Direct Online		[1 Hr]
Starter and its merits for Cage Motors Star Delta Starter – Auto Transformer Starter		[1 Hr]
Rotor Resistance Starter – Cogging – Crawling in Induction Motor		[2 Hrs]
Double cage Induction Motor - Induction Generator-		[2 Hrs]
Simple Problems of three phase induction motor		[1 Hr]

Unit IV	SINGLE PHASE MOTORS AND MAINTENANCE OF INDUCTION MOTORS	[11Hrs]
SINGLE PHASE MOTORS:		[1 Hr]
Types of Single Phase Motors Single Phase Induction Motors Methods of starting		[1 Hr]
Construction, Working Principle and Slip Torque Characteristics of Split PhaseMotor		[1 Hr]
Capacitor Motors, Shaded Pole Motor, Repulsion Motor, Universal Motor and		[1 Hr]
Reluctance Motor -Operation of Three Phase Motor with Single Phase Supply		[1 Hr]
MAINTENANCE OF INDUCTION MOTORS:		[1 Hr]
BIS Publication dealing with the code of Practice of Induction Motors and starters		[1 Hr]
Classification of Cage motors – Continuous rating and intermittent rating		[1 Hr]
Varioustypes of enclosures – Selection of Starters for Induction Motor		[1 Hr]
Common Induction Motor Troubles and their Remedies		[1 Hr]
Static Balancing – Degreasing – Vacuum Impregnation.		[1 Hr]
Unit V	**SYNCHRONOUS MOTOR AND SPECIAL AC MACHINES**	**[9Hrs]**
SYNCHRONOUS MOTOR:		
Principle of Operation – Methods of Starting		[1 Hr]
Effects of Excitation on Armature Current and Power Factor		[1 Hr]
V Curve and Inverted V Curve of Synchronous Motor		[1 Hr]
The Phenomenon of Hunting and Prevention of Hunting by Damper Winding		[1 Hr]
Comparison between Synchronous Motor and Three Phase Induction Motor Applications.		[2 Hrs]
SPECIAL AC MACHINES:		
Permanent Magnet Synchronous Motor		[1 Hr]
Switched Reluctance Motor – Variable Reluctance Motor		[1 Hr]
AC Servo Motor – Linear Induction Motor.		[1 Hr]
	TOTAL PERIODS	**60 Hrs**

Suggested List of Students Activity:

- Presentations/Seminars: Students present on alternator construction innovations, synchronous motor applications, etc.
- Periodic Quizzes: Weekly quizzes on alternator principles, induction motor characteristics, etc.
- Mini Projects: Develop projects on synchronous motor applications or special AC machine simulations.
- Hands-on Demonstrations: Conduct demonstrations on synchronous motor starting methods, alternator testing procedures.
- Problem-Solving Sessions: Solve problems related to alternator cooling methods, induction motor maintenance issues.
- Group Discussions: Discuss topics like load sharing in alternators, synchronization techniques in class.
- Field Visits: Visit power plants or industrial facilities to observe alternator operation and maintenance practices.
- Lab Exercises: Perform experiments on induction motor speed control methods, single-phase motor starting mechanisms.

Text Books

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Electrical Technology volume-II(AC andDC Machines	B. L. Theraja and A. K. Theraja,	Multicolour Edition, S. Chand & Co., 2005
2.	Principles of Electrical Machines	V.K. Mehta & Rohit Mehta	Third Edition, McGraw Hill Education, 2008.
3.	Electric Machines	Ashfaq Husain, Haroon Ashfaq,	Third Edition, Dhanpat Rai & Co. (P) Ltd., 2016.
4.	Electrical Machines	S.K.Bhattacharya	Third Edition, McGraw Hill Education, 2008.

Web-based/Online Resources

S.No	Web-based/Online Resources
1.	**NPTEL (Website):** The National Programme on Technology Enhanced Learning (NPTEL) offers free online courses on Electrical Machines and other Electrical Engineering topics. NPTEL Electrical Engineering.
2.	**YouTube:** There are numerous educational channels offering tutorials on electrical machines principles and construction, performance analysis, and testing. Channels like Learn Engineering, Engineering Explained, and Electrical Engineering Portal provide valuable insights.
3.	Course: Courses like "Electric Machines" offered by University of Colorado Boulder cover topics including alternator principles, construction, and performance analysis. They provide video lectures, quizzes, and assignments.

MODEL QUESTION PAPER

EEE4110- ELECTRICAL MACHINES II

Time : 3 Hrs. **Max.Marks : 100**

PART – A (5X2X10=100 MARKS)					
Note :Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.					
S. No	**Questions**	**Unit**	**Bloom's level**	**Co**	**Po**
I.	1.Explain the stator and rotor constructional details of salient pole motor?	I	R	E4110.1	PO2,PO5, PO7
	2.Derive an expression for EMF equation of alternator?	I	U	E4110.1	PO2,PO5, PO7
	3).Explain briefly the construction of salient pole rotor of an alternator?	I	R	E4110.1	PO2,PO5, PO7
	4).Explain briefly types of armature winding?	I	R	E4110.1	PO2,PO5, PO7
II	5).With schematic diagram explain briefly the synchronizing of two 3 phase alternators by dark lamp method?	II	U	E4110.2	PO2,PO5, PO7
	6).Explain briefly the synchronising of two 3 phase alternators by bright lamp method?	II	R	E4110.2	PO2,PO5, PO7
	7).Describe the synchronizing of two three phase alternators by synchroscope method?	II	R	E4110.2	PO2,PO5, PO7
	8).Explain synchronising current, synchronizing power, synchronising torque?	II	R	E4110.2	PO2,PO5, PO7
III	9).Explain the working principle of an induction motor?	III	U	E4110.3	PO2,PO5, PO7
	10).Explain with neat diagram the working of a star delta starter and mention its merits and demerits?	III	U	E4110.3	PO2,PO5, PO7
	11).Explain the working principle of induction generator?	III	R	E4110.3	PO2,PO5, PO7
	12).Comparision between cage and Slip ring induction motor?	III	An	E4110.3	PO2,PO5, PO7
IV	13).Explain the construction and working Principle of split phase induction motor?	IV	U	E4110.4	PO2,PO5, PO7
	14).Explain the construction and principle of capacitor start and capacitor run induction motor?	IV	R	E3110.4	PO2,PO5, PO7
	15).Explain the construction and working principle of Repulsion induction motor?	IV	R	E4110.4	PO2,PO5, PO7

	16).Explain the construction and working of universal motor?	IV	U	E4110.4	PO2,PO5, PO7
V	17).Explain why synchronous motor is not self starting?	V	R	E3110.5	PO2,PO5, PO7
	18).Explain 'V' curve and inverted 'V' curve of synchronous motor?	V	R	E4110.5	PO2,PO5, PO7
	19).Explain working principle of permanent synchronous motor?	V	U	E4110.5	PO2,PO5, PO7
	20).Explain briefly about servo motor?	V	U	E4110.5	PO2,PO5, PO7

QUESTION PAPER SETTING :

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **Ap-**Apply	**An-** Analyse, **E-**Evaluate, **C**-Create
% to be included	90 %	10 %

EEE4210- GENERATION , TRANSMISSION AND DISTRIBUTION

Programme Name : EEE
Course Code : EEE4210
Semester : IV SEMESTER
Course Title : GENERATION, TRANSMISSION AND DISTRIBUTION
Course Type : THEORY

L	T	P	C
4	0	0	4

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Generation , Transmission And Distribution	4	60	40	100*	100	3 Hrs

*Examinations will be conducted for 100 marks and will be converted to 60 marks

TOPICS AND ALLOCATION OF HOURS

Unit	Topics	Time (Hrs)
I	Generation of electrical power	12
II	A.c transmission	12
III	Hvdc transmission & facts	12
IV	Line insulators and underground cables	12
V	Distribution	12
Total		**60**

COURSE DESCRPTION:

This course, Generation, Transmission and Distribution, explores into the core components of electrical power systems. Various methods of generating electricity, from traditional hydropower and thermal plants to modern renewable like solar and wind are discussed. Factors influencing power plant location and load management techniques used to optimize power delivery are examined. AC transmission systems, analyzing their components and conductor properties are focused. Students will learn how to perform basic calculations related to overhead transmission lines. The course then explores High Voltage Direct Current (HVDC) transmission and Flexible AC Transmission Systems (FACTS) controllers, highlighting their role in modern power grids. It also covers line insulators and underground cables used for power transmission, before concluding with a detailed look at distribution systems and substations, the final delivery points of electrical power.

COURSEOBJECTIVES:

The objective of this course is to enable the student to

- Understand various power generation methods, site selection factors and load management techniques.
- Analyze AC transmission systems, including components, conductor properties, and overhead line calculations.
- Introduce HVDC transmission principles, converter stations and integration with renewables and FACTS controllers.
- Explain line insulator properties, types, and methods to improve string efficiency. Describe underground cable construction and types.
- Understand distribution system requirements, components and classifications. Identify substation types and key equipment.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to	
E4210.1	Describe various generation methods, grid integration and smart Grid technologies.
E4210.2	Design and analyse overhead transmission lines, line supportselection and transmission efficiency for optimal power delivery.
E4210.3	Propose solutions for HVDC transmission and FACTS controllers for enhanced power transmission and grid stability.
E4210.4	Assess effective insulation systems for power transmission, as well as the construction and classification of underground cables.
E4210.5	Analyse electrical distribution systems, including substations, busbar arrangements and AC distribution networks.

Pre-requisites

Basic Mathematics Skills, Science Fundamental, Technology Awareness, Problem-Solving Aptitude, Curiosity and Interest in Energy Systems

CO/PO & PSO Mapping Matrix:

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E4210.1	3	3	3	3	2	2	3	3	2	3
E4210.2	3	2	2	2	2	2	2	3	2	3
E4210.3	3	2	2	2	2	2	2	3	2	3
E4210.4	3	2	2	2	2	2	2	3	2	3
E4210.5	3	3	3	3	2	2	3	3	2	3
Total	**15**	**14**	**9**	**14**	**10**	**10**	**9**	**15**	**10**	**15**
Correlation level	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**3**

Legend:3-HighCorrelation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy:

This syllabus covers a wide range of topics in power system. Here are some instructional strategies, the staff can use to make the learning process engaging and effective:

1. **Active Learning:**
   - Case Studies: Present real-world scenarios related to power generation or transmission challenges. Students can analyze the situation and propose solutions using the course concepts.
   - Group Projects: Divide students into groups to search specific topics like advancements in renewable energy or the impact of smart grids. This fosters collaboration and deeper understanding.
   - Problem-Solving Sessions: Dedicate time in class for students to solve problems related to line calculations, load management, or transmission efficiency. This helps them apply theoretical knowledge.
   - Role-Playing Activities: Simulate a load dispatching centre or a power plant control room. Students can take on roles and make decisions based on course material.
2. **Visualization and Technology:**
   - Animations and Simulations: Utilize animations to illustrate complex concepts like power plant operation or corona formation.
   - Interactive Software: Use software that allows students to simulate transmission line behaviour or power flow analysis.
   - Virtual Field Trips: Take students on virtual tours of power plants or substations using online resources or VR technology.
   - Short Video Clips: Integrate short educational videos to explain specific topics or provide real- world examples.
3. **Varied Assessment Techniques:**
   - Quizzes and Exams: Use traditional quizzes and exams to assess students' understanding of keyconcepts and calculations.
   - Seminar Presentations: Have students present their seminars on chosen topics, allowing them to showcase their knowledge and communication skills.
   - Lab Experiments: Conduct lab experiments related to transmission line properties, insulators, or cable testing.
   - Take-Home Assignments: Assign challenging problems or case studies that encourage critical thinking and application of knowledge.
4. **Additional Tips:**
   - Start with the Big Picture: Begin each unit by outlining the learning objectives and how they connect to the overall course goals.
   - Connect Theory to Practice: Emphasize real-world applications of the concepts through case studies, industry examples, or guest lectures from professionals.
   - Incorporate Student Feedback: Conduct mid-term surveys or discussions to understand student needs and adjust teaching strategies accordingly.
   - Provide Resources and Support: Offer student’s access to additional resources like reference books and online tutorials for clarification.

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Unit 1 & 2)	Written test (Unit 3 & 4)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative schedule	6th Week	12th Week	13-14th Week	16th Week	-

CONTINUOUS ASSESSMENT

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 10 Marks for the internal assessment.

CA1and CA2, Assessment test should be conducted for two units as below

- PART A: (5 X 10 Marks = 50 Marks).
- Eight questions will be asked, students should write five questions. Four questions can be asked from each unit.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 10 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 10 marks for the internal assessment.

Question Pattern:

- Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.
- Four questions will be asked from every unit. Students should write any two questions.

Question Pattern - Model Examination and End Semester Examination Theory Exam

PART- A (5 X 20 Marks = 100 Marks)

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.

Sample:

I 1.
2.
3.
4.

II	5.
	6.
	7.
	8.
III	9.
	10.
	11.
	12.
IV	13.
	14.
	15.
	16.
V	17.
	18.
	19.
	20.

QUESTION PAPER SETTING:

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **Ap**-Apply	**An**- Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

EEE4210- GENERATION, TRANSMISSION AND DISTRIBUTION

THEORY

L	T	P	C
5	0	0	4

Unit I	**GENERATION OF ELECTRICAL POWER**	**[12Hrs]**
Methods of Generation: Schematic arrangement and choice of site for Hydel,		[2 Hrs]
Thermal, Nuclear power plants –Hybrid renewable Energy		[1 Hr]
Block Diagram of Diesel, Solar Thermal, Solar Photovoltaic		[2 Hrs]
Solar Cell Technologies		[1 Hr]
Wind & Pumped storage schemes.		[1 Hr]
Load Management: Grid or Inter connected system		[1 Hr]
Smart Grid - Load curve Demand factor - Load factor		[1 Hr]
Plant Use Factor - Diversity factor		[1 Hr]
Plant capacity factor – Types of Tariff – hybrid renewable energy		[1 Hr]
Load Dispatching Centre.		[1 Hr]
Unit II	**A.C TRANSMISSION**	**[12Hrs]**
Typical Layout of A.C. Power supply scheme		[1 Hr]
Elements of a Transmission Line - Over Head Line		[1 Hr]
Conductor materials and their properties		[1 Hr]
Line supports and their properties		[1 Hr]
Types of supports and their applications		[1 Hr]
Sag in overhead lines - Calculation of Sag		[1 Hr]
When the supports are at equal and unequal levels		[1 Hr]
Simple Problems		[1 Hr]
Constants of a Transmission line - Transposition of Transmission lines		[1 Hr]
Skin Effect - Ferranti Effect - Corona Formation - Factors affecting Corona		[1 Hr]
Classification of O.H. Transmission lines		[1 Hr]
Voltage regulation and Transmission Efficiency (No Problems).		[1 Hr]
Unit III	**HVDC TRANSMISSION & FACTS**	**[12Hrs]**
H.V.D.C Transmission: Layout Scheme		[1 Hr]
D.C Link configurations (Mono polar, Bipolar and Homo polar)		[2 Hrs]
HVDC Convertor Station (Schematic diagram only)		[1 Hr]
Integration of HVDC & Renewable energy into existing AC grids		[2 Hrs]
HVDC Locations in India.		[1 Hr]
FACTS: Definition - Need for FACTS controllers		[2 Hrs]
Types of FACTS controllers - SVS		[1 Hr]
STATCOM - UPFC (Block diagram explanation only).		[2 Hrs]
Unit IV	**LINE INSULATORS AND UNDERGROUND CABLES**	**[12Hrs]**
Line Insulators: Properties of Insulators – Materials Types		[1 Hr]
Causes of failure of Insulators		[1 Hr]
Testing of Insulators		[1 Hr]

Potential Distribution over suspension Insulator string String Efficiency - Methods of improving string Efficiency Problems. Underground Cables: Construction of a three core cable Classification of cables-Grading of Cables Cables for three phase service Construction of Belted cable, Screened cable, Pressure cables - Laying of underground cables.		[1 Hr] [2 Hrs] [1 Hr] [2 Hrs] [1 Hr] [1 Hr] [2 Hrs]
Unit V	**DISTRIBUTION**	**[12Hrs]**
Distribution system Requirements and parts of Distribution system Classification Comparison of different distribution systems (A.C and D.C, Overhead & Underground) A.C Distribution - Types - Connection schemes of AC Distribution system. Sub stations - Classification of sub stations Indoor and outdoor S.S Gas insulated S.S Layout of 110/11KV Substation and 11KV/400V Distribution Substation Substation equipments Bus bar - Types of bus bar arrangements.		[1 Hr] [1 Hr] [1 Hr] [2 Hrs] [1 Hr] [1 Hr] [1 Hr] [1 Hr] [1 Hr] [2 Hrs]
TOTAL PERIODS		**60Hrs**

Suggested List of Students Activity:

- Presentations/Seminars: Students present on alternator construction innovations, synchronous motor applications, etc.
- Periodic Quizzes: Weekly quizzes on alternator principles, induction motor characteristics, etc.
- Mini Projects: Develop projects on synchronous motor applications or special AC machine simulations.
- Hands-on Demonstrations: Conduct demonstrations on synchronous motor starting methods, alternator testing procedures.
- Problem-Solving Sessions: Solve problems related to alternator cooling methods, induction motor maintenance issues.
- Group Discussions: Discuss topics like load sharing in alternators, synchronization techniques in class.
- Field Visits: Visit power plants or industrial facilities to observe alternator operation and maintenance practices.
- Lab Exercises: Perform experiments on induction motor speed control methods, single-phase motor starting mechanisms.

Text Books

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Principles of Power Systems,	VK. Mehta, Rohit Mehta	Revised Edition, S. Chand & Co, 2022.
2.	A Course in Electrical Power	M.L. Sony, P.V. Gupta and U.S. Bhatnagar,	Dhanpath Rai &Co (P) Ltd., 2013.
3.	Electrical Power Systems	C.L. Wadhwa	Eighth Multi Colour Edition, New AgeInternational Publishers.
4.	HVDC Power Transmission Systems Technology and System Interactions	K.R. Padiyar	Reprint, New Age International, 2005.

Web-based/Online Resources

S.No	Websites
1.	https://www.tangedco.org/en/tangedco/about-us/generation/
2.	https://nptel.ac.in/courses/108102047
3.	https://pvwatts.nrel.gov/
4.	https://nptel.ac.in/courses/108105104
5.	https://onlinecourses.nptel.ac.in/noc20_ee39/preview
6.	https://www.tangedco.org/en/tangedco/about-us/

MODEL QUESTION PAPER

EEE4210- GENERATION , TRANSMISSION AND DISTRIBUTION

Time : 3 Hrs. **Max.Marks : 100**

PART – A (5X2X10=100 MARKS)

Note :Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.

S. No	Questions	Unit	Bloom's level	Co	Po
I	1.Draw and explain the schematic arrangement of thermal power plant?	I	R	E4210.1	PO2,PO5 PO7
	2. Draw and explain the schematic arrangement of Hydral power plant?	I	U	E4210.1	PO2,PO5, PO7
	3.Explain the basic principle of solar energy?	I	R	E4210.1	PO2,PO5, PO7
	4.Explain the principle of operation of wind power station?	I	R	E4210.1	PO2,PO5, PO7
II.	5.Draw and explain the typical layout.AC power supply scheme.	II	U	E4210.2	PO2,PO5, PO7
	6.Explain the different conductors used in transmission line and state its merits and demerits?	II	R	E4210.2	PO2,PO5, PO7
	7.Derive an expression for the sag in a transmission line conductors suspended between,two supports at different level?	II	R	E4210.2	PO2,PO5, PO7
	8.Write short notes on (i)skin effect(ii)Ferranti effect	II	R	E4210.2	PO2,PO5, PO7
III	9. Draw the layout diagram and explain the principle of operation of HVDC transmission.	III	U	E4210.3	PO2,PO5, PO7
	10.Draw the schematic diagram of different types of links used in HVDC transmission.	III	U	E4210.3	PO2,PO5, PO7
	11.Explain the operation of STATROM .	III	R	E4210.3	PO2,PO5, PO7
	12. Explain the operation of UPFC.	III	R	E4210.3	PO2,PO5, PO7
IV	13. Explain the causes of failure of insulators.	IV	U	E4210.4	PO2,PO5, PO7
	14.Explain the various method of testing of insulator.	IV	R	E4210.4	PO2,PO5, PO7
	15.Explain the various parts of three conductor UG Cable.	IV	R	E3110.4	PO2,PO5, PO7

	16.Explain different types of laying of cable.	IV	U	E4210.4	PO2,PO5, PO7
V	17.What are the advantages and disadvantages of outdoor substations?	V	R	E4210.5	PO2,PO5, PO7
	18.Explain the different equipment used in a substation.	V	R	E4210.5	PO2,PO5, PO7
	19.Draw and explain a typical double bus bar arrangement and enumerate its advantages.	V	U	E4210.5	PO2,PO5, PO7
	20.Diagramatically represent the layout of a typical 110KV/11KV substation with all details.	V	U	E4210.5	PO2,PO5, PO7

QUESTION PAPER SETTING :

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **Ap**-Apply	**An**- Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

EEE4340-MICROCONTROLLER AND EMBEDDED SYSTEMS

L	T	P	C
1	0	4	3

Programme Name : EEE
Course Code : EEE4340
Semester : IV SEMESTER
Course Title : MICROCONTROLLER AND EMBEDDED SYSTEMS
Course Type : PRACTICUM

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Autonomous Examination	Total	
Microcontroller and embedded systems	5	75	40	100*	100	3Hrs

* Examinations will be conducted for 100 marks and will be converted to 60 marks.

COURSE DESCRIPTION:

The dsPIC33CH dual-core Digital Signal Controller (DSC) allows separate design teams to develop software for each core independently and then integrate the code seamlessly into one chip. The dsPIC33CH DSC family is optimized for safety-critical applications requiring functional safety compliance and security. It enables running sophisticated algorithms.

COURSE OBJECTIVES:

The objective of this course is to enable the student to

- Understand the essential knowledge and skills of basic Digital Signal Processor encountered in professional practice for diploma holders.
- Comprehend the fundamental concepts and scope of Digital Signal Processor.
- Describe the properties dsPIC33CH dual-core Digital Signal Controller (DSC) allows separate design teams to develop software for each core independently and then integrate the code seamlessly into one chip.
- Examine the workings and applications of power transmission drives in mechanical systems.
- Understand the Industrial needs with the application of dsPIC33CH

COURSE OUTCOMES:

On successful completion of this course, the student will be able to	
E4340.1	Remember Microcontroller and embedded systems and it’s evolution.
E4340.2	Understand dsPIC33CH architecture, memory and Interfacing techniques.
E4340.3	Demonstrate dsPIC33CH with simple program.
E4340.4	Examine dsPIC33CH with simple experiments.
E4340.5	Develop their own power controls using dsPIC33CH.

Pre-requisites

Electrical Circuit Theory

Analog and Digital Electronics

C-Programming

CO/PO & PSO Mapping Matrix:

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E4340.1	3	3	3	2	3	2	3	3	2	3
E4340.2	3	3	3	3	3	3	3	3	2	3
E4340.3	3	3	3	3	3	3	3	3	2	3
E4340.4	3	3	3	3	3	3	3	3	2	3
E4340.5	3	3	3	3	3	3	3	3	2	3
Total	**15**	**15**	**15**	**14**	**15**	**14**	**15**	**15**	**10**	**15**
Correlation Level	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**

Legend:3-HighCorrelation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

Assessment Methodology:

	Continuous Assessment (40 Marks)				End Semester Examination (60 Marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Model Practical Examination	Practical Examination
Portion	Ex. 1 to 6	Ex. 7 to 11	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	7^{th} Week	14^{th} Week	15^{th} Week	16^{th} Week	-

- **CA1 and CA2:** All the exercises/experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the exam The marks awarded will be converted to 10 Marks foreach assessment test.
- Practical document (Hand written document / Notebook consists of Aim, Apparatus Required, Algorithm or Flow Chart, Program and Result) should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise / experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

SCHEME OF EVALUATION – Practical Test

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Algorithm or Flow Chart	15
C	Program	10
D	Execution and Output/Result	20
TOTAL		50
E	Practical Documents (As per the portions)	10
TOTAL		**60**

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 10 Marks for internal assessment.

	Description	Pattern	Marks
PART-A	30 Multiple Choice Questions (MCQ)	30 x 1 Mark	30
PART-B	7 Questions to be answered out of 10 Questions	7 x 10 Mark	70
TOTAL			**100**

- **CA 4:** All the exercises/experiments should be completed and kept for the Model Practical Examination. The students shall be permitted to select any one by lot for the exam. The model practical examination should be conducted as per the End Semester Examination question pattern as given below. The marks awarded should be converted to 10 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical and End Semester Examination- Practical Exam

Part	**Description**	**Marks**
A	Aim & Apparatus Required	05
B	Algorithm or Flow Chart	20
C	Program	20
D	Execution and Output/Result	25
E	MCQ from Theory Portions	20
F	Viva Voce	10
TOTAL		**100**

EEE4340- MICROCONTROLLER AND EMBEDDED SYSTEMS

L	T	P	C
1	0	4	3

Theory Portion :		
Unit I	**INTRODUCTION TO MICROCONTROLLER**	**[2 Hrs]**
Introduction to Embedded systems and Microcontroller - Features of Microcontroller Special Microcontroller for Power Electronics Application (PIC & as PIC) - About single-core and Multi-core systems.		[1 Hr] [1 Hr]
Unit II	**INTRODUCTION TO dsPIC33CH DUAL CORE DIGITAL SIGNAL CONTROLLER**	**[3Hrs]**
dsPIC33 - Introduction to aspic Microcontroller - dsPIC33ch Features - Master and Slave core Features - Pin Details of dsPIC33CH512MP508		[1 Hr]
Block diagram of aspic dsPIC33CH512MP508 - Targeted Application - Maser Module Register - Instruction set		[1 Hr]
Data Space Addressing - Addressing Modes – Programmer’s Model - CPU Resources - Arithmetic Logic Unit - DSP Engine and Instruction.		[1 Hr]
Practical Exercises:		
Ex.No	**Name of the Experiment**	
1.	Write a Program to Blink an LED connected to a General Purpose Input / Output (GPIO) pin.	[8Hrs]
2.	Write a Program to Read the state of a push-button and control an LED.	
Theory Portion:		
Unit III	**MEMORY ORGANIZATION**	**[2 Hrs]**
Master Memory Organization - Program Address Space - Program Memory MAP For dsPIC33CH512MP508 Device - Program Memory Organization Interrupt and Trap Vectors Unique Device Identifier (UDID) –		[1 Hr]
Data Space Width - Data Memory Organization and Alignment - SFR Space MAPs - Paged Memory Scheme – Extended X Data Space.		[1 Hr]
Unit IV	**ADDRESSING**	**[2 Hrs]**
Instruction Addressing Modes - File Register Instruction - MCU Instructions		[1 Hr]
MODULO Addressing - Interfacing Program and Memory Spaces.		[1 Hr]
Unit V	**INTERFACING AND PERIPHERALS**	**[6Hrs]**
Understanding the concept of peripherals -Types of Peripherals		[1 Hr]
Introduction to internal peripherals of dsPIC microcontroller - Timer / Counter		[1 Hr]
High Resolution PWM - ADC		[1 Hr]
Universal Asynchronous Receiver Transmitter (UART)		[1 Hr]
Serial Peripheral Interface (SPI) – Inter Integrated Circuit (I2C)		[1 Hr]
LED interfacing – display interfacing - Stepper motor interfacing.		[1 Hr]

Practical Exercises:		
Ex.No	**Name of the Experiment**	
3.	Write a Program to Read Analog data from a potentiometer and display the data by using LCD.	[12 hrs]
4.	Write a Program to Establish communication between the dsPIC33CH and a computer using UART.	
5.	Write a Program to generate one PWM to drive an IGBT Switch to Control a DC Motor/Stepper Motor.	
6.	Write a program to generate PWM for Buck/Boost Converter	[25 hrs]
7.	Write a Program to read 2 channel ADC.	
8.	Write a Program to generate Sine PWM to Drive a IGBT to get a 50Hz sine waveform.	
9.	Write a Program to generate 3 Phase output from an Inverter Module.	
10.	Simulate a V/F Control of Induction Motor in MATLAB-SIMULINK & download the program to a IGBT Power Module and run a 3 phase Induction Motor at 800RPM.	
11	Interfacing of LED and LCD Display	
	Required Practical Instruction for all the Experiments	15 hrs
	TOTAL PERIODS	**75 hrs**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.

Text and Reference Books:

S.NO	TITLE
1.	Beginner's Guide to Programming the PIC24/dsPIC33: Using the Micro stick and Microchip C Compiler for PIC24 and dsPIC33
2.	dsPIC33F Product Overview
3.	Programming dsPIC MCUs in C
4.	dsPIC33 Language Tools Libraries by Microchip.
5.	The Beginner's Guide to Designing with the dsPIC33 Microcontroller

Web-based/Online Resources:

S.No	Websites
1.	https://www.microchip.com/en-us/products/microcontrollers and-microprocessors/dspic-dscs/dspic33c/dspic33ch-dual-core dsc
2.	https://www.mouser.in/new/microchip/microchip-dspic33ch-dsc/
3.	https://www.youtube.com/watch?v=r19Vxd_u5MI
4.	https://www.amazon.in/Microchip-Technology-DM330028-dsPIC33CH- Development/dp/B07FML7CRK
5.	https://www.tme.eu/Document/4644324b87bfbc44691614b542bf4ecb/dspic33ch_ 1.pdf

List of Equipment /Required for a batch of 30students

S.No	Name of the Equipment	Quantity Required
1.	dsPIC33CH Dual Core Development Board	6 Nos
2.	a. Program / Interface kit to generate Sine PWM to Drive a IGBT toget a 50Hz sine waveform b. Function Generator c. Digital Signal Oscilloscope	Each 1 No
3.	Interface kit to generate 3 Phase output from a Inverter Module	1 No
4.	MATLAB-SIMULINK software	1 No
5.	Desktop Computers	6 Nos

MODEL QUESTION PAPER

EEE4340- MICROCONTROLLER AND EMBEDDED SYSTEMS

Duration: 3 Hours **Max. Marks: 100**

S.No	Experiments	CO	PO
1	Write a Program to Blink an LED connected to a General Purpose Input /Output (GPIO) pin.	E4340.1	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
2	Write a Program to Read the state of a push-button and control an LED.	E4340.1	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
3	Write a Program to Read Analog data from a potentiometer and display the data by using LCD.	E4340.2	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
4	Write a Program to Establish communication between the dsPIC33CHand a computer using UART.	E4340.2	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
5	Write a Program to generate one PWM to drive an IGBT Switch to Control a DC Motor/Stepper Motor.	E4340.2	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
6	Write a program to generate PWM for Buck/Boost Converter	E4340.2	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
7	Write a Program to read 2 channel ADC.	E4340.2	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
8	Write a Program to generate Sine PWM to Drive a IGBT to get a 50Hz sine waveform.	E4340.2	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
9	Write a Program to generate 3 Phase output from an Inverter Module.	E4340.3	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
10	Simulate a V/F Control of Induction Motor in MATLAB-SIMULINK & down load the program to a IGBT Power Module and run a 3 phase Induction Motor at 800RPM.	E4340.3	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
11	Interfacing of LED and LCD Display	E4340.3	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7

EEE4440- ELECTRICAL CAD DESIGN

L	T	P	C
1	0	4	3

Programme Name : EEE
Course Code : EEE4440
Semester : IV SEMESTER
Course Title : ELECTRICAL CAD DESIGN
Course Type : PRACTICUM

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
			Marks			
	Hours / Week	Hours / Semester	Internal Assessment	Autonomous Examination	Total	Duration
Electrical cad design	5	75	40	100	100	3Hrs

* Examinations will be conducted for 100 marks and will be converted to 60 marks.

COURSE DESCRIPTION:

A technician working in design and shop floor must possess the skill of preparing electrical estimation and drawings with the evolution of Computer software. The Computer Aided Drafting software will be used to perform various practical exercises in this course. This will enable the students to become competent for working in the fast-growing information technology environment by enhancing their computer aided drawing, designing skills in the field of electrical engineering.

COURSE OBJECTIVES:

The objective of this course is to enable the student to

- Understand I.E Rules 1956 and learn Toolbars in AutoCAD Software.
- Draw Electrical Symbols used in Electrical and Electronics circuits using AutoCAD.
- Practice Electrical Estimation for Residential and Industrial wirings.
- Practice in AutoCAD Software to draw the Single Line Diagrams of various Panels and Distribution Board.
- Practice in AutoCAD to draw Motor Winding Diagram, Substation Layout and Fire Alarmarrangements.

COURSE OUTCOMES:

On successful completion of this course, using Auto CAD the student will be able to	
E4440.1	Explain the features and various tool bars of AutoCAD Software.
E4440.2	Draw the Electrical Symbols used in Wirings, Machines and Electronic Circuits.
E4440.3	Prepare Electrical Estimation for Residential and Industrial wirings.
E4440.4	Draw the Single Line Diagrams of various Panels and Distribution Board.
E4440.5	Draw the Motor Winding Diagram, Substation Layout and Fire Alarm arrangements.

Pre-requisites

- Knowledge in Drafting Practices
- Basics of Electrical Engineering

CO/PO & PSO Mapping Matrix:

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E4440.1	3	3	3	3	3	3	3	3	2	3
E4440.2	3	3	3	3	3	3	3	3	2	3
E4440.3	3	3	3	3	3	3	3	3	2	3
E4440.4	3	3	3	3	3	3	3	3	2	3
E4440.5	3	3	3	3	3	3	3	3	2	3
Total	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**10**	**15**
Correlation Level	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**

Legend:3-HighCorrelation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy

- It is advised that teachers take steps to pique pupils' attention and boost their curiosity to learn.
- Implement task-based learning activities where students work on specific tasks or projects.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- Incorporate formative and summative assessments to gauge student progress and provide targeted feedback.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices may be followed in the real environment as far as possible.

Assessment Methodology:

	Continuous Assessment (40 Marks)				End Semester Examination (60 Marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Model Practical Examination	Practical Examination
Portion	Ex. 1 to 7	Ex. 8 to 13	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	-

- **CA1 and CA2:** All the exercises/experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the exam. The marks awarded will be converted to 10 Marks foreach assessment test.
- Practical document (Hand written document / Notebook consists of Aim, Apparatus Required, Drawing, Printout, Procedure and Result) should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise / experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below

SCHEME OF EVALUATION – Practical Test

Part	Description for CAD Ex.1to4	Mark	Description for Ex: 5 to 8	Marks
A	Aim & Apparatus Required	05	Aim & Apparatus Required	05
B	Manual Drawing	10	Pipe Layout & Load Calculation	10
C	Circuit using CAD Software	30	Wiring Diagram & Material Calculation	20
D	Print out	05	Schedule of Materials with Cost	15
TOTAL		**50**	**TOTAL**	**50**
E	Practical Documents	10	Practical Documents (as per portions)	10
EXAM MARKS		**60**	**EXAM MARKS**	**60**

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 10 Marks for internal assessment. The question setting details are as follows.

	Description	Pattern	Marks
PART-A	30 Multiple Choice Questions (MCQ)	30 x 1 Mark	30
PART-B	7 Questions to be answered out of 10 Questions	7 x 10 Mark	70
TOTAL			**100**

- **CA 4:** All the exercises/experiments should be completed and kept for the Model Practical Examination. The students shall be permitted to select any one by lot for the exam .The model practical examination should be conducted as per the End Semester Examination question pattern as given below. The marks awarded should be converted to 10 Marks for the internal assessment

SCHEME OF EVALUATION

Model Practical and End Semester Examination- Practical Exam

Part	Description for CAD Ex.1to 4	Marks	Description for Ex: 5 to 8	Marks
A	Aim & Apparatus Required	05	Aim & Apparatus Required	05
B	Manual Drawing	10	Pipe Layout & Load Calculation	15
C	Circuit using CAD Software	45	Wiring Diagram & Material Calculation	25
D	Printout	10	Schedule of Materials with Cost	25
E	MCQ from Theory Portions	20	MCQ from Theory Portions	20
F	Viva Voce	10	Viva Voce	10
TOTAL MARKS		**100**	**TOTAL MARKS**	**100**

EEE4440-ELECTRICAL CAD DESIGN

L	T	P	C
1	0	4	3

TOPICS AND ALLOCATION OF HOURS

Theory Portion :		
Unit I	**ELECTRICAL SYMBOLS**	**[4Hrs]**
Need of Electrical symbols – List of Symbols Brief study of Indian Electricity Rules 1956 (IE Rule : 28, IE Rule 30, IE Rule 31, IE Rule 54, IE Rule 56 and IE Rule 87) Overview of Computer Aided Electrical Drafting Overview of Various Toolbars in AutoCAD Software.		[1 Hr] [1 Hr] [1 Hr] [1 Hr]
Ex.No.	**Name of the Experiment**	
1.	Draw the following Electrical Symbols using AutoCAD: Relay, Fluorescent Lamp, Ceiling Fan, Exhaust Fan, One Way Switch, 5A Socket Outlet with Switch, Energy Meter, Star Delta Starter, DC Shunt Motor, Step Down Transformer, PN Junction Diode, BJT, AND Gate, OR Gate	[20Hrs]
2.	Draw the single line diagram of Three phase MCB Distribution Board.	
3.	Draw the panel wiring diagram of Horizontal bus bar arrangement with Incoming and Outgoing Switches using AutoCAD.	
4.	Draw the single line diagram of typical Medium Voltage (MV Panel) with following feeders using AutoCAD. Incoming: One from EB and Another from DG with Interlock. Outgoing: 12 Outgoing feeders with various loads.	
Unit II	**RESIDENTIAL AND INDUSTRIAL WIRING**	**[8Hrs]**
Introduction about Electrical Wiring - Looping back system, Joint box system and Tree system of wiring Types of Internal Wiring – Over Head and Under Ground Service connections - Protection of electrical installation against overload, short circuit and earth fault General requirements of electrical installations for Residential, Commercial and Industrial Wiring Lighting and Power sub-circuits – Location of Main Switch, Distribution Board, Switch Board and Outlets Steps to be followed in preparing electrical estimate Building Plan - Wiring Pipe Layout Wiring Diagram – Load Calculation.		[1 Hr] [1 Hr] [1 Hr] [1 Hr] [2 Hrs] [1 Hr] [1 Hr]
Ex.No	**Name of the Experiment**	
5.	Estimate the quantity of Materials and Cost required for a single Bedroom residential building (1 BHK).	**[20Hrs]**

6.	Estimate the quantity of Materials and Cost required for street light service having 12 Lamps light fittings.	
7.	Estimate the quantity of Materials and Cost required for Irrigation Pump wiring with 5 hp Induction Motor.	
8.	Estimate the quantity of Materials and Cost required for Industrial power wiring having four machines.	
Theory Portion :		
Unit III	**WINDING DIAGRAM AND SUBSTATION LAYOUT**	**[3Hrs]**
Overview of AC Motor Winding Diagram and DC Motor Winding Diagram Various components of Electrical Substation Importance of Fire Alarm Arrangements in Multi Storey Building - Symbols used in Fire Alarm Arrangement.		[1 Hr] [1 Hr] [1 Hr]
Practical exercises:		
Ex.No	**Name of the Experiment**	
9.	Draw the Mush Winding Diagram of a Three Phase Induction Motor using AutoCAD.	[20Hrs]
10	Draw the Concentric Winding Diagram of Single Phase Induction Motor	
11.	Draw the Winding Diagram of Lap Connected DC Armature with Commutator Connections and Brush Positions using AutoCAD.	
12.	Draw the single line diagram of 110 KV / 11 KV Receiving Substation using AutoCAD.	
13.	Draw the Single Line Diagram of Fire Alarm Riser Arrangement in typical Multi-Storey Building using AutoCAD.	
	TOTAL PERIODS	**75**

Suggested List of Students Activity:

1. **Activity 1:** Collect various Electrical Schematic Layout/Drawings from A Grade Electrical Contractors and Analyse it by discussing the Types of Symbols used in Layouts, How the cable rating is mentioned in the drawings, Additional information provided in Drawings Sheets etc.,
2. **Activity 2**: 3 or 4 students may be formed as a group and Prepare the Building Plan, Pipe Layout and Wiring Diagram of college class room or Laboratory building. Submit the drawings as activity report.

Text and Reference Books:

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Electrical Design Estimating and Costing	K.B. Raina & S.K. Battacharya	New AgeInternational (p) limited, 2017.
2.	Computer Aided Electrical Drawing	M. Yokes, B. S. Nagaraja, N. Nandan,	PHI LearningPvt. Ltd, 2014.
3.	AutoCAD 2013 for Engineers and Designers	Sham Tickoo, Anurag	Wiley, 2012.

Web-based/Online Resources:

S.No	Websites
1.	http://students.autodesk.com/ (register and get free student version of LATEST AutoCAD software for approximately 3 year)
2.	https://www.autodesk.in/campaigns/autocad-tutorials

List of Equipment /Required for a batch of 30students

S.No	Name of the Equipment's	Quantity Required
1.	PC/Laptop	30 Nos.
2.	Electrical CAD Software Multi user	01 No
3.	UPS – 5KVA with half an hour battery backup	01 No

MODEL QUESTION PAPER

EEE4440- ELECTRICAL CAD DESIGN

Duration: 3 Hours **Max. Marks: 100**

S.No	Experiments	CO	PO
1	Draw the following Electrical Symbols using AutoCAD: Relay, Fluorescent Lamp, Ceiling Fan, Exhaust Fan, One Way Switch, 5A Socket Outlet with Switch, Energy Meter, Star Delta Starter, DC Shunt Motor, Step Down Transformer, PN Junction Diode, BJT, AND Gate, OR Gate	E4440.1	PO1,PO2,PO3, PO4,PO5,PO6, PO7
2	Draw the single line diagram of Three phase MCB Distribution Board.	E4440.1	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
3	Draw the panel wiring diagram of Horizontal bus bar arrangement with Incoming and Outgoing Switches usingAutoCAD.	E4440.2	PO1,PO2,PO3, PO4,PO5,PO6,PO7
4	Draw the single line diagram of typical Medium Voltage (MV Panel) with following feeders using AutoCAD. Incoming: One from EB and Another from DG with Interlock. Outgoing: 12 Outgoing feeders with various loads.	E4440.2	PO1,PO2,PO3, PO4,PO5,PO6 ,PO7
5	Estimate the quantity of Materials and Cost required for a single Bedroom residential building (1 BHK).	E4440.2	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
6	Estimate the quantity of Materials and Cost required for street light service having 12 Lamps light fittings.	E4440.2	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
7	Estimate the quantity of Materials and Cost required for Irrigation Pump wiring with 5 hp Induction Motor.	E4440.2	PO1,PO2,PO3, PO4,PO5,PO6,PO7
8	Estimate the quantity of Materials and Cost required for Industrial power wiring having four machines.	E4440.2	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
9	Draw the Mush Winding Diagram of a Three Phase Induction Motor using AutoCAD.	E4440.3	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
10	Draw the Concentric Winding Diagram of Single Phase Induction Motor	E4440.3	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
11	Draw the Winding Diagram of Lap Connected DC Armature with Commutator Connections and Brush Positions using AutoCAD.	E4440.3	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
12	Draw the single line diagram of 110 KV / 11 KV Receiving Substation using AutoCAD.	E4440.4	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7
13	Draw the Single Line Diagram of Fire Alarm Riser Arrangement in typical Multi-Storey Building using AutoCAD.	E4440.4	PO1,PO2,PO3,PO4 ,PO5,PO6,PO7

EEE 4540- SERVICING OF ELECTRICAL APPLIANCES

Programme Name : EEE

Course Code : EEE 4540

Semester : IV SEMESTER

Course Title : SERVICING OF ELECTRICAL APPLIANCES

Course Type : PRACTICUM

L	T	P	C
1	0	2	2

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Autonomous Examination	Total	
Servicing Of Electrical Appliances	3	45	40	100*	100	3Hrs

* Examinations will be conducted for 100 marks and will be converted to 60 marks.

COURSE DESCRIPTION:

In almost every home there are many of appliances that practically remain in use throughout the day to provide us the comfort and easiness of life that we deserve. We are really grateful to these appliances which are necessity of every home. Therefore, there is a tremendous scope for the repair & servicing centre's, especially in semi-urban and Rural Areas. So fundamental knowledge in the parts and servicing of Electrical appliances are essential for diploma engineers. This course aims to prepare unemployed youth to enable them in becoming successful as entrepreneur.

COURSE OBJECTIVES:

The objective of this course is to enable the student to

- Understand the key elements and connection diagram of Heating and Motorized domestic appliances.
- Predict the goodness and perform layman checks of domestic appliances.
- Develop professional skills for dismantling, problem diagnosis and rectification of fault in domestic appliances.
- Understand the techniques involved in advanced repairing of domestic appliances.
- Explain the installation procedure of OFF Grid Solar PV System.

COURSE OUTCOMES:

On successful completion of this course, using Auto CAD the student will be able to	
E4540.1	Identify various parts of Heating and Motorized domestic appliances.
E4540.2	Interpret connection diagrams of Heating and Motorized domestic appliances.
E4540.3	Execute Servicing of Iron Box, Water Heater, Induction Stove and Micro Oven.
E4540.4	Execute Servicing of Fans, Mixer Grinder and Wet Grinders.
E4540.5	Install OFF Grid Solar PV system and test its working.

Pre-requisites

- Basics of Electrical and Electronics Engineering.

CO/PO & PSO Mapping Matrix:

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E4540.1	3	3	3	2	3	3	3	3	2	3
E4540.2	3	3	3	2	3	3	3	3	2	3
E4540.3	3	3	3	2	3	3	3	3	2	3
E4540.4	3	3	3	2	3	3	3	3	2	3
E4540.5	3	3	3	2	3	3	3	3	2	3
Total	**15**	**15**	**15**	**10**	**15**	**15**	**15**	**15**	**10**	**15**
Correlation Level	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**3**

Legend:3-HighCorrelation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy

- It is advised that teachers take steps to pique pupils' attention and boost their curiosity to learn.
- Implement task-based learning activities where students work on specific tasks or projects.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- Incorporate formative and summative assessments to gauge student progress and provide targeted feedback.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices may be followed in the real environment as faras possible.

Assessment Methodology:

	Continuous Assessment (40 Marks)				End Semester Examination (60 Marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Model Practical Examination	Practical Examination
Portion	Ex. 1 to 5	Ex. 6 to 9	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	-

- **CA1 and CA2:** All the exercises/experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the exam. The marks awarded will be converted to 10 Marks foreach assessment test.
- Practical document (Hand written document / Notebook consists of Aim, Apparatus Required, Drawing, Printout, Procedure and Result) should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise / experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below

SCHEME OF EVALUATION – Practical Test

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Circuit / Connection Diagram	15
C	Dismantle & Identify the Parts	10
D	Checking, Re-assembling & Testing	20
TOTAL		50
E	Practical Documents (As per the portions)	10
TOTAL		**60**

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 10 Marks for internal assessment. The question setting details are as follows.

	Description	Pattern	Marks
PART-A	30 Multiple Choice Questions (MCQ)	30 x 1 Mark	30
PART-B	7 Questions to be answered out of 10 Questions	7 x 10 Mark	70
TOTAL MARKS			**100**

- **CA 4:** All the exercises/experiments should be completed and kept for the Model Practical Examination. The students shall be permitted to select any one by lot for the exam.The model practical examination should be conducted as per the End Semester Examination question pattern as given below. The marks awarded should be converted to 10 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical and End Semester Examination- Practical Exam

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Circuit / Connection Diagram	20
C	Dismantle & Identify the Parts	20
D	Checking, Re-assembling & Testing	25
E	MCQ from Theory Portions	20
F	Viva Voce	10
TOTAL		**100**

EEE 4540- SERVICING OF ELECTRICAL APPLIANCES

L	T	P	C
1	0	2	2

Theory Portion :		
Unit I	**DOMESTIC APPLIANCES I**	**[8Hrs]**
ELECTRICAL IRON BOX: Tools and instruments required for Servicing of Electrical Appliances – Various Parts of Non-Automatic and Automatic Iron Box – Connection Diagram – Common defects - Causes. ELECTRIC HEATER: Various Parts of Water Heater – Types of Water Heater – Parts of Room Heater - Connection Diagram of water Heater and Room Heater – Common defects – Causes. ELECTRIC FANS: Construction of Ceiling Fan - Connection Diagram – Checking of Capacitor - Common defects – Overview of Table Fan and Exhaust Fan. ELECTRIC MIXER GRINDER: Identification of various Parts - Working principles – Connection Diagram - Checking of carbon brush and OLR - Common defects - causes.-		[2 Hrs] [2 Hrs] [2 Hrs] [2 Hrs]
Practical Exercises: Perform the experiments by using actual electrical appliances and Trainer Kits are not allowed.		

Ex.No	Name of the Experiment	
1	ERVICING OF AUTOMATIC IRON BOX <u>Activities to Perform:</u> • Dismantle and Identify the parts of Iron Box. • Check the condition of thermostat and Power cord. • Do technical check (OC, SC and Earth Fault, etc.,) and Rectify the fault if any. • Re-assemble and Test its working with supply.	
2	SERVICING OF WATER HEATER Activities to Perform: • Dismantle and Identify the parts of ceiling fan. • Check the condition of thermostat and Power cord. • Do technical check (OC, SC and Earth Fault, etc.,) and Rectify the fault if any. • Re-assemble and Test its working with supply	[16hrs]
3	SERVICING OF CEILING FAN & TABLE FAN Activities to Perform: • Dismantle and Identify the parts of ceiling fan and Table fan. • Check the condition of capacitor and bearings. • Do technical check (OC, SC and Earth Fault, etc.,) and Rectify the fault if any. • Re-assemble and Test its working with supply.	

4	SERVICING OF MIXER GRINDER Activities to Perform: • Dismantle and Identify the parts of Mixer Grinder. • Check the condition of Carbon Brush, Selector Switch and OLR. • Do technical check (OC, SC and Earth Fault, etc.,) and Rectify the fault if any. • Re-assemble and Test its working with supply.	
Theory Portion :		
Unit II	**DOMESTIC APPLIANCES II**	**[7 Hrs]**
ELECTRIC WET GRINDER: Identification of various Parts - Connection Diagram -Common defects - causes. INDUCTION STOVE: Specifications – Various parts - Working Principle of Induction Stove – Features – Electrical Circuit Diagram - Common defects - causes. MICROWAVE OVEN: Various Parts – Connection Diagram – Testing Heating element - Checking and testing of Magnetron - Common defects - causes. OFF GRID SOLAR PV SYSTEM: Connection diagram of Solar Panel with Inverter/Charge Controller and Battery-		[2 Hrs] [2 Hrs] [2 Hrs] [1 Hr]
Practical Exercises:		
5	SERVICING OF WET GRINDER Activities to Perform: • Dismantle and Identify the parts of Wet Grinder. • Check the condition of Capacitor, Centrifugal Switch and Bearings. • Do technical check (OC, SC and Earth Fault, etc.,) and Rectify the fault if any. • Re-Assemble and Test its working with supply.	[14 Hrs]
6	SERVICE OF REFRIGERATOR Activities to Perform: • Dismantle and Identify the parts of refrigerator. • Check the condition of Capacitor and Bearings. • Do technical check (OC, SC and Earth Fault, etc.,) and Rectify the fault if any. e-Assemble and Test its working with supply.	
7	SERVICING OF PORTABLE INDUCTION STOVE Activities to Perform: • Dismantle and Identify the parts of Portable Induction Stove. • Do technical check by referring the Error Codes and Rectify the fault if any. • Re-Assemble and Test its working with supply.	

8	SERVICING OF MICROWAVE OVEN Activities to Perform: • Dismantle and Identify the parts of Micro Oven. • Do technical test as per the service manual on Transformer, Magnetron, Capacitor, Motors and Control Panel and Rectify the fault if any. • Re-Assemble and Test its working with supply.	
9	INSTALLATION OF OFF GRID SOLAR PV SYSTEM Activities to Perform: • Install of Solar Panel, Charge Controller, Inverter and Battery and make connections. • Do technical checks on above items and Rectify the fault. • Test its working with load.	
	TOTAL PERIODS	**45**

Suggested List of Students Activity:

1. Activity 1: Four students can be grouped as a batch to prepare and submit the activity report of the following. Draw the wiring diagram, Write the various parts and tabulate the Troubleshooting Procedure of Washing Machine by referring service manual or Instruction manual or user manual of it.
2. Activity 2: Four students can be grouped as a batch to prepare and submit the activity report for the following. Measure the power and energy consumed by various domestic appliances by using Digital Power Monitor.
3. Activity 3: Perform troubleshooting of Indoor and Outdoor unit of Air Conditioner System.
4. Activity 4: Perform troubleshooting of Refrigerator unit.

Text and Reference Books:

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Hand Book on Home Appliances	L. Palaniappan	Firt Edition, S.P. Publications, 2019
2.	Study of Electrical Appliances & Devices	K.B. Bhatia	Seventh Edition, Khanna publishers, 2024.
3.	Domestic Appliances Servicing	K.P.Anwer	Fifth Edition, Scholar institute Publications,2018.

Web-based/Online Resources:

S.No	Websites
1.	Sway am Online Course Portal: https://youtu.be/FZU5VrfFA70

List of Equipment /Required For A Batch Of 30students

S No	Name of the Equipment	Quantity Required
1.	Non-Automatic and Automatic Iron Box	Each 2 Nos
2.	Electric Water Heater (Wall Mounted)	2 Nos
3.	Ceiling Fan and Table Fan	Each 2 Nos
4.	Mixer Grinder	2 Nos
5.	Wet Grinder	2 Nos
6	Refrigerator	2 Nos
7.	Portable Induction Stove	2 Nos
8.	Micro Oven	2 Nos
9.	100W Solar Panel, Inverter/Charge Controller and Battery	2 Set
10.	Tools Set	6 Nos
11.	Digital Multimeter	6 Nos
12.	Digital Power Monitor	2 Nos
13.	Bench Vice	1 No
14.	Series Test Board	As required
15.	Display Charts for Parts of above Appliances	Each 1 No
16.	Service Manual of Each Appliances	Each 1 No

MODEL QUESTION PAPER

EEE4540- SERVICING OF ELECTRICAL APPLIANCES

Duration: 3 Hours **Max. Marks: 100**

S.No	Experiments	CO	PO
1	Perform Dismantling, Identification of parts, Technical Checking, Re-assembling and Testing of Automatic Iron box.	E4540.1	PO1,PO2,PO3, PO4,PO5,PO6, PO7
2	Perform Dismantling, Identification of parts, Technical Checking, Re-assembling and Testing of Water Heater.	E4540.1	PO1,PO2,PO3, PO4,PO5,PO6, PO7
3	Perform Dismantling, Identification of parts, Technical Checking, Re-assembling and Testing of Ceiling Fan.	E4540.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
4	Perform Dismantling, Identification of parts, Technical Checking, Re-assembling and Testing of MixerGrinder.	E4540.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
5	Perform Dismantling, Identification of parts, Technical Checking, Re-assembling and Testing of Wet Grinder.	E4540.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
6	Perform Dismantling, Identification of parts, Technical Checking, Re-assembling and Testing of Refrigerator.	E4540.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
7	Perform Dismantling, Identification of parts, Technical Checking, Re-assembling and Testing of Portable Induction Stove.	E4540.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
8	Perform Dismantling, Identification of parts, Technical Checking, Re-assembling and Testing of Microwave Oven.	E4540.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
9	Perform Installation of OFF Grid Solar PV System and Test its Performance.	E4540.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7

EEE4620- ELECTRICAL MACHINES II PRACTICAL

Programme Name : EEE
Course Code : EEE4620
Semester : IV SEMESTER
Course Title : ELECTRICAL MACHINES II
Course Type : PRACTICAL

L	T	P	C
0	0	4	2

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

<table>
<tr><th rowspan="3">` `
Course</th><th colspan="2">Instructions</th><th colspan="4">Examination</th></tr>
<tr><th rowspan="2">Hours / Week</th><th rowspan="2">Hours / Semester</th><th colspan="3">Marks</th><th rowspan="2">Duration</th></tr>
<tr><th>Internal Assessment</th><th>Autonomous Examination</th><th>Total</th></tr>
<tr><td>Electrical Machines II Practical</td><td>4</td><td>60</td><td>40</td><td>100*</td><td>100</td><td>3 Hrs</td></tr>
</table>

*Examinations will be conducted for 100 marks and will be converted to 60 marks

Course Description

The syllabus for Electrical Machines – II Practical is designed to offer students a comprehensive, hands-on understanding of various electrical machines, focusing particularly on alternators, induction motors, and their applications in electrical engineering. The rationale behind including each exercise in the syllabus is grounded in both educational and practical considerations, aimed at equipping students with the necessary skills and knowledge to excel in the field.

Course Objectives

The objective of this course is to enable the student to

1. Assess the performance of a three-phase alternator under varying loads, ensuring voltage and frequency stability.
2. Determine voltage regulation using the EMF method, measuring no-load voltage and analyzing regulation across different loads.
3. Sync alternators with the grid or another alternator, ensuring precise phase and frequency alignment.
4. Analyze the performance of three phase induction motors, including torque-speed characteristics and efficiency, under diverse loads.
5. Establish resistance, reactance, and leakage coefficients for precise modeling of three-phase induction motor.
6. Demonstrate techniques such as capacitor banks to enhance power factor, reducing reactive

power consumption and enhancing system efficiency.

7. Conduct load analysis to single phase induction motor and understand torque-speed characteristics and efficiency.
8. Perform Transformer windings and End connection in three phase squirrel cage induction motor.

COURSE OUTCOMES :

After successful completion of this course, the students will be able to	
E4620.1	Grasp alternator operation, performance, and voltage regulation using EMF method.
E4620.2	Synchronize proficiently 3-phase alternators using lamp and synchroscope method.
E4620.3	Compare slip ring and squirrel cage motor performance via load testing.
E4620.4	Develop skills in determining induction motor constants and Demonstrate power factor improvement using capacitors.
E4620.5	Access single-phase induction motor performance through load testing for efficiency insight.

Pre-requisites

- Electrical Circuit Theory
- Electrical Machines II Theory.

CO/PO & PSO Mapping Matrix:

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E4620.1	3	3	3	3	3	3	2	3	2	3
E4620.2	3	3	3	3	3	3	2	3	2	3
E4620.3	3	3	3	3	3	3	2	3	2	3
E4620.4	3	3	3	3	3	3	2	3	2	3
E4620.5	3	3	3	3	3	3	2	3	2	3
Total	**15**	**15**	**15**	**15**	**15**	**15**	**10**	**15**	**10**	**15**
Correlation Level	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**

Legend:3-HighCorrelation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy

- **Demonstrations:** Conduct live demonstrations of load testing procedures for the three- phase alternator, slip ring and squirrel cage induction motors, and single-phase induction motor. Show step-by-step processes and highlight key measurements and observations.
- **Hands-on Practical Sessions:** Provide students with opportunities to conduct load tests on

various electrical machines in a laboratory setting. Allow them to operate testing equipment, collect data, and analyze results under the supervision of instructors.

- **Problem-Based Learning:** Assign problem-solving tasks related to predetermining alternator regulation, determining equivalent circuit constants of induction motors, and optimizing power factor. Encourage students to apply theoretical knowledge to real- world scenarios. **Interactive Workshops:** Organize workshops on synchronization methods, load testing techniques, and power factor improvement strategies. Allow students to actively participate through discussions, role-plays, and hands-on activities.
- **Peer Learning:** Facilitate peer learning sessions where students can share their experiences, discuss challenges, and provide feedback to each other. Encourage peer teaching and collaboration to enhance comprehension and retention of concepts.
- **Formative Assessment:** Conduct regular quizzes, assignments, and in-class exercises to assess students' understanding of key concepts and monitor their progress throughout the course. Provide constructive feedback to guide their learning journey.

Assessment Methodology:

	Continuous Assessment (40 Marks)				**End Semester Examination (60 Marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Model Practical Examination	Practical Examination
Portion	Ex. 1 to 6	Ex. 7 to 12	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	50	50	100	100	100
Converted to	10	10	10	10	60
Marks	10	10	10	10	60
Internal Marks	40				60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	-

CA1 and CA2: All the exercises/experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the exam.The practical test should be conducted as per the scheme of evaluation as below. The marks awarded will be converted to 10 Marks for each assessment test.

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Circuit Diagram	15
C	Connection	10
D	Execution and Output/Result	20
TOTAL		**50**

CA 3: Practical document (Hand written document / Notebook consists of Aim, Apparatus Required, Circuit, Tabulation, Graph, Procedure and Result) should be maintained for every exercise / experiment immediately after completion of the practice. The same should be evaluated for 10 Marks. The total marks awarded should be converted to 10 Marks for the internal assessment. The practical document should be submitted for the Practical test.

CA 4: All the exercises/experiments should be completed and kept for the model practical examination. The students shall be permitted to select any one by lot for the exam. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded should be converted to 10 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical and End Semester Examination- Practical Exam

Part	Description	Marks
A	Aim & Apparatus Required	10
B	Circuit Diagram	25
C	Connections	25
D	Execution and Output/Result	30
E	Viva Voce	10
TOTAL		**100**

List of Equipment /Required for a batch of 30students

S.No	List of equipment	Quantity Required
1.	3KW, 415V, 50Hz Three Phase Alternator with prime mover.	2 Nos
2.	5HP, 440V, 1440 rpm Three Phase Squirrel Cage Induction motor with starting and loading arrangement.	2 Nos
3.	5HP, 440V, 1440 rpm Three Phase Squirrel Cage Induction motor without starting and loading arrangement.	1 No
4.	5HP, 440V, 1440 rpm Three phase Slip ring Induction motor with starting and loading arrangement.	1 No
5.	2HP, 250V, 1440 rpm Single phase induction motor with staring and loading arrangement.	1 No
6.	5HP/3HP, 440V, 1500 rpm Synchronous Motor with starting and loading arrangement.	1 No
7.	Alternator Synchronizing panel	1 No
8.	MI Voltmeter (0 - 600V)	4 Nos
9.	MI Voltmeter (0 - 150/300V) & MC Ammeter (0 - 2A)	Each 2 Nos
10.	MI Ammeter (0 - 10/20A)	3 Nos
11.	Wattmeter (600V,10A) UPF	4 Nos
12.	Wattmeter (600V, 5A) LPF	2 Nos
13.	Wattmeter (300V, 10A) UPF	1 No
14.	Rheostat : 400Ω/1A or Suitable Range	2 Nos
15.	Rheostat 530Ω/1A or Suitable Range	3 Nos
16.	Rheostat :40Ω/6A & Rheostat 1180Ω/0.6A	Each 2 Nos
17.	Capacitor bank (2 KVAR,1000V)	2 Nos
18.	Three Phase Induction Motor with End Connection Terminals	1 No
19.	Winding Machine	1 No
20.	Copper coil, E and I Cores and Bobbin	As required

EEE 4620- ELECTRICAL MACHINES II PRACTICAL

L	T	P	C
0	0	4	2

List of the Experiments

Practical Exercises:		
Ex.No	**Name of the Experiment**	**Period**
1	Conduct Load test on 3 Phase Alternator.	5
2	Predetermine the Regulation of Three Phase Alternator by EMF method.	5
3	Synchronization of 3 Phase Alternators by a) Lamp method. b) Synchroscope method	6
4	Study of AC Motor Starter	3
5	Conduct Load Test on a three phase squirrel cage induction motor and plot the performance curve.	5
6	Conduct Load Test on a three phase slip-ring induction motor and plot the performance curve.	5
7	Find the equivalent circuit constants of a three phase induction motor by conducting No-Load and Blocked Rotor tests.	5
8	Demonstrate that power factor of an induction motor load is improved by connecting capacitor bank.	6
9	Conduct Load Test on a single phase induction motor and plot the performance curve.	5
10	Determination the ‘V’ curve and inverted ‘v’ curve of synchronous motor.	6
11	Perform Winding of primary and secondary coils of 230V/12V, 500mA Transformer. Insert suitable cores and Check the output voltage.	6
12	Make end connection to a three phase induction motor winding for a two pole/four pole operations and verify the output.	3
	TOTAL PERIODS	**60**

Note: Common Test and Revision periods can be used for conducting Continuous Assessment During all practical examinations, sub-division in Q.No 03 & 08 will be treated as separate experiment and separate qstion.

Suggested List of Students Activity:

- Case Studies: Present case studies on power factor improvement techniques, synchronization methods for three-phase alternators, and performance prediction of induction motors. Analyze real-world examples to deepen understanding and stimulate critical thinking.
- Simulations: Utilize computer simulations to replicate load testing procedures, synchronization techniques, and performance analysis of electrical machines. Simulations offer a risk-free environment for students to explore different scenarios and outcomes.

- Group Projects: Assign group projects where students design and implement load testing protocols, analyze data, and present findings. Encourage collaboration and teamwork to foster communication and problem-solving skills.
- Guest Lectures: Invite industry experts to deliver guest lectures on topics such as power factor correction, synchronous motor characteristics, and practical applications of electrical machines. Provide insights into current trends and real-world challenges.

General Guidelines:

- Preparation: Before each class, ensure all equipment is functional and safety protocols are in place.
- Demonstration: Initially, demonstrate each experiment or test procedure to the students.
- Hands-On: Encourage students to perform experiments in groups, under supervision, to ensure engagement and understanding.
- Discussion: After experiments, hold discussions to interpret results and relate them to theoretical concepts.
- Assessment: Evaluate students through quizzes, lab reports, and presentations on their understanding and analysis of the experiments.

Text and Reference Books:

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	A Textbook of Electrical Technology Volume - II (ACand DC Machines)	B. L. Theraja and A. K. Theraja	Multicolour Edition, S. Chand & Co., 2005
2.	Principles of Electrical Machines	V.K. Mehta & Rohit Mehta	Second Edition, S. Chand& Co.,2019
3.	Electrical Machines	S. K. Bhattacharya	Third Edition, McGraw Hill Education, 2008.
4.	Electric Machines	Ashfaq Husain, Haroon Ashfaq	Third Edition, Dhanpat Rai & Co. (P)Ltd., 2016.

Web-based/Online Resources

S.No	Websites
1.	IE Xplore Digital Library**:** https://iExplore.iE.org/
2.	All About Circuits**:** https://www.allaboutcircuits.com/
3.	Electrical4U**:** https://www.electrical4u.com/
4.	Engineering360 from IE: https://www.engineering360.com/
5.	Khan Academy: https://www.khanacademy.org/
6.	Learn Engineering: https://www.learnengineering.org/
7.	Electrical Engineering Portal: https://electrical-engineering-portal.com/

MODEL QUESTION PAPER

EEE 4620- ELECTRICAL MACHINES II PRACTICAL

Duration: 3 Hours **Max. Marks: 100**

S.No	Experiments	CO	PO
1	Conduct Load test on 3 Phase Alternator.	E4620.1	PO1,PO2,PO3, PO4,PO5,PO6, PO7
2	Predetermine the Regulation of Three Phase Alternator by EMF method.	E4620.1	PO1,PO2,PO3, PO4,PO5,PO6, PO7
3	Synchronization of 3 Phase Alternators by a) Lamp method. b) Synchroscope method	E4620.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
4	Study of AC Motor Starter	E4620.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
5	Conduct Load Test on a three phase squirrel cage induction motor and plot the performance curve.	E4620.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
6	Conduct Load Test on a three phase slip-ring induction motor and plot the performance curve.	E4620.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
7	Find the equivalent circuit constants of a three phase induction motor by conducting No-Load and Blocked Rotor tests.	E4620.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
8	Demonstrate that power factor of an induction motor load is improved by connecting capacitor bank.	E4620.3	PO1,PO2,PO3, PO4,PO5,PO6, PO7
9	Conduct Load Test on a single phase induction motor and plot the performance curve.	E4620.3	PO1,PO2,PO3, PO4,PO5,PO6, PO7
10	Determination the ‘V’ curve and inverted ‘v’ curve of synchronous motor.	E4620.3	PO1,PO2,PO3, PO4,PO5,PO6, PO7
11	Perform Winding of primary and secondary coils of 230V/12V, 500mA Transformer. Insert suitable cores and Check the output voltage.	E4620.3	PO1,PO2,PO3, PO4,PO5,PO6, PO7
12	Make end connection to a three phase induction motor winding for a two pole/four pole operations and verify the output.	E4620.3	PO1,PO2,PO3, PO4,PO5,PO6, PO7

EEE5110-POWER SYSTEM PROTECTION AND UTILIZATION

L	T	P	C
3	0	0	3

Programme Name : EEE
Course Code : EEE5110
Semester : V SEMESTER
Course Title : POWER SYSTEM PROTECTION AND UTILIZATION
Course Type : THEORY

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Power System Protection And Utlization	3	45	40	100*	100	3 Hrs

***Examinations will be conducted for 100 marks and will be converted to 60 marks

TOPICS AND ALLOCATION OF HOURS

Unit	Topics	Time (Hrs)
I	Protection schemes	9
II	Relays and circuit breakers	9
III	Electric traction	9
IV	Illumination	9
V	Electric heating and welding	9
	Total	**45**

COURSE DESCRIPTION:

Power system protection and utilization are crucial for ensuring the reliability, safety, and sustainability of electrical power systems. Power system protection encompasses a set of techniques, devices and strategies designed to detect, isolate, and mitigate faults or abnormalities in electrical networks. These faults could include short circuits, overloads, insulation failures, and other potential disturbances that may lead to equipment damage, power outages, or even hazardous conditions. The primary objective of power system protection is to swiftly isolate the faulty components while maintaining the integrity and stability of the overall power system. Effective protection mechanisms safeguard equipment, prevent disruptions, and reduce downtime, thereby enhancing system reliability. Efficient utilization practices contribute to energy conservation, cost savings, and environmental sustainability by promoting optimal use of electrical resources and encouraging the adoption of clean energy technologies.

COURSE OBJECTIVES

The objective of this course is to enable the student to

- Understand the significance of protection, protection schemes, common faults in power system apparatus and applying suitable protective schemes.
- Understand the functioning of relays and circuit breakers.
- Understand the principles of electric traction systems and the technology to optimize modern electric traction systems.
- Explore theories and practices of electric illumination, covering lighting design principles, technologies and energy efficiency.
- Examine principles of electric heating and welding, encompassing techniques, equipment, safety protocols, and applications

COURSE OUTCOMES

On successful completion of this course, the student will be able to	
E5110.1	Understand and select proper protective scheme for different major electric equipment.
E5110.2	the fundamentals of relays and circuit breaker.
E5110.3	Describe the principles of electric traction systems.
E5110.4	Understand the fundamentals of illumination systems and to design for few applications.
E5110.5	Demonstrate the utilization of electrical energy for heating and welding purposes.

Pre-requisites

Basic Electrical Engineering

- Electrical Machines I
- Electrical Machines II

CO/PO &PSO Mapping Matrix:

CO/PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E5110.1	3	3	2	3	3	3	3	3	3	2
E5110.2	3	3	2	3	3	3	3	3	3	2
E5110.3	3	3	3	3	3	3	3	3	3	2
E5110.4	3	3	3	3	3	3	3	3	3	2
E5110.5	3	3	2	3	2	3	2	3	3	2
Total	**15**	**15**	**12**	**15**	**14**	**15**	**14**	**15**	**15**	**10**
Correlation level	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**

Legend:3-HighCorrelation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy:

- Begin by introducing foundational concepts such as electrical networks, power generation, transmission, and distribution systems.
- Explain the importance of power system protection and utilization in ensuring the reliability, safety, and efficiency of electrical power systems.
- Present case studies of power system failures or incidents and analyze the role of protection

systems in preventing or mitigating the consequences.

- Explain the advantages of electric traction, such as higher efficiency, lower emissions, and reduced dependence on fossil fuels.
- Introduce illumination principles, lighting technologies, design considerations, and energy efficiency through interactive activities, case studies, and practical demonstrations.
- Cover fundamental principles of electric heating and welding, safety precautions, equipment operation, and applications.
- Assess learners' understanding through quizzes, assignments, or project–based assessments.
- Encourage peer feedback discussion, and reflection to evaluate learning outcomes and identify areas for improvement.

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Unit 1 & 2)	Written test (Unit 3 & 4)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	6^{th} Week	12^{th} Week	$13\text{-}14^{th}$ Week	16^{th} Week	

CONTINUOUS ASSESSMENT

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 10 Marks for the internal assessment.

CA1and CA2, Assessment test should be conducted for two units as below

- PART A: (5 X 10 Marks = 50 Marks).
- Eight questions will be asked, students should write five questions. Four questions can be asked from each unit.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 10 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 10 marks for the internal assessment.

Question Pattern:

- Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.
- Four questions will be asked from every unit. Students should write any two questions.

Question Pattern - Model Examination and End Semester Examination Theory Exam

PART- A (5 X2X10 Marks = 100 Marks)

Note: Answer Ten questions by selecting two questions from each unit. Eachquestion carries 10 marks.

Sample:

I	1.
	2.
	3.
	4.
II	5.
	6.
	7.
	8.
III	9.
	10.
	11.
	12.
IV	13.
	14.
	15.
	16.
V	17.
	18.
	19.
	20.

QUESTION PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **Ap**-Apply	**An**- Analyse, **E**-Evaluate, **C**-Create

EEE5110-POWER SYSTEM PROTECTION AND UTILIZATION

L	T	P	C
3	0	0	3

THEORY

Unit I - PROTECTION SCHEMES	**[9 Hrs]**
Protection Schemes: Significance and need for protective schemes	[1 Hr]
Nature and causes of faults – Types of faults – Effects of faults	[1 Hr]
Zones of protection. Equipment Protection: Applications of Current Transformers	[1 Hr]
(CT)Potential Transformers (PT) in protection schemes – Protection of Transformer.	[1 Hr]
Over Voltage Protection: Voltage surge – Causes of Over Voltage	[1 Hr]
Lightning– Direct stroke, Indirect stroke – Protection against lightning	[1 Hr]
Earthing screen, Overhead Ground Wires, Lightning Arresters – Expulsion Type	[1 Hr]
Gapless Arrester. Fuses: Construction and Working of HRC Fuse – H.V. Fuses.	[2 Hrs]
Unit II- RELAYS AND CIRCUIT BREAKERS	**[9 Hrs]**
Relays: Basic principle — Relay characteristics – Relay timing – Instantaneous relay	[1 Hr]
Inverse time relay and Definite time lag relay – Inverse definite minimum time relay	[1 Hr]
Primary and back up Protection - Classification of relays –	[1 Hr]
Induction type over current relay (Directional and Non directional),	[1 Hr]
Differential relay – Over Current relay Distance relay.	[1 Hr]
Static Relays: Basic elements of static relay.	[1 Hr]
Circuit Breakers: Arcing phenomenon and Arc interruption – Re–Striking Voltage	[1 Hr]
Recovery Voltage – Rate of rise of recovery voltage –	[1 Hr]
Types of circuit breakers Air Blast, Oil, SF6 and Vacuum Circuit Breakers – HVDC Breaker.	[1 Hr]
Unit III- ELECTRIC TRACTION	**[9 Hrs]**
Fundamentals of electric drive – Factors governing the selection of Electric Motor	[1 Hr]
Different types of electrical drives – Application of Motors for Particular Services	[1 Hr]
Characteristic Features of Traction Motor – Advantages and Disadvantages of Electric Traction Over Head Equipment	[1 Hr]
Contact Wire, Centenary and Droppers and Collection Gear	[1 Hr]
Bow and Pantograph Collector – Different Systems of Track Electrification.	[1 Hr]
Traction Mechanics: Units and Notations used in Traction Mechanics	[1 Hr]
Speed Time Curve for Different Services –Simple problems	[1 Hr]
Simplified Speed Time Curve Energy Saving with Series Parallel Starting – Shunt Transition	[1 Hr]
Bridge Transition Multiple Unit Control – Regenerative Braking – Magnetic Levitation (MAGLEV).	[1 Hr]

Unit IV - ILLUMINATION	**[9 Hrs]**
Introduction – Definition and meaning of terms used in illumination engineering	**[1 Hr]**
Classification of light sources – Incandescent lamps – Sodium Vapour Lamps	[1 Hr]
Mercury Vapour Lamps – Fluorescent Lamps – Energy Saving Lamps	[2 Hrs]
CFL – LED – Recent trends in lighting systems.	[1 Hr]
Lighting schemes – Indoor lighting schemes –	[1 Hr]
Factory lighting Outdoor lighting schemes – Flood lighting – Street lighting	[1 Hr]
Lighting control using Sensors and IoT.	[1 Hr]
Simple problems	[1 Hr]
Unit V- ELECTRIC HEATING AND WELDING	**[9 Hrs]**
Introduction – Advantages of electric heating – Methods of electric heating	[2 Hrs]
Resistance heating – Infrared Heating – Arc Heating – High Frequency Electric Heating	[2 Hrs]
Induction Heating – Eddy Current Heating and Dielectric Heating.	[1 Hr]
Electric Furnaces: Resistance Furnace – Arc Furnace – Direct and Indirect	[1 Hr]
Arc Furnace – Induction Furnace – Direct and Indirect Core Type Induction Furnace	[1 Hr]
Coreless Induction Furnace. Electric Welding: Resistance Welding	[1 Hr]
Arc Welding– Ultrasonic Welding - Laser Beam Welding.	[1 Hr]
TOTAL	**45Hrs**

Suggested List of Students Activity

- Power point presentation on “Technology in recent superfast trains”.
- Group Discussion on “Design procedure for lighting schemes using Flood lighting.
- Case study of HVAC (Heating, Ventilation and Air conditioning) in Industry.
- Quiz Questions on each topic can be asked at the end of each unit.

REFERENCE BOOKS

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1	Switchgear and Protection	Sunil S.Rao,	Khanna Publishers, 2010.
2	Generation Distribution and Utilisation of Electrical Energy	C.L. Wadhwa	Academic Science, New Delhi, 2011

Web-based/OnlineResources

S.No	Websites
1.	https://youtu.be/WPmOB31UTkI?si=3uqr7o_C4nC9whoo
2.	https://youtu.be/gWv4lx6y2Qw?si=XKnI181-P-ahu1xi.

MODEL QUESTION PAPER

EEE5110-POWER SYSTEM PROTECTION AND UTILIZATION

Time : 3 Hrs. **Max.Marks : 100**

PART – A (5X2X10=100 MARKS)					
Note :Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.					
S. No	**Questions**	**Unit**	**Bloom's level**	**Co**	**Po**
I	1.What is the purpose of Fuse? Explain about the HRC Fuse	I	R	E5110.1	PO2,PO5, PO7
	2.How the Lightning Strokes are formed? Describe Direct And Indirect Stroke of Lightning	I	U	E5110.1	PO2,PO5, PO7
	3.What are the different types faults and its Explain	I	R	E5110.1	PO2,PO5, PO7
	4.What are the protection of Transformer	I	R	E5110.1	PO2,PO5, PO7
II	5.Explain the working principle of Differential Relay	II	U	E5110.2	PO2,PO5, PO7
	6.Draw and explain induction type over current relay	II	R	E5110.2	PO2,PO5, PO7
	7.Explain above static relay	II	R	E5110.2	PO2,PO5, PO7
	8.Explain the construction and working principle of SF6 Circuit Breaker with neat sketch	II	R	E5110.2	PO2,PO5, PO7
III	9.Explain different current collectors used in Electric Traction	III	U	E5110.3	PO2,PO5, PO7
	10.Draw the typical Speed Time Curve and explain each constituent of it	III	U	E5110.3	PO2,PO5, PO7
	11.Explain in detail Series - Parallel method of starting of Traction Motors	III	R	E5110.3	PO2,PO5, PO7
	12.Draw and explain Magnetic levitation	III	R	E5110.3	PO2,PO5, PO7
IV	13.Explain with a sketch the working of Sodium Vapour Lamp	IV	An	E5110.4	PO2,PO5, PO7
	14.Explain with a sketch the working of Mercury Vapour Lamp	IV	R	E5110.4	PO2,PO5, PO7
	15.What are the types of energy saving lamps	IV	R	E5110.4	PO2,PO5, PO7
	16.Explain lighting control using sensor and IOT	IV	U	E5110.4	PO2,PO5, PO7
	17.Draw and explain Resistance Heating	V	R	E5110.5	PO2,PO5,

					PO7
	18.With a neat sketch explain the Function of coreless induction Furnace	V	R	E5110.5	PO2,PO5, PO7
V	19.Draw the diagram and explain Arc Welding	V	U	E5110.5	PO2,PO5, PO7
	20.Explain with sketch ultrasonic Welding	V	U	E5110.5	PO2,PO5, PO7

QUESTION PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-remember, U-understand, Ap-apply	An- analyse, e-evaluate, c-create
% to be included	90 %	10 %

EEE5210-ELECTRIC VEHICLE TECHNOLOGY

L	T	P	C
3	0	0	3

Programme Name : EEE
Course Code : EEE5210
Semester : V SEMESTER
Course Title : ELECTRIC VEHICLE TECHNOLOGY
Course Type : THEORY

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Electric Vehicle Technology	3	45	40	100*	100	3 Hrs

***Examinations will be conducted for 100 marks and will be converted to 60 marks**

TOPICS AND ALLOCATION OF HOURS

Unit	Topics	Time (Hrs)
I	Introduction to electric vehicles	9
II	Electric vehicle motors	9
III	Electronics and sensor-less control in ev	9
IV	Hybrid vehicles	9
V	Fuel cells for electric vehicles	9
Total		**45**

COURSE DESCRIPTION:

Hybrid electric vehicles are powered by an internal combustion engine and one or more electric motors, which uses energy stored in batteries. A hybrid electric vehicle cannot be plugged in to charge the battery. Instead, the battery is charged through regenerative braking and by the internal combustion engine.

COURSE OBJECTIVES

The objective of this course is to enable the student to

- Understand the concept of electric vehicles.
- Study about the motors & drives for electric vehicles.

- Understand the electronics and sensors in electric vehicles.
- Understand the concept of hybrid vehicles.
- Study about fuel cell for electric vehicles

COURSE OUTCOMES

On successful completion of this course, the student will be able to	
E5210.1	Describe about working principle of electric vehicles.
E5210.2	Explain the construction and working principle of various motors used in electric vehicles.
E5210.3	Understand working principle of electronics and sensor less control in electric vehicles.
E5210.4	Understand working principle of hybrid vehicles.
E5210.5	Illustrate the various types and working principle of fuel cells

Pre-requisites

- Basics of Science and Engineering.

CO/PO&PSO Mapping Matrix:

CO/PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E5210.1	3	3	3	3	3	3	2	3	2	3
E5210.2	3	3	3	3	3	3	2	3	2	3
E5210.3	3	3	3	3	3	3	2	3	2	3
E5210.4	3	3	3	3	3	3	2	3	3	3
E5210.5	3	3	3	3	3	3	2	3	2	3
Total	**15**	**15**	**15**	**15**	**15**	**15**	**10**	**15**	**10**	**15**
Correlation Level	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**

Legend:3-HighCorrelation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Unit 1 & 2)	Written test (Unit 3 & 4)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	6^{th} Week	12^{th} Week	$13\text{-}14^{th}$ Week	16^{th} Week	-

CONTINUOUS ASSESSMENT

- **CA1 and CA2:** Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 10 Marks for the internal assessment.

CA1and CA2, Assessment test should be conducted for two units as below

- PART A: (5 X 10 Marks = 50 Marks).
- Eight questions will be asked, students should write five questions. Four questions can be asked from each unit.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 10 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 10 marks for the internal assessment.

Question Pattern:

- Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.
- Four questions will be asked from every unit. Students should write any two questions.

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Question Pattern - Model Examination and End Semester Examination Theory Exam

PART- A (5 X2X10= 100 Marks)

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.

Sample:

I	1.
	2.
	3.
	4.
II	5.
	6.
	7.
	8.
III	9.
	10.
	11.
	12.
IV	13.
	14.
	15.
	16.
V	17.
	18.
	19.
	20.

QUESTION PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **Ap**-Apply	**An-** Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

EEE5210-ELECTRIC VEHICLE TECHNOLOGY

THEORY

L	T	P	C
3	0	0	3

Unit I - INTRODUCTION TO ELECTRIC VEHICLES	**[9 Hrs]**
Electric Vehicle – Need - Types – Cost and Emissions – End of life	[2 Hrs]
Electric Vehicle Technology Layouts – Cables – Components	[2 Hrs]
Controls - Batteries – Overview and its types	[2 Hrs]
Battery plug-in and life - Ultra-capacitor Charging	[1 Hr]
Methods and Standards - Alternate charging sources Wireless & Solar.	[2 Hrs]
Unit II- ELECTRIC VEHICLE MOTORS	**[9 Hrs]**
Motors (DC, Induction, BLDC)	[1 Hr]
Types, Principle, Construction, Control - Electric Drive Trains (EDT)	[1 Hr]
Series HEDT (Electrical Coupling) Power Rating Design - Peak Power Source (PPS)	[2 Hrs]
Parallel HEDT (Mechanical Coupling)	[1 Hr]
Torque Coupling andSpeed Coupling	[1 Hr]
Switched Reluctance Motors (SRM) Drives – Basic structure, Drive	[2 Hrs]
Convertor and Design.	[1 Hr]
Unit III- ELECTRONICS AND SENSOR-LESS CONTROL IN EV	**[9 Hrs]**
Basic Electronics Devices – Diodes,	[1 Hr]
Thyristors, BJTs, MOSFETs, IGBTs,	[2 Hrs]
Convertors- Inverters Safety: Risks and Guidance,	[1 Hr]
Precautions, High Voltage safety, Hazard management – Sensors:	[1 Hr]
Autonomous EV cars, Self-drive Cars, Hacking - Sensor less: Control methods –	[1 Hr]
Phase Flux Linkage-Based Method, Phase Inductance Based, Modulated Signal Injection,	[2 Hrs]
Mutually Induced Voltage-Based and Observer-Based.	[1 Hr]
Unit IV- HYBRID VEHICLES	**[9 Hrs]**
Hybrid Electric vehicles – Classification	[1 Hr]
Micro, Mild, Full, Plug-in	[2 Hrs]
EV Layout and Architecture Series, Parallel and Series-Parallel	[2 Hrs]
HybridPropulsion systems and components Regenerative Braking –	[2 Hrs]
Economy Vibration and Noise reduction	[1 Hr]
Hybrid Electric Vehicles System: Analysis, Types and Controls.	[1 Hr]
Unit V- FUEL CELLS FOR ELECTRIC VEHICLES	**[9 Hrs]**
Fuel cell – Introduction, Technologies & Types - Obstacles	[2 Hrs]
Operation principles -Potential and I-V curve	[1 Hr]
Fuel and Oxidation Consumption - Fuel cell Characteristics	[1 Hr]
Efficiency, Durability, Specific power, Factors affecting,	[1 Hr]
Power design of fuel Cell Vehicle and freeze capacity	[2 Hrs]
Lifetime cost of Fuel cell Vehicle System Components, maintenance.	[2 Hrs]
TOTAL	**45 Hrs**

Suggested List of Students Activity

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

Text Books

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Electric and Fuel Cell Vehicles	Jack Erjavec and Jeff Arias, Hybrid	Cengage Learning,2012
2.	“Modern Electric, HybridElectric and Fuel Cell Vehicles: Fundamentals, Theory and Design”	Jack Erjavec and Jeff Arias, Hybrid	Cengage Learning Pvt. Ltd., New Delhi, 2007.
3.	Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”,	Mehrdad Ehsani, Yimin Gao, sebastien E. Gay and Ali Ema	CRC Press, 2009

Web-based/OnlineResources

S.No	Websites
1.	NPTEL Electrical Vehicle Technology.
2.	https://afdc.energy.gov/vehicles/how-do-all-electric-cars-work
3.	https://e-amrit.niti.gov.in/types-of-electric-vehicles
4.	https://www.niti.gov.in/sites/default/files/2021-08/HandbookforEVChargingInfrastructureImplementation081221.pdf
5.	NPTEL Electrical Vehicle Technology.

MODEL QUESTION PAPER

EEE5210-ELECTRIC VEHICLE TECHNOLOGY

Time : 3 Hrs. **Max.Marks : 100**

PART – A (5X2X10=100 MARKS)

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.

S. No	QUESTIONS	UNIT	BLOOM'S LEVEL	CO	PO
I	1.Explain electric vehicle need and its types	I	R	E5210.1	PO2,PO5,PO7
	2.Draw and explain electric vehicle Technology	I	U	E5210.1	PO2,PO5,PO7
	3.What are the control of electric vehicle and its explain	I	R	E5210.1	PO2,PO5,PO7
	4.Explain method and standard of E - vehicle	E	R	E5210.1	PO2,PO5,PO7
II	5.What are the different types of motors used in E-vehicle	II	U	E5210.2	PO2,PO5,PO7
	6.Draw and Explain switched Reluctance motors	II	R	E5210.2	PO2,PO5,PO7
	7.What are the different type of coupling and its explain	II	R	E5210.2	PO2,PO5,PO7
	8.Explainwith neat sketch of drive converter and design	II	R	E5210.2	PO2,PO5,PO7
III	9.Draw and explain autonomous EV cars	III	U	E5210.3	PO2,PO5,PO7
	10.What are the control of methods E - vehicle	III	U	E5210.3	PO2,PO5,PO7
	11.What are the different types of electronics devices	III	R	E5210.3	PO2,PO5,PO7
	12.What are the precautions of E - vehicle	III	R	E5210.3	PO2,PO5,PO7
IV	13.Explain with neat sketch Hybrid electric vehicles system	IV	U	E5210.4	PO2,PO5,PO7
	14.Analysis of electric vehicle types and control	IV	An	E5210.4	PO2,PO5,PO7
	15.Layout and architecture E - vehicle	IV	R	E5210.4	PO2,PO5,PO7
	16.Explain regenerative of breaking of E - vehicle	IV	U	E5210.4	PO2,PO5,PO7
V	17.Explain the working of fuel cell electric vehicle with the block diagram	V	R	E5210.5	PO2,PO5,PO7
	18.Draw and explain potential and I-V curve	V	R	E5210.5	PO2,PO5,PO7
	19.What are the factors affecting E - vehicle	V	U	E5210.5	PO2,PO5,PO7
	20.Explain about E – vehicle maintenance	V	U	E5210.5	PO2,PO5,PO7

QUESTION PAPER SETTING

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, U-Understand, Ap-Apply	An- Analyse, E-Evaluate, C-Create
% to be included	90 %	10 %

EEE5340 - POWER ELECTRONICS

Programme Name : EEE

Course Code : EEE5340

Semester : V SEMESTER

Course Title : POWER ELECTRONICS

Course Type : PRACTICUM

L	T	P	C
1	0	4	3

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Power Electronics	5	75	40	100*	100	3Hrs

***** Examinations will be conducted for 100 marks will be converted to 60 marks.

COURSE DESCRIPTION:

Electronic control circuits play major role in industries. In this era of automation in industry and manufacturing sector, the mechanical controls are largely replaced by power electronic devices. In this context this course aims at acquainting the pass outs with a comprehensive knowledge base about the devices and circuits used in Electrical Power so that they can maintain the control circuits used in the field. Hence this course has been designed to achieve this aim.

COURSE OBJECTIVES:

The objective of this course is to enable the student to

- Explain the operating region and rating of SCR.
- Explain the trigger and commutation circuits of SCR.
- Familiarize with the phase controlled rectifier circuits.
- Understand the operation of cyclo converter.
- Understand the working of choppers and inverters

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

Course	EEE5340 - POWER ELECTRONICS
After successful completion of this course, the students should be able to	
E5340.1	Understand and construct the trigger and commutation circuits of SCR.
E5340.2	Understand the Line commutated power control circuits.
E5340.3	Understand the working of different types of choppers and inverters.
E5340.4	Understand the basics of DC Drives
E5340.5	Understand the basics of AC Drives

Pre-Requisites:

- Basics of Electrical and Electronics Engineering
- Analog and Digital electronics
- Electrical Machines I
- Electrical Machines II.

CO/PO&PSO Mapping Matrix:

CO/PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E5340.1	3	3	3	3	3	3	3	3	2	3
E5340.2	3	3	3	3	3	3	3	3	2	3
E5340.3	3	3	3	3	3	3	3	3	2	3
E5340.4	3	3	3	3	3	2	3	3	2	3
E5340.5	3	3	3	3	3	3	3	3	2	3
Total	**15**	**15**	**15**	**15**	**15**	**14**	**15**	**15**	**10**	**15**
Correlation Level	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**

Legend:3-HighCorrelation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy

- It is advised that teachers take steps to pique pupils' attention and boost their curiosity to learn.
- Implement task-based learning activities where students work on specific tasks or projects.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- Incorporate formative and summative assessments to gauge student progress and provide targeted feedback.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices may be followed in the real environment as far as possible.

Assessment Methodology

	Continuous Assessment (40 Marks)				End Semester Examination (60 Marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Model Practical Examination	Practical Examination
Portion	Ex. 1 to 5	Ex. 6 to 11	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	60	60	100	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	7^{th} Week	14^{th} Week	15^{th} Week	16^{th} Week	-

Note:

CA1 and CA2: All the exercises/experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the exam. The marks awarded will be converted to 10 Marks for each assessment test.

- Practical document (Hand written document / Notebook consists of Aim, Apparatus Required, Circuit, Tabulation / Graph, Procedure and Result) should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise / experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Circuit Diagram	15
C	Connection	10
D	Execution and Output/Result	20
TOTAL		50
E	Practical Documents (As per the portions)	10
TOTAL		**60**

CA 3: Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 10 Marks for internal assessment. The question setting details are as follows.

	Description	Pattern	Marks
PART-A	30 Multiple Choice Questions (MCQ)	30 x 1 Mark	30
PART-B	7 Questions to be answered out of 10 Questions	7 x 10 Mark	70
TOTAL			**100**

CA 4: All the exercises/experiments should be completed and kept for the Model Practical Examination. The students shall be permitted to select any one by lot for the exam. The model practical examination should be conducted as per the End Semester Examination question pattern as given below. The marks awarded should be converted to 10 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Circuit Diagram	20
C	Connections	20
D	Execution and Output/Result	25
E	MCQ from Theory Portions	20
F	Viva Voce	10
TOTAL		**100**

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EEE5340 - POWER ELECTRONICS

L	T	P	C
1	0	4	3

THEORY

Unit I	**COMMUTATION CIRCUITS AND PHASE CONTROLLED RECTIFIERS**	[7 Hrs]
Power Electronics: Definition – Scope and Applications – Power Electronic Switch Specifications – Types of Power Electronic Circuits. SCR – rating and their importance, Symbol, Circuit, Working, Characteristics Applications - Line Synchronized UJT Triggering Circuits - Working, Characteristics and Applications of IGBT and MOSFET.Commutation Circuits: SCR Turn Off Methods – Natural Commutation Forced Commutation – Class A, Class B, Class C, Class D, Class E and Class F. Phase Controlled Rectifiers: Introduction – Phase Controlled Rectifiers Single Phase Fully Controlled Bridge with R Load, RL Load - Single Phase Dual Converter Three Phase Fully Controlled Bridge with RL Load - Introduction to Single Phase Cyclo Converter with Simple Circuit.		[1Hr] [1Hr] [1Hr] [1Hr] [1Hr] [1Hr] [1Hr]
Practical Exercises:		
Ex.No	Name of the Experiment	
1.	Construct the Line synchronized Ramp trigger circuit using UJT with AC Load to measure firing angles.	[6Hrs]
2.	Construct and test the SCR commutation circuits.	[6Hrs]
3.	Construct and test a Half wave controlled rectifier with R Load.	[6Hrs]
4.	Construct and test a Single phase fully controlled bridge rectifier with RL-Load.	[6Hrs]
5.	Construct and test the Single phase to single phase Cyclo converter.	[6Hrs]
Theory Portion:		
Unit II	**CONVERTERS AND APPLICATIONS OF POWER ELECTRONICS**	[8Hrs]
Choppers: Introduction, Principle of Chopper Operation. Control Strategies Constant Frequency System and Variable Frequency System – Circuit Diagram and Working Step Up Chopper – Four Quadrant Choppers. **Inverters**: Introduction, Classification of Inverter. Circuit Diagram, Working and Waveform Full Bridge Inverter – Three Phase Bridge Inverter Under 180° Mode & 120° Mode Operations Pulse Width Modulated Inverters, (Single Pulse, Multiple Pulse, Sinusoidal Pulse). **DC Drives**: Basic DC Motor Speed Equation- Circuit Diagram, Output Waveforms and Output Equation of – Separately Excited DC Motor – Single Phase Full Converter Drives. **AC Drives**: Speed Control by Rotor Resistance for Slip Ring Induction Motors – Static Scherbius Drive (Slip Power Recovery Scheme) – Variable voltage and Variable frequency drive – Block Diagram.		[1Hr] [1Hr] [1Hr] [1Hr] [1Hr] [1Hr] [1Hr] [1Hr]

Practical Exercises:		
Ex.No	Name of the Experiment	
6.	Design the PWM based step down DC Chopper using MOSFET/IGBT.	[5Hr]
7.	Construct and test the Single phase Single pulse / Sinusoidal PWM inverter using MOSFET/IGBT.	[5Hr]
8.	Construct and test the ON / OFF control of Lamp using solid state Relay.	[5Hr]
9.	Construct and test the Speed Control of AC Motor using VFD drive.	[5Hr]
10.	Construct a Lamp dimmer circuit using TRIAC.	[5Hr]
11.	Construct and test the closed loop control of AC and DC motor	[5Hr]
	TOTAL PERIODS	**75**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course
- Viva Voce will be conducted before conducting an experiment

Text and Reference Book

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Power Electronics	MD Singh, K.B. Khanchandani	Tata Mc Graw HillPublishing Company Ltd,2005..
2.	Power Electronics	Mohammed H. Rashid	New age publication, 2004
3.	Power Electronics: Converters, Applications and Design	William P. Robbins, Ned Mohan, Tore M. Undeland	Third Edition, Wiley, 2002.

Web-based/Online Resources

S.No	Websites
1.	https://www.electronicsforu.com/technology-trends/learn-electronics/understanding-power-electronics
2.	https://www.geeksforgeeks.org/power-electronics
3.	https://www.youtube.com/watch?v=1Auay7ja2oY – NPTEL Lecture Series on Power Electronics by Prof. B.G. Fernandes, Department of Electrical Engineering, IIT Bombay.

List of Equipments Required for a batch of 30 students

S.No	Name of the Equipment's	Quantity Required
1.	Line synchronized Ramp trigger circuit using UJT	3 Nos.
2.	SCR commutation circuit kit	1 No.
3.	Half wave controlled rectifier kit	1 No.
4.	Single phase fully controlled bridge rectifier with RL- Load	1 No.
5.	Single phase to single phase cyclo converter kit	1 No.
6.	PWM based step down DC chopper using MOSFET/IGBT kit	1 No.
7.	Single phase Single pulse / Sinusoidal PWM inverter using MOSFET/IGBT kit	1 No.
8.	Solid state Relay	1 No.
9.	Lamp 60W	1 No.
10.	Variable Frequency Drive (VFD)	1 No.
11.	Single Phase/Three Phase Induction Motor	1 No
12.	TRIAC - BT136, DIAC - DB32, Resistor - 2KΩ,26Ω, Capacitor - 0.01μf,Potentiometer - 1 MΩ	Each 1 No
13.	CRO	5 Nos.

MODEL QUESTION PAPER

EEE5340 - POWER ELECTRONICS

Duration: 3 Hours Max. Marks: 100

S.No	Experiments	CO	PO
1	Construct the Line synchronized Ramp trigger circuit using UJT with AC Load to measure firing angles.	E5340.1	PO1,PO2,PO3, PO4,PO5,PO6, PO7
2	Construct and test the SCR commutation circuits.	E5340.1	PO1,PO2,PO3, PO4,PO5,PO6, PO7
3	Construct and test a Half wave controlled rectifier with R Load.	E5340.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
4	Construct and test a Single phase fully controlled bridge rectifier with RL- Load.	E5340.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
5	Construct and test the Single phase to single phase Cyclo converter.	E5340.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
6	Construct PWM based step down DC Chopper using MOSFET/IGBT.	E5340.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
7	Construct and test the Single phase Single pulse / Sinusoidal PWM inverter usingMOSFET/IGBT.	E5340.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
8	Construct and test the ON / OFF control of Lamp using solid state Relay.	E5340.2	PO1,PO2,PO3, PO4,PO5,PO6, PO7
9	Construct and test the Speed Control of AC Motor using VFD drive.	E5340.3	PO1,PO2,PO3, PO4,PO5,PO6, PO7
10	Construct a Lamp dimmer circuit using TRIAC.	E5340.3	PO1,PO2,PO3, PO4,PO5,PO6, PO7
11	Construct and test the closed loop control of AC and DC motor	E5340.3	PO1,PO2,PO3, PO4,PO5,PO6, PO7

EEE5440 - PLC AND AUTOMATION

L	T	P	C
1	0	4	3

Programme Name : EEE

Course Code : EEE5440

Semester : V SEMESTER

Course Title : PLC AND AUTOMATION

Course Type : PRACTICUM

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
PLC AND AUTOMATION	5	75	40	100*	100	3Hrs

***** Examinations will be conducted for 100 marks will be converted to 60 marks.

COURSE DESCRIPTION:

Nearly all the industrial equipment that you find in a modern manufacturing facility shares one thing in common - computer control. The most commonly used controller is the PLC. PLC is using a programming language called Ladder Logic. Its format is similar to the electrical style of drawing known as the “ladder diagram”. A diploma holder when employed in automated industrial process controls will be required to know the basics of Programmable Logic Controllers, their working and their programming.

COURSEOBJECTIVES:

The objective of this course is to enable the student to

- Understand the role of each component of PLC system.
- Practice Relay Type Instructions and Timers Instructions in PLC Programming.
- Implement Counter, Math and Compare Instructions in conveyor applications.
- Explain the importance of Analog I/O Module in PLC.
- Learn the concept of I/O Bus networks and SCADA.
- Course Outcomes

On successful completion of this course, the student will be able to

On successful completion of this course, the student will be able to	
E5440.1	Describe the importance of typical components of a PLC.
E5440.2	Develop and Execute PLC Program using Relay type and Timer Instructions.
E5440.3	Develop and Execute PLC Program using Counter and Compare Instructions.
E5440.4	Develop and Execute PLC Program using Analog Input Instruction.
E5440.5	Describe the importance of I/O Bus networks and SCADA in automation.

Pre-requisites

Basics of Electrical and Electronics Engineering

CO/PO&PSO Mapping Matrix:

CO/PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E5440.1	3	3	3	3	3	3	3	3	2	3
E5440.2	3	3	3	3	3	3	3	3	2	3
E5440.3	3	3	3	3	3	3	3	3	2	3
E5440.4	3	3	3	3	3	3	3	3	2	3
E5440.5	3	3	3	3	3	3	3	3	2	3
Total	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**10**	**15**
Correlation Level	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**

Legend:3-HighCorrelation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy

- It is advised that teachers take steps to pique pupils' attention and boost their curiosity to learn.
- Implement task-based learning activities where students work on specific tasks or projects.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- Incorporate formative and summative assessments to gauge student progress and provide targeted feedback.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices may be followed in the real environment as far as possible.
- In theory class period, use simulation tools to develop and execute the ladder logic for better understanding.

Assessment Methodology:

	Continuous Assessment(40marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Experiments/ 50% Experiments	Cycle II Experiments/ Another50% Experiments	All Units	All Experiments	All Experiments
Duration	2Periods	2Periods	3hours	3hours	3hours
Exam Marks	60	60	100	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	7^{th} Week	14^{th}Week	15^{th}Week	16^{th}Week	-

Note:

CA1 and CA2: All the exercises/experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the exam. The marks awarded will be converted to 10 Marks for each assessment test.

- Practical document (Hand written document / Notebook consists of Aim, Apparatus Required, Ladder Diagram, Interfacing circuit, Procedure and Result) should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise / experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

SCHEME OF EVALUATION – Practical Test

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Ladder Diagram	15
C	Connections / Interfacing	10
D	Execution and Output/Result	20
TOTAL		50
E	Practical Documents (As per the portions)	10
TOTAL		**60**

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 10 Marks for internal assessment. The question setting details are as follows.

	Description	Pattern	Marks
PART-A	30 Multiple Choice Questions (MCQ)	30 x 1 Mark	30
PART-B	7 Questions to be answered out of 10 Questions	7 x 10 Mark	70
TOTAL			**100**

CA 4: All the exercises/experiments should be completed and kept for the Model Practical Examination. The students shall be permitted to select any one by lot for the exam. The model practical examination should be conducted as per the End Semester Examination question pattern as given below. The marks awarded should beconverted to 10Marks for the internal assessment

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SCHEME OF EVALUATION

Model Practical and End Semester Examination- Practical Exam

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Ladder Diagram	20
C	Connections / Interfacing	20
D	Execution and Output/Result	25
E	MCQ from Theory Portions	20
F	Viva Voce	10
TOTAL		**100**

EEE5440 - PLC AND AUTOMATION

L	T	P	C
1	0	4	3

THEORY

Unit I	**INTRODUCTION TO PLC**	**[7Hrs]**
Automation – Components of Automation – Factory Automation and Process Automation – Advantages of Automation Block diagram of PLC – Principle of operation – PLC Scan – Advantages of PLC. Typical Discrete I/O field Devices – Sinking and Sourcing I/O modules Relay output module – Isolated output module - Criteria for selection of suitable PLC List of PLCs available in the market Develop ladder logic program using Relay type instructions - Introduction about Timer Instructions – ON Delay and OFF Delay Timer – Retentive Timer Instruction.		[2Hrs] [1Hr] [1Hr] [1Hr] [1Hr] [1Hr]
Practical Exercises:		
Ex.No	Name of the Experiment	
1.	PLC BASED DOL STARTER Sequence of Operation: Develop and Execute Ladder Logic in PLC for DOL Starter Operation with Single Phasing Prevention. Check the output by interfacing PLC with three phase Cage Induction Motor.	[5Hrs]
2	INTERFACING OF DISCRETE FIELD DEVICES WITH PLC Sequence of Operation: Develop Ladder Logic in PLC to execute the following logical relation between the input and output field devices. • Y = A + B + C + D • Y = A . B .C . D • Y = (A+B) . (C+D) • Y = (A.B) + (C.D) Interface Push Button (A), Limit Switch (B), Reed Switch (C) and 3 wireProximity Sensor (D) and Buzzer (Y) with PLC and check the output.	[5Hrs]
3	PLC BASED STAR DELTA STARTER Sequence of Operation: Develop and Execute Ladder Logic in PLC for Automatic Star- Delta Starter Operation. Check the output by interfacing PLC with three phase cage induction motor.	[5Hrs]

4	PLC BASED FORWARD AND REVERSE CONTROL OF INDUCTION MOTOR* <u>Sequence of Operation:</u> Develop and Execute Ladder Logic in PLC to control three phase induction motor in Forward and Reverse direction of Rotation. Interface external pilot lamp with PLC to indicate the direction of rotation. Check the output by interfacing PLC with three phase cage induction motor.	[5Hrs]
5	PLC BASED CONVEYOR SYSTEM WITH PRE WARNING SIREN <u>Sequence of Operation:</u> Develop and Execute Ladder Logic in PLC using an ON delay timer to delay the start of a conveyor. While press the START button, activate the Warning Siren for Pre-set Time. After the Pre-Set time delay the Warning siren turns OFF and the conveyor starts running. When STOP button is pressed turns OFF the conveyor.	[5Hrs]
6	PLC BASED WATER LEVEL CONTROL SYSTEM <u>Sequence of Operation:</u> Develop and Execute Ladder Logic in PLC to fill the empty tank with liquid when the START button is pressed. When liquid reaches the HIGH Level, turn OFF the Pump Motor and turn ON the Solenoid Valve to drain the liquid from tank. When liquid reaches the LOW Level, turn OFF the Solenoid Valve and turn ON the Pump Motor for refilling. Interface external pilot lamp with PLC to indicate the operation of Pump Motor and Solenoid Valve.	[5Hrs]
Theory Portion:		
Unit II	**COUNTERS, MATH & DATA COMPARE INSTRUCTIONS.**	**[3Hrs]**
Introduction about Counter Instructions – UP Counter – DOWN Counter – Applications of Counter Instructions Math Instructions - Data Compare Instructions Simple programs using above instructions.		[1Hr] [1Hr] [1Hr]
Ex.No	**Name of the Experiment**	
7	PLC BASED COUNTING OF MOVING OBJECTS ON A CONVEYOR <u>Sequence of Operation:</u> Develop and Execute ladder logic in PLC for counting the object moving in the conveyor. Interface manual START and STOP push buttons to operate the conveyor motor and Proximity sensor detect the object. Interface buzzer to give beep sound while sensor is detecting the product. When the pre-set value of count has reached turn OFF the conveyor automatically.	[5Hrs]

8	PLC BASED COUNTING OF MOVING OBJECTS ON TWO CONVEYORS <u>Sequence of Operation:</u> A manufacturing plant is arranged with 2 feeder conveyors for transferring the Objects into the plant. Develop and Execute Ladder Logic using math instruction in PLC to get the total number of objects transferred by 2 conveyors into the Plant. When the count of total object has reached pre-set count value, turn ON buzzer to give beep sound for 1 second and turn OFF the conveyors.	[5Hrs]
9	PLC BASED CAR PARKING CONTROL SYSTEM* <u>Sequence of Operation:</u> A parking lot allows 10 cars. Sensor 1 senses the incoming car at ENTRY Gate. Sensor 2 senses the outgoing car at the EXIT Gate. Develop and Execute ladder logic in PLC to count the number of cars parked and based on the parking slot available turn ON pilot lamps to Indicate FULL or AVAILABLE. Interface suitable proximity sensors with PLC.	[5Hrs]
10	PLC BASED FAN CONTROL FOR ENERGY CONSERVATION Develop and Execute a ladder logic in PLC to operate Fans in the Meeting Hall based on counting the number of persons entering into the Hall. Interface suitable types of sensor with PLC to sense the person entering into the hall through ENTRY Gate. Interface Low Voltage DC Fan with PLC to check the output. Assume the capacity of the Meeting Hall as 10 or something. • If less than 50% of the hall capacity is filled, turn ON Fan F1 & F2. • If 70 to 80% of the capacity is filled turn ON Fan F1 to F3. • If greater than or equal to 90% of capacity is filled turn ON F1 to F4.	[5Hrs]
Unit III	**ANALOG I/O MODULE& INDUSTRIAL NETWORK**	**[5Hrs]**

Analog Input Modules - Typical Analog Input field devices – Analog Output Modules - Typical analog output field devices.	[1Hr]
Block diagram of I/O bus networks - Serial communications	[1Hr]
Field bus Networks -Typical PROFIBUS architecture	[1Hr]
Typical MODBUS architecture - Typical Foundation field bus architecture	[1Hr]
Importance of HMI and SCADA in Automation - Typical SCADA system architecture.	[1Hr]

Practical exercises:

Ex.No	**Name of the Experiment**	
12.	PLC BASED ILLUMINATION CONTROL SYSTEM. Develop and Execute a ladder logic program for multilevel Illumination control system. When the potentiometer reaches 25% of its value, turn ON one Lamp in the output to get minimum illumination.	

	When the potentiometer reaches 50% of its value, turn ON two Lamps in the output to get medium illumination. When the potentiometer reaches 75% of its value, turn ON three Lamps in the output to get Maximum illumination.	[5Hrs]
TOTAL PERIODS		**75Hrs**

Suggested List of Students Activity:

- Activity 1 – PLC Based Mini Project: Four students can be grouped as a batch to do PLC based Mini project. Photograph Evidence to be maintained by faculty as record ofactivity.
- Activity 2 – Audio or Video Assignment: Ask the students to submit the recorded audio or video of his Technical Explanation or Demonstration on PLC and Automation related topics.
- Activity 3 – Industrial visit to Fully Automated Industry to observe the practical applications of PLC.
- Activity 4: PLC Based Round Table Liquid Filling System: Develop and Execute a ladder logic in PLC to control round table liquid filling system.
- Activity 5: PLC Based Temperature Control System: Develop ladder logic in PLC to control the heating element in the water tank to maintain the temperature between two predetermined limits.

Text Books

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Programmable Logic Controllers	Frank D. Petruzella	6th Edition, Indian Edition, McGraw Hill, 2023
2.	Technician's Guide to Programmable Logic Controllers	Richard A. Cox	Fourth Edition,Delmer Cengage Learning, 2013
3.	Introduction to Programmable Logic Controllers	Gary Dunning	Third Edition, Cengage Learning India Pvt Ltd, 2021.
4.	Automating Manufacturing Systems with PLCs	Hugh Jack,	Free Software Foundation, 2007.
5.	"Programmable Controllers Theory and Implementation," 2nd Edition	L. A. Bryan and E. A. Bryan	Industrial Text Company Publication, 1997

Web-based/Online Resources

S.No	Websites
1.	https://www.sanfoundry.com/100-plc-programming-examples/
2.	https://archive.nptel.ac.in/courses/108/105/108105062/
3.	https://www.youtube.com/watch?v=MS3qJq2jvu0
4.	https://www.youtube.com/watch?v=rqxoREpOjTU

List of Equipments Required for a Batch of 30 Students

S.No	Name of the Equipment's	Quantity Required
1.	PLC with Digital I/O Module	6 Nos
2.	PLC with Analog I/O Module	1 No
3.	PC (or) Laptop installed with PLC Programming Software	7 Nos
4.	DOL Starter Interfacing Kit	1 No
5.	Push Button, Limit Switch, Reed Switch, 3 Wire Proximity Sensor and Buzzer or Pilot Light	Each 1 No
6.	Star Delta Starter Interfacing Kit	1 No
7.	Forward and Reverse Control Interfacing Kit	1 No
8.	Conveyor Arrangement With Siren	1 No
9.	Water Tanks with Float Switch and Solenoid Valve	1 No
10.	Conveyor Arrangement With Proximity Sensor and Buzzer	2 Nos
11.	Car Parking Arrangement with two Sensors and Pilot Light	1 No
12.	Thru beam type Sensor (1No) & DC Fan (4Nos)	1 Set
13.	3 Floor Lift Interfacing Model	1 No
14.	Push Button, Buzzer, Pilot Lights and Connecting cables	As required

MODEL QUESTION PAPER

EEE5440 - PLC AND AUTOMATION

Duration: 3 Hours **Max. Marks: 100**

S.No	Experiments	CO	PO
1	Develop and Execute Ladder Logic in PLC for DOL Starter Operation with Single Phasing Prevention.	E5440.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
2	Develop Ladder Logic in PLC to execute the following logical relation between the input and output field devices: a) Y = A + B + C + D b) Y = A . B .C . D c) Y = (A+B) . (C+D) d) Y = (A.B) + (C.D).	E5440.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
3	Develop and Execute Ladder Logic in PLC for Automatic Star- Delta Starter Operation.	E5440.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7
4	Develop and Execute Ladder Logic in PLC to delay the start of a conveyor with pre-warning siren.	E5440.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7
5	Develop and Execute Ladder Logic in PLC for automatic Water Level Control System using pump motor and solenoid valve.	E5440.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7
6	Develop and Execute ladder logic in PLC for counting the object moving in the conveyor.	E5440.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7
7	Develop and Execute Ladder Logic in PLC to get the total number of objects transferred by two conveyors into the Plant.	E5440.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7
8	Develop and Execute a ladder logic in PLC to operate Fans in the Meeting Hall based on counting the number of persons entering into the Hall.	E5440.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7
9	Develop and Execute a ladder logic in PLC to control Lift/Elevator in three floor system.	E5440.3	PO1,PO2,PO3,PO4, PO5,PO6,PO7
10	Develop and Execute a ladder logic program for multilevel Illumination control system.	E5440.3	PO1,PO2,PO3,PO4, PO5,PO6,PO7

EEE5541- IOT AND APPLICATION

L	T	P	C
1	0	4	3

Programme Name : EEE

Course Code : EEE5541

Semester : V SEMESTER

Course Title : IOT AND APPLICATION

Course Type : PRACTICUM

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Iot and Application	5	75	40	100*	100	3Hrs

* Examinations will be conducted for 100 marks will be converted to 60 marks.

COURSE DESCRIPTION:

Internet of Things has emerged as an cutting-edge technology with applications in manufacturing, healthcare, Agriculture, transport, mining, smart cities and many more. This subject covers the fundamentals of IoT with its architecture, protocols and Applications. It also covers the overview and programming of the popular IoT platform Raspberry Pi.

COURSE OBJECTIVES:

The objective of this course is to enable the student to

- Learn the fundamental concepts of IoT.
- Learn the Raspberry PI platform that is widely used in IoT applications.
- Practice the Python Scripting Language which is used in many IoT devices.
- Implement web-based services on IoT devices.
- Interface various sensors with Raspberry Pi in IoT applications

COURSE OUTCOMES:

On successful completion of this course, the student will be able to	
E5541.1	Demonstrate the architecture and functioning of IoT systems.
E5541.2	Understand the Python Scripting Language which is used in IoT devices.
E5541.3	Understand the working and features of Raspberry Pi.
E5541.4	Build a prototype using Raspberry pi.
E5541.5	Design an IoT system to take the benefit of the Clouds for computing and storage.

Pre-requisites

- Sensors and Measurements
- Analog and Digital Electronics

- Programming in C
- Microcontroller and Embedded systems.

CO-PO & PSOs Mapping Matrix:

CO / PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E5541.1	3	3	3	3	3	3	3	3	3	3
E5541.2	3	3	3	3	3	3	3	3	3	3
E5541.3	3	3	3	3	3	3	3	3	3	3
E5541.4	3	3	3	3	3	3	3	3	3	3
E5541.5	3	3	3	3	3	3	3	3	3	3
Total	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**
Correlation Level	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- It is advised that teachers take steps to pique pupils' attention and boost their curiosity to learn.
- Implement task-based learning activities where students work on specific tasks or projects.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- Incorporate formative and summative assessments to gauge student progress and provide targeted feedback.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices may be followed in the real environment as faras possible.

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Ex. 1 to 5	Ex. 6 to 10	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 hours	3 hours	3 hours
Exam Marks	60	60	100	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the exam. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test
- Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

SCHEME OF EVALUATION – Practical Test

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Program / Circuit Diagram	15
C	Execution / Connections	10
D	Output/Result	20
TOTAL		50
E	Practical Documents (As per the portions)	10
TOTAL		**60**

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 10 Marks for internal assessment. The question setting details are as follows.

	Description	Pattern	Marks
PART-A	30 Multiple Choice Questions (MCQ)	30 x 1 Mark	30
PART-B	7 Questions to be answered out of 10 Questions	7 x 10 Mark	70
TOTAL			**100**

- **CA 4:** All the exercises/experiments should be completed and kept for the Model Practical Examination. The students shall be permitted to select any one by lot for the exam. The model practical examination should be conducted as per the End Semester Examination question pattern as given below. The marks awarded should be converted to 10 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical and End Semester Examination- Practical Exam

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Program / Circuit Diagram	20
C	Execution / Connections	20
D	Output/Result	25
E	MCQ from Theory Portions	20
F	Viva Voce	10
TOTAL		**100**

EEE5541- IOT AND APPLICATION

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THEORY

Unit I	**BASICS OF IoT & PYTHON**	**[7 Hrs]**
Application areas of IoT		[1Hr]
Characteristics of IoT		[1Hr]
Things in IoT - IoT stack – Enabling technologies		[1Hr]
IoT challenges - IoT levels - IoT and cyber physical system -IoT and WSN.		[1Hr]
Introduction to Python - Language features of Python		[1Hr]
Data types - Looping instructions		[1Hr]
Control of flow - functions - classes - Exception handling Python packages.		[1Hr]
Practical Exercises:		
Ex.No	**Name of the Experiment**	
1.	Write a simple Python program to display message on screen.	[6Hrs]
2.	Write a simple Python program using Logical operators.	[6Hrs]
3.	Write a simple Python program to demonstrate use of if else statement.	[6Hrs]
4.	Write a Python program to demonstrate use of ‘while’ loop.	[6Hrs]
5.	Write a Python program to demonstrate use of ‘for’ loop.	[6Hrs]
Theory Portion:		
Unit II	**IoT WITH RASPBERRY PI**	**[8Hrs]**
Raspberry Pi-Linux on Raspberry Pi-Raspberry Pi Interfaces-Programming		[1Hr]
Raspberry Pi with Python - Controlling LED/Buzzer with Raspberry		[1Hr]
Pi -Interfacing an LED and Switch with Raspberry Pi		[1Hr]
Interfacing a Light Sensor (LDR) with Raspberry Pi.		[1Hr]
Introduction to Cloud Storage models and communication APIs Webserver		[2Hrs]
Web server for IoT - Cloud for IoT		[1Hr]
IOT Case studies: smart cities, Industrial IOT.		[1Hr]
Practical Exercises:		
Ex.No	Name of the Experiment	
6.	Install an OS in Raspberry pi.	[6Hrs]
7.	Write a program to blink a LED using raspberry pi.	[6Hrs]
8.	Write and Execute a program for turning a LED ON, when the switch is pressed using raspberry pi.	[6Hrs]
9.	Write a program to control street light automatically using LDR and raspberry pi.	[6Hrs]
10.	Construct an IoT based Air pollution monitoring system.	[6Hrs]
	TOTAL PERIODS	**75 Hrs**

Suggested List of Students Activity:

- Activity 1: Students shall practice on their own “Arduino DIY Kits”.
- Activity 2: Mobile based Home automation (IOT) using Raspberry pi.
- Activity 3: Micro project that shall be an extension of any practical lab exercise to real- world application.

Text Books

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Programming the Raspberry Pi: Getting Started with Python	Simon Monk	McGraw Hill Professional, January 2012.
2.	Internet of Things (A Hands-on-Approach	Vijay Madisetti and Arshdeep Bahga	1stEdition,VPT, 2016.
3.	Internet of Things and its Applications	Daniel W. Hart	1st Edition,BPB, 2020.
4	“Raspberry Pi User Guide”, 4th edition	Eben Upton and Gareth Halfacree	John Wiley &Sons., August 2016.
5	“Learning Python with Raspberry Pi”,	Alex Bradbury and Ben Everard	John Wiley &Sons., Feb 2014.

Websites / Online Resources

S.NO	Wesites
1.	https://archive.nptel.ac.in/courses/106/105/106105166/
2.	https://www.raspberrypi.com/documentation/computers/getting-started.html
3.	https://projects.raspberrypi.org/en/collections/python
4.	https://projects.raspberrypi.org/en/projects/raspberry-pi-getting-started
5.	https://randomnerdtutorials.com/projects-raspberry-pi/

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

S.No	Name of the Equipment’s	Quantity Required
1.	Desktop Computer	30 Nos
2.	Raspberry Pi Kit with Accessories	6 Nos
3.	Switches, LDR, LEDs and Sensors	As required

MODEL QUESTION PAPER

EEE5541- IOT AND APPLICATION

Ex.No	Name of the Experiment	CO	PO
1	Write and Execute a simple Python program to display message on screen.	E5541.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
2	Write and Execute a simple Python program using Logical operators.	E5541.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
3	Write and Execute a simple Python program to demonstrate the use of if else statement.	E5541.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
4	Write and Execute a Python program to demonstrate the use of ‘while’ loop.	E5541.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
5	Write and Execute a Python program to demonstrate the use of ‘for’ loop.	E5541.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
6	Perform Installation of an OS in Raspberry pi.	E5541.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
7	Write and Execute a program to blink a LED using raspberry pi.	E5541.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
8	Write and Execute a program for turning a LED ON, when the switch is pressed using raspberry pi.	E5541.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7
9	Write and Execute a program to control street light automatically using LDR and raspberry pi.	E5541.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7
10	Construct an IoT based Air pollution monitoring system.	E5541.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7

EEE 5542- COMPUTER HARDWARE AND NETWORKING

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Programme Name : EEE

Course Code : EEE5542

Semester : V SEMESTER

Course Title : COMPUTER HARDWARE AND NETWORKING

Course Type : PRACTICUM

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Computer Hardware and Networking	5	75	40	100*	100	3Hrs

***** Examinations will be conducted for 100 marks will be converted to 60 marks.

COURSE DESCRIPTION:

Computer hardware and networking form the foundation of modern IT infrastructure, enabling businesses, organizations, and individuals to harness the power of computing technology for various purposes, including productivity, communication, entertainment, and research. Understanding both hardware and networking concepts are essential for anyone working in the field of information technology

COURSE OBJECTIVES

The objective of this course is to enable the student to

- Identify various Computer Hardware Components of PC
- Install various secondary storage devices with memory partition, formatting and enable to perform different cable crimping in a network.
- Know the various types of printer installation and perform TCP / IP Configuration.
- Install of Dual OS in a system and perform TCP/IP file transfer.
- Install and configure the networking devices.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to	
E5542.1	Install various secondary storage devices with memory partition and formatting.
E5542.2	Install optical storage devices like DVD & Blue Ray disc and perform different cable crimping in a network.
E5542.3	Install the printers and configure TCP / IP for network connectivity.
E5542.4	Assemble and disassemble laptop to identify the parts and install dual OS in a system.
E5542.5	Install and configure networking devices.

Pre-requisites

Basic knowledge of Computers.

CO-PO & PSOs Mapping Matrix:

CO / PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E5542.1	3	3	-	3	-	-	-	3	3	3
E5542.2	3	3	-	3	-	-	-	3	3	3
E5542.3	3	3	-	3	-	-	-	3	3	3
E5542.4	3	3	-	3	-	-	3	3	3	3
E5542.5	3	3	-	3	-	-	3	3	3	3
Total	**15**	**15**	**-**	**15**	**-**	**-**	**6**	**15**	**15**	**15**
Correlation Level	**3**	**3**	**-**	**3**	**-**	**-**	**1**	**3**	**3**	**3**

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Ex. 1 to 5	Ex. 6 to 10	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 hours	3 hours	3 hours
Exam Marks	60	60	100	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	-

- **CA1 and CA2**: All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the exam. The. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test.
- Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

SCHEME OF EVALUATION – Practical Test

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Procedure	15
C	Equipment handling & Execution	10
D	Output/Result	20
TOTAL		50
E	Practical Documents (As per the portions)	10
EXAM MARKS		**60**

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 10 Marks for internal assessment. The question setting details are as follows.

	Description	Pattern	Marks
PART-A	30 Multiple Choice Questions (MCQ)	30 x 1 Mark	30
PART-B	7 Questions to be answered out of 10 Questions	7 x 10 Mark	70
TOTAL MARKS			**100**

- **CA 4:** All the exercises/experiments should be completed and kept for the Model Practical Examination. The students shall be permitted to select any one by lot for the exam The model practical examination should be conducted as per the End Semester Examination question pattern as given below. The marks awarded should be converted to 10 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical and End Semester Examination- Practical Exam

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Procedure	20
C	Equipment handling & Execution	20
D	Output/Result	25
E	MCQ from Theory Portions	20
F	Viva Voce	10
TOTAL MARKS		**100**

EEE5542- COMPUTER HARDWARE AND NETWORKING

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1	0	4	3

Unit I	PC HARDWARE COMPONENTS	[8 Hrs]
Introduction: Parts - Mother board, sockets, expansion slots, memory, power supply, drives and front panel and rear panel connectors Hardware, Software and Firmware. Secondary storage: Hard disk – Working principle. Removable Storage: CD & DVD – reading & writing operations Working of DVD Reader / Writer - Blue-ray – Recording and Playback Principles. Cablings and Standards - Steps for Cable Crimping – Cable Tester. Printers: Introduction – Types of printers – Dot Matrix – Laser – Multi Function Printer- Operation – Features.		[1Hr] [1Hr] [1Hr [1Hr] [1Hr] [1Hr] [1Hr] [1Hr]
Practical Exercises:		
Ex.No	**Name of the Experiment**	
1.	Identification of system layout (Study Exercise) a) Front panel indicators & switches and front side & rear side connectors. b) Familiarize the computer system Layout: Marking positions of SMPS, Motherboard, HDD, DVD and add on cards. c) Configure bios setup program and troubleshoot the typical problems using BIOS utility.	[5Hrs]
2.	Hard Disk a) Install Hard Disk. b) Configure CMOS-Setup. c) Partition and Format Hard Disk. d) Identify Master /Slave / IDE Devices. e) Practice with scan disk, disk clean up, disk De-fragmentation, Virus Detecting and Rectifying Software.	[5Hrs]
3.	a) Install and Configure a DVD Writer & Blue-ray Disc Writer. b) Recording a Blank DVD & Blue-ray Disc	[5Hrs]

4.	Do the following cabling works in a network a) Cable Crimpling b) Standard Cabling c) Cross Cabling d) I/O Connector Crimping e) Testing the Crimped cable using a Cable tester.	[5Hrs]
5.	Printer Installation: a) Install and configure Dot matrix printer b) Install and configure Laser printer.	[5Hrs]
Theory Portion:		
Unit II	**NETWORKING**	**[7 Hrs]**
IP Addressing - Dotted Decimal Notation – IP configuration Commands. Displays and Graphic Cards: Panel Displays– Principles of LED, LCD and TFT Displays - SVGA Port signals – common problems and solutions. I/O Ports: Serial – Parallel – USB - Game Port - Bluetooth interface - IR connector -fire ware. Application Layer Protocols – File Transfer Protocol File Transfer Steps in LAN –Sharing Printer in LAN. Network devices: Features and Concepts of Switches – Routers – Gateways.		[1Hr] [1Hr] [1Hr] [1Hr] [1Hr] [1Hr] [1Hr]
Practical Exercises:		
Ex.No	**Name of the Experiment**	
6.	a) Configure Host IP, Subnet Mask and Default Gateway in a system inLAN (TCP/IP Configuration). b) Configure Internet connection and use IPCONFIG, PING / Tracert and Net stat utilities to debug the Network issues.	[5Hrs]
7.	Assemble a system with add on cards and check the working condition Of the system and install Dual OS.	[5Hrs]
8.	Transfer files between systems in LAN using FTP Configuration. Install a printer in LAN and share it in the network.	[5Hrs]
9.	Install and configure Network Devices: HUB, Switch and Routers.	[3Hrs]
10.	Install and Configure Wired and Wireless NIC and transfer files between systems.	[5Hrs]
	Required Practical Instructions for Cycle I & II Experiments	[10Hrs]
	TOTAL PERIODS	**75Hrs**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments basedon the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.

Text Books

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Data communication and Networking	Behrouz A. Forouzan	Fourth Edition, Mc. GrawHill Higher Education, 2007
2.	Network Security Essentials: Applications and Standards	William Stallings	Pearson Publications (Prentice Hall), 2011.
3.	Cryptography and Network Security: Principles and Practice	William Stallings	Pearson Publications, 2016
4.	Cyptography and Network Security	Behrouz A.Forouzan	Special Indian Edition, Tata McGraw-Hill, 2007.
5.	Computer Networks	Andrew S.Tanenbaum, David J. Wetherall	Fifth Edition, Pearson Publications, 2013

Websites / Online Resource

S.NO	Wesites
1.	http://nptel.ac.in/.
2.	Vlabs: http://cse29-iiith.vlabs.ac.in/
3.	https://dgt.gov.in/sites/default/files/CHNM_CTS2.0_NSQF-3.pdf

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

S.No	Name of the Equipment's	Quantity Required
1.	Desktop Systems	30 Nos
2.	Hard disk drive	6 Nos
3.	DVD, Blu-ray Drive	6 Nos
4.	Blank DVD , Blu-ray Disc	6 Nos
5.	Head Cleaning CD	1 No
6.	Network Cables	50 Mtrs
7.	Crimping Tool & Screw Driver Set	Each 06 Nos
8.	RJ 45 Jack	1 Box
9.	Dot matrix Printer and Laser Printer	Each 1 No
10.	Add on card	6 Nos
11.	Crimping Tool & Screw Driver Set	Each 06 Nos
12.	Switch, Hub and Router	Each 01 No
13.	NIC Card	1 No
14.	Windows / Linux OS Software	-
15.	DVD and Blue Ray Burning S/W	-

MODEL QUESTION PAPER

EEE5542- COMPUTER HARDWARE AND NETWORKING

Ex.No	Name of the Experiment	CO	PO
1	Perform following activity on Hard Disk a. Install Hard Disk. b. Configure CMOS-Setup. c. Partition and Format Hard Disk. d. Identify Master /Slave / IDE Devices. e. Practice with scan disk, disk cleanup, disk De-fragmentation, Virus Detecting andRectifying Software	E5542.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
2	a. Install and Configure a DVD Writer & Blu-ray Disc Writer. b. Recording a Blank DVD & Blu-ray Disc.	E5542.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
3	Do the following cabling works in a network a) Cable Crimpling b) Standard Cabling c) Cross Cabling d) I/O Connector Crimping e) Testing the Crimped cable using a Cable tester.	E5542.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
4	Install and configure Dot matrix printer and Laser printer.	E5542.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
5	a) Configure Host IP, Subnet Mask and Default Gateway in a system in LAN (TCP/IPConfiguration). b) Configure Internet connection and use IPCONFIG, PING / Tracert and Netstat utilities to debug the Network issues.	E5542.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
6	Assemble a system with add on cards and check the working condition of the system and install Dual OS.	E5542.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
7	Transfer files between systems in LAN using FTP Configuration. Install a printer in LAN and share. it in the network	E5542.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
8	Install and configure Network Devices: HUB, Switch and Routers.	E5542.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7
9	Install and Configure Wired and Wireless NIC and transfer files between systems.	E5542.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7

EEE5543- CONTROL OF ELECTRICAL MACHINES

L	T	P	C
1	0	4	3

Programme Name : EEE

Course Code : EEE5543

Semester : V SEMESTER

Course Title : CONTROL OF ELECTRICAL MACHINES

Course Type : PRACTICUM

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Control of Electrical Machines	5	75	40	100*	100	3Hrs

* Examinations will be conducted for 100 marks will be converted to 60 marks.

COURSE DESCRIPTION:

Electrical control of motors and other machinery started with the advent of relays, timers and contactors. The study of relay logic becomes essential for an electrical engineer in order to gain proficiency in the design of control logic. Here construction and working of different types of components and Starters for different types of ac motors are included in this syllabus. The main highlight and interesting part of this course is the explanation of a large number of typical control circuits used in industry. It is hoped that a careful study of these circuits will generate confidence in the students and enhance their confidence in handling such control circuitry employed in industry.

COURSE OBJECTIVES :

The objective of this course is to enable the student to

- Describe the operation of switches, relays, contactor and timers.
- Describe the operation of control and main circuit of AC Motor Starters.
- Understand the concept/principle of various motor controls.
- Understand the operation of motor controls such as two speed control, Forward-Reverse control, Jogging and Dynamic Braking of AC Motor.
- Understand the schematic diagram and design Industrial control circuits

COURSE OUTCOMES:

On successful completion of this course, the student will be able to	
E5543.1	Familiarize control circuit elements such as industrial switches, relays, timers, Contactors, and interlocking arrangements.
E5543.2	Develop and Execute control and main circuit of DOL starter and star delta starter for cage induction motor.
E5543.3	Understand the control and main circuit of Rotor Resistance Starter.
E5543.4	Develop and execute the control and power circuit for Two Speed Control, Forward-Reverse Control, Jogging and Dynamic Braking of ac motor.
E5543.5	Design the industrial control circuits based on the schematic diagram.

Pre-requisites

- Electrical Machines - I
- Electrical Machines -II.

CO-PO & PSOs Mapping Matrix:

CO / PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E5543.1	3	3	3	3	3	3	3	3	3	3
E5543.2	3	3	3	3	3	3	3	3	3	3
E5543.3	3	3	3	3	3	3	3	3	3	3
E5543.4	3	3	3	3	3	3	3	3	3	3
E5543.5	3	3	3	3	3	3	3	3	3	3
Total	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**
Correlation Level	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- It is advised that teachers take steps to pique pupils' attention and boost their curiosity to learn.
- Implement task-based learning activities where students work on specific tasks or projects.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- Incorporate formative and summative assessments to gauge student progress and provide targeted feedback.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices may be followed in the real environment as far as possible.

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Ex. 1 to 5	Ex. 6 to 10	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 hours	3 hours	3 hours
Exam Marks	60	60	100	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	-

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the exam. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test.
- Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

SCHEME OF EVALUATION – Practical Test

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Circuit Diagram	15
C	Connection (Control & Main Circuit)	10
D	Execution and Output/Result	20
TOTAL		50
E	Practical Documents (As per the portions)	10
EXAM MARKS		**60**

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 10 Marks for internal assessment. The question setting details are as follows.

	Description	Pattern	Marks
PART-A	30 Multiple Choice Questions (MCQ)	30 x 1 Mark	30
PART-B	7 Questions to be answered out of 10 Questions	7 x 10 Mark	70
TOTAL MARKS			**100**

- **CA 4:** All the exercises/experiments should be completed and kept for the Model Practical Examination. The students shall be permitted to select any one by lot for the exam. The model practical examination should be conducted as per the End Semester Examination question pattern as given below. The marks awarded should be converted to 10 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical and End Semester Examination- Practical Exam

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Circuit Diagram	20
C	Connections (Control & Main Circuit)	20
D	Execution and Output/Result	25
E	MCQ from Theory Portions	20
F	Viva Voce	10
TOTAL		**100**

EEE5543- CONTROL OF ELECTRICAL MACHINES

L	T	P	C
1	0	4	3

THEORY:

Unit I	**COMPONENETS OF CONTROL CIRCUIT**	**[7Hrs]**
Switches – Push button and proximity switch - Relays – Frequency response relay Phase failure relay (single phasing preventer) - Over current relay Bimetallic thermal over load relay and Magnetic dash pot oil filled relay Timer – Pneumatic and Electronic timer - Solenoid type contactor (Air break contactor) - Solid state relay Simple ON-OFF motor control circuit Remote control Operation and interlocking of drives - Concept and operation of DOL starter and Semi-Automatic and Automatic Star-delta starters.		[1Hr] [1Hr] [1Hr] [1Hr] [1Hr] [1Hr] [1Hr]
Practical Exercises:		
Ex.No	**Name of the Experiment**	
1.	Wire and test the control and main circuit for DOL starter with OLR.	[6Hrs]
2.	Wire and test the control and main circuit for conveyor motor with detection of metal object stop the conveyor motor for 5 seconds (use proximity sensor and timer).	[6Hrs]
3.	Wire and test the working of single-phasing preventer with control and main circuit.	[6Hrs]
4.	Wire and test the control and main circuit for semi-automatic star – delta starter.	[6Hrs]
5.	Wire and test the control and main circuit for automatic star – delta starter.	[6Hrs]
Theory Portion:		
Unit II	**MOTOR CONTROL CIRCUITS**	**[8Hrs]**
Concept and working /operation of forward and reverse, Jogging, Dynamic braking of cage induction motor Automatic Rotor Resistance Starting of Slip Ring Induction Motor. Design of control circuit: Planner Machine Skip hoist control - Conveyor system Automatic water level control.		[1Hr] [1Hr] [2Hrs] [1Hr] [1Hr] [2Hrs]
Practical Exercises:		
Ex. No	Name of the Experiment	
6.	Wire and test the control and main circuit for two speed pole changing motor.	[6Hrs]
7.	Wire and test the control and main circuit for forward and reverse operation.	[6Hrs]

8.	Wire and test the control and main circuit for jogging in cage induction motor.	[6Hrs]
9.	Wire and test the control and main circuit for dynamic braking of cage motor.	[6Hrs]
10.	Wire and test the control and main circuit for automatic rotor resistance starter.	[6Hrs]
	TOTAL PERIODS	**75Hrs**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based onthe course.
- Periodic class quizzes to be conducted on a weekly/fortnightly based on the course.
- Micro project that shall be an extension of any practical lab exercise to real-world application.

Text book:

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Control of Electrical Machines, Revised Second Edition	S.K. Bhattacharya, Brijinder Singh,	New Age International Publishers, 2003
2.	Motor Control Fundamentals, First Edition,	Steve Senty,	Delmar Cengage Learning,2013.
3.	Electric Motor Control 10th Edition	Stephen L. Herman	Delmar Cengage Learning,2014.

Web-based/Online Resources

S.No	Websites
1.	https://www.youtube.com/watch diploma dote e - lectures

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

S.No	Name of the Equipment's	Quantity Required
1.	AC Contactor 230V/440V, 16A	20 Nos
2.	Push Button With NO/NC Elements	24 Nos
3.	Three Phase Cage Induction Motor (any HP)	5 Nos
4.	Three Phase Slip Ring Induction Motor (any HP)	1 No
5.	Three Phase Two Winding Induction Motor (2 set of Poles)	1 No
6.	Proximity Sensor	1 No
7.	Single Phasing Preventer	1 No
8.	ON Delay Timer	5 Nos
9.	Electronic Timer with Instantaneous and time delay contact	1 No
10.	Multimeter	5 Nos

MODEL QUESTION PAPER

EEE5543- CONTROL OF ELECTRICAL MACHINES

Ex.No	Name of the Experiment	CO	PO
1	Wire and test the control and main circuit for DOL starter with OLR.	E5543.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
2	Wire and test the control and main circuit for conveyor motor with detection of metal object stop the conveyor motor for 5 seconds (use proximity sensor and timer).	E5543.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
3	Wire and test the working of single-phasing preventer with control and main circuit.	E5543.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
4	Wire and test the control and main circuit for semi-automatic star – delta starter.	5543.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
5	Wire and test the control and main circuit for automatic star – delta starter.	E5543.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
6	Wire and test the control and main circuit for two speed pole changing motor.	E5543.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
7	Wire and test the control and main circuit for forward and reverse operation.	E5543.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
8	Wire and test the control and main circuit for jogging in cage induction motor.	E5543.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7
9	Wire and test the control and main circuit for dynamic braking of cage motor.	E5543.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7
10	Wire and test the control and main circuit for automatic rotor resistance starter.	E5543.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7

EEE5544- AUTO MECHATRONICS

Programme Name : EEE

Course Code : EEE5544

Semester : V SEMESTER

Course Title : AUTO MECHATRONICS

Course Type : PRACTICUM

L	T	P	C
1	0	4	3

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Auto Mechatronics	5	75	40	100*	100	3Hrs

*** Examinations will be conducted for 100 marks will be converted to 60 marks.**

COURSE DESCRIPTION:

The Autotronics is referred to as modern automotive technology and also commonly known as Automotive Mechatronics. Autotronics is the combination of automobile and electronics while hybrid refers to technology that uses two or more distinct power sources to move the vehicle. Electronic components and circuits are used to control and monitor the mechanical aspects of a system.

COURSE OBJECTIVES

The objective of this course is to enable the student to

- Learn the concept of automated drive technology.
- Explain the importance of alternate energy sources.
- Practice in developing prototype of automobile with alternate energy sources.
- Explain the advanced charging and starting, ignition and fuel injection in automobiles.
- Demonstrate the vehicle safety, comfort and Automatic Climate Control in automobiles

COURSE OUTCOMES:

On successful completion of this course, the student will be able to	
E5544.1	Understand the operation of sensors and electrical systems in vehicle.
E5544.2	Understand automated driving technology.
E5544.3	Prepare prototype of solar and wind powered vehicles.
E5544.4	Describe advanced charging and Electronic fuel ignition in Automobile.
E5544.5	Understand the vehicle safety and automatic climate control in automobiles through technology.

Pre-requisites

- Basics of Electrical and Electronics
- Sensors
- Digital Skills

CO-PO & PSOs Mapping Matrix:

CO / PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E5544.1	3	3	3	3	3	3	3	3	3	3
E5544.2	3	3	3	3	3	3	3	3	3	3
E5541.3	3	3	3	3	3	3	3	3	3	3
E5541.4	3	3	3	3	3	3	3	3	3	3
E5541.5	3	3	3	3	3	3	3	3	3	3
Total	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**
Correlation Level	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle 1 Exercises	Cycle 2 Exercises	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 hours	3 hours	3 hours
Exam Marks	60	60	100	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the exam. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test.
- Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

SCHEME OF EVALUATION – Practical Test

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Diagram and/or Procedure	15
C	Handling of Components	10
D	Execution and Output/Result	20
TOTAL		50
E	Practical Documents (As per the portions)	10
TOTAL		**60**

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 10 Marks for internal assessment. The question setting details are as follows.

	Description	Pattern	Marks
PART-A	30 Multiple Choice Questions (MCQ)	30 x 1 Mark	30
PART-B	7 Questions to be answered out of 10 Questions	7 x 10 Mark	70
TOTAL MARKS			**100**

- **CA 4:** All the exercises/experiments should be completed and kept for the Model Practical Examination. The students shall be permitted to select any one by lot for the exam. The model practical examination should be conducted as per the End Semester Examination question pattern as given below. The marks awarded should be converted to 10 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical and End Semester Examination- Practical Exam

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Diagram and/or Procedure	20
C	Handling of Components	20
D	Execution and Output/Result	25
E	MCQ from Theory Portions	20
F	Viva Voce	10
TOTAL		**100**

EEE5544- AUTO MECHATRONICS

L	T	P	C
1	0	4	3

THEORY:

Unit I	**INTRODUCTION TO AUTOMATED DRIVING TECHNOLOGIES**	[3Hrs]
The road to autonomy Sensor Positioning Automated Driving System – Mapping.		[1Hr] [1Hr] [1Hr]
Practical exercises:		
Ex.No	**Name of the Experiment**	
1.	Online Case studies from Nvidia – Bosch - Google (Waymo) - Tesla Autopilot – Audi - Jaguar Land Rover - Toyota Guardian – FLIR - First sensor AG.	[8Hrs]
Theory Portion :		
Unit II	**ALTERNATE ENERGY SOURCES**	[3Hrs]
Overview of Alternate Energy sources in India – Energy and Environment Overview Importance of Alternate Energy sources.		[1Hr] [1Hr] [1Hr]
Practical Exercises:		
Ex.No	**Name of the Experiment**	
2.	Create a prototype of Solar powered vehicle.	[14Hrs]
3.	Create a prototype of Wind powered vehicle.	
Theory Portion :		
Unit III	**ADVANCED CHARGING AND STARTING, IGNITION AND FUEL INJECTION**	**[4Hrs]**
Ex.No	**Name of the Experiment**	
4.	Demonstrate fast charging in an electric vehicle.	[16Hrs]
5.	Dismantling, trouble shooting and assembling of electronic starter motor.	
6.	Trace the automobile electrical system with respect to electronic ignition System.	
7.	Removing, servicing and replacing electronic control of diesel injection.	
Theory Portion :		
Unit IV	**VEHICLE SAFETY AND COMFORT**	[2Hrs]
Anti-lock brakes - Automatic transmission Central locking and child locking.		[1Hr] [1Hr]
Practical exercises:		

Ex.No	Name of the Experiment	
8.	Demonstrate the working of Antilock braking system.	[12Hrs]
9.	Verify the functionality of individual door lock actuators	
10.	Online Study of the Automatic transmission's shifting behavior under Various driving conditions.	
Theory Portion :		
Unit V	**AUTOMATIC CLIMATE CONTROL IN CAR**	**[3Hrs]**
Automatic Climate Control in Car- difference between Air conditioning		[1Hr]
automatic climate control-Saving fuel		[1Hr]
Role of sensor in climate control		[1Hr]
Importance of Recirculation mode in summer.		[1Hr]
Practical Exercises:		
Ex.No	**Name of the Experiment**	
11.	Online case studies of climate control in different manufacturers	[10Hrs]
12.	Dismantle existing AC unit and replace climate control unit in a car and note down the changes in performance.	
TOTAL PERIODS		**75Hrs**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments basedon the course
- Periodic class quizzes conducted on a weekly/fortnightly based on the course
- Viva Voce will be conducted before conducting an experiment.

Text Book:

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Automotive Mechatronics Automotive Networking Driving StabilitySystems,	Konrad Reif,	springer
2.	Automotive Mechatronics: Operational and Practical Issues volume1	B.T. Fijalkowski	springer
3.	Automated Driving and Driver Assistance Systems, 1st Edition, Routledge,	Tom Denton	1st Edition,Routledge, Taylor & Francis Group, UK, 2020.
4.	Alternative Fuels and Advanced Vehicle Technologies for ImprovedEnvironmental Performance	Richard Folkson	Woodhead Publishing Ltd, 2014.

Web-based/Online Resources

S.No	Websites
1.	https://www.tesla.com/support/autopilot

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

S.No	Name of the Equipment's	Quantity Required
1.	12V Solar Cell	2 Nos
2.	12 V Battery	2 Nos
3.	Multimeter	5 Nos
4.	Prototype Wind Mill	1 No
5.	Fast Charging Kit	1 No
6.	Electronic Starter Motor	1 No
7.	Electronic Ignition Kit	1 No
8.	Electronic control of diesel injection kit	1 No
9.	Antilock Braking kit	1 No
10.	Power door lock actuator	1 No
11.	Automatic climate control kit for car	1 No

MODEL QUESTION PAPER

EEE5544- AUTO MECHTRONICS

Duration : 3Hrs **Max Marks :100**

Ex.No	Name of the Experiment	CO	PO
1	Create a prototype of Solar powered vehicle.	E5544.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
2	Create a prototype of Wind powered vehicle.	E5544.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
3	Demonstrate fast charging in an electric vehicle.	E5544.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
4	Dismantling, trouble shooting and assembling of electronic starter motor.	E5544.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
5	Trace the automobile electrical system with respect to electronic ignition System.	E5544.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
6	Removing, servicing and replacing electronic control of diesel injection.	E5544.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
7	Demonstrate the working of Antilock braking system.	E5544.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
8	Online Study of the Automatic transmission's shifting behavior under Various driving conditions.	E5544.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7
9	Verify the functionality of individual door lock actuators	E5544.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7
10	Dismantle existing AC unit and replace climate control unit in a car and note down the changes in performance.	E5544.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7

EEE5545- MECHANICAL ENGINEERING

L	T	P	C
1	0	4	3

Programme Name : EEE

Course Code : EEE5545

Semester : V SEMESTER

Course Title : MECHANICAL ENGINEERING

Course Type : PRACTICUM

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Mechanical Engineering	5	75	40	100*	100	3Hrs

* Examinations will be conducted for 100 marks will be converted to 60 marks.

COURSE DESCRIPTION:

Technically, mechanical engineering is the application of the principles and problem-solving techniques of engineering from design to manufacturing to the marketplace for any object. Being ingrained in many challenges and innovations across many fields means a mechanical engineering education is versatile. In this course the students will have fundamental understanding of the Laws of thermodynamics, pressure and temperature measurement, thermal machines, sources of energy, power transmitting elements, various manufacturing processes and engineering materials

COURSE OBJECTIVES

The objective of this course is to enable the student to

- Impart knowledge of General Principles of Mechanical Engineering.
- Understand the laws of thermodynamics and Thermodynamic Processes.
- Learn the working Principles of Thermal Machines and Power Plants
- Learn the working Principles of Power Transmitting Devices.
- Learn the Manufacturing Processes and Engineering Materials.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to	
E5545.1	Understand the fundamental concept of Thermodynamics.
E5545.2	Understand the Law of Thermodynamics.
E5545.3	Describe the working of Thermal Machines and Power Plants.
E5545.4	Understand the principle of Power Transmitting Elements.
E5545.5	Understand various Manufacturing Processes and Engineering Materials.

Pre-requisites

- Knowledge of science and Engineering

CO-PO & PSOs Mapping Matrix:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E5545.1	3	3	3	3	3	3	3	3	3	3
E5545.2	3	3	3	3	3	3	3	3	3	3
E5545.3	3	3	3	3	3	3	3	3	3	3
E5545.4	3	3	3	3	3	3	3	3	3	3
E5545.5	3	3	3	3	3	3	3	3	3	3
Total	15	15	15	15	15	15	15	15	15	15
Correlation Level	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Ex. 1 to 5	Ex. 6 to 10	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 hours	3 hours	3 hours
Exam Marks	60	60	100	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	-

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the exam. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test.
- Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

SCHEME OF EVALUATION – Practical Test

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Diagram	15
C	Execution	10
D	Output/Result	20
TOTAL		50
E	Practical Documents (As per the portions)	10
TOTAL		**60**

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 10 Marks for internal assessment. The question setting details are as follows.

	Description	Pattern	Marks
PART-A	30 Multiple Choice Questions (MCQ)	30 x 1 Mark	30
PART-B	7 Questions to be answered out of 10 Questions	7 x 10 Mark	70
TOTAL			**100**

- **CA 4:** All the exercises/experiments should be completed and kept for the Model Practical Examination. The students shall be permitted to select any one by lot for the exam. The model practical examination should be conducted as per the End Semester Examination question pattern as given below. The marks awarded should be converted to 10 Marks for the internal assessment

SCHEME OF EVALUATION
Model Practical and End Semester Examination- Practical Exam

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Diagram	20
C	Execution	20
D	Output/Result	25
E	MCQ from Theory Portions	20
F	Viva Voce	10
TOTAL		**100**

EEE5545- MECHANICAL ENGINEERING

L	T	P	C
1	0	4	3

THEORY:

Unit I	**FUNDAMENTALS OF THERMODYNAMICS**	[3Hrs]
Fundamentals of Thermodynamics, Pressure and Pressure Measurement, Temperature, Zeroth law of Thermodynamics, Thermometric scale, Forms of Energy, Work Transfer, P-dV work, Heat Transfer, Concept of Specific Heat, Sensible Heat, Latent Heat.		[1Hr] [1Hr] [1Hr]
Unit II	**FIRST LAW OF THERMODYNAMICS**	[3Hrs]
First law of Thermodynamics: Law of Conservation of Energy, Joule's experiment, First law for Cyclic and Non-Cyclic processes, Concept of Internal Energy, Enthalpy, Ideal Gases– Concept of Constant Pressure, Constant Volume, Constant Temperature, Adiabatic, Polytropic, Throttling Processes and their representation on p-V and T-s diagrams, Engineering applications of various processes.		[1Hr] [1Hr] [1Hr]
Unit III	**INTRODUCTION TO THERMAL MACHINES**	[3Hrs]
Introduction to Thermal Machines & Sources of Energy: Working principles and application of - Internal Combustion Engines – (2-stroke and 4- stroke engines), Turbines, Compressor, Refrigerator (Description with block diagrams).		[1Hr] [1Hr] [1Hr]
Unit IV	**POWER TRANSMITTING ELEMENTS**	[3Hrs]
Power Transmitting Elements: Working principles and application of – Shaft, Axle and Spindles. Couplings- types of couplings, Friction Clutches, Bearings, Brakes- types of Brakes, Drives – Belt, Chain drives construction, Gears- Classification of Gears.		[1Hr] [1Hr] [1Hr]

Unit V	**MANUFACTURING PROCESSES AND ENGINEERING MATERIALS**	
Manufacturing Processes and Engineering Materials: Working principles and applications of – Casting, Forging, Welding, Brazing and Soldering. Machining Processes - Turning, Shaping, Milling, Drilling and Grinding, Introduction to Engineering Materials - Ferrous and Non Ferrous.		[1Hr] [1Hr] [1Hr]
Ex.No	**Name of the Experiment**	
1.	Study and identification of IC engine components.	
2.	Study and identification of components of Refrigerator.	
3.	Test on OLP, current coil relay and PTC relay of a refrigeration system.	

4.	Study and Demonstration of working of Brakes, Clutch and Couplings.	[60Hr]
5.	Determination of air flow velocity using anemometer.	
6.	Lathe: Plain Turning	
7.	Lathe: Drilling and Thread Cutting.	
8.	Plain turning using CNC Machines.	
9.	Arc Welding: Lap Joint and Butt Joint	
10.	Arc Welding: Butt Joint	
TOTAL PERIODS		**75Hrs**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

Text Book:

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Thermal Engineering (Engineering Thermodynamics & EnergyConversion Techniques),	Prof. B.L. Ballaney	Khanna Publishers
2.	, A Textbook of Engineering Thermodynamics, Second Edition,	R.K. Rajput,	LaxmiPublications Pvt Ltd,. Reprint 2003.
3.	Elements of Work ShopTechnology – Volume I and II,	S.K. Hajra Choudhary, A.K. Hajra Choudhary, Nirjhar Roy,	Media Promoters & publishers
4.	Design of Machine Elements, Fourth Edition	V.B. Bhandari,	Tata-McGraw Hill Publications, 2017.

Web-based/Online Resources

S. No	Websites
1.	https://phys.libretexts.org/Courses/University_of_California_Davis/UCD%3A_Physics_9B_Waves_Sound_Optics_Thermodynamics_and_Fluids/05%3A_Fundamentals_of_Thermodynamics.
2.	https://www.sources#:~:text=Primary%20energy%20sources%20take%20many,%2C%20solar%2C%20geothermal%20and%20hydropower.

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

S.No	Name of the Equipment's	Quantity Required
1.	I.C. Engines	1 No
2.	Refrigerator	1 No
3.	Brakes, Clutch, Couplings, Bearings and Gears	Each 3 Nos
4.	Lathe Machines	1 No
5.	Drilling and Threading Machine	1 No
6.	CNC Machine.	1 No
7.	Welding Set	1 No
8.	Anemometer	1 No
9.	OLP, Current coil relay and PTC relay	Each 1 No

MODEL QUESTION PAPER

EEE5545- MECHANICAL ENGINEERING

Duration : 3Hrs **Max Marks :100**

Ex.No	Name of the Experiment	CO	PO
1	Identify and label the major components of an internal combustion engine provided in the practical setup and Describe the function of each identified component.	E5545.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
2	Identify and label the key components of a refrigerator provided in the practical setup and Explain the function of each component and its contribution to the refrigeration cycle.	E5545.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
3	Perform tests on the Overload Protector (OLP), Current Coil Relay, and Positive Temperature Coefficient (PTC) Relay as per the provided instructions and Interpret the test results.	E5545.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
4	Demonstrate the working principles of brakes, clutch, and couplings using the provided setups and Explain the operation of each component and discuss its role in power transmission or control in mechanical systems.	E5545.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
5	Use the anemometer to measure the air flow velocity at specified locations and record the measurements accurately and calculate the average air flow velocity.	E5545.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
6	Perform plain turning on a workpiece using a lathe machine. And Ensure precision in the turning process and achieve the specified dimensions of the workpiece.	E5545.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
7	Drill holes of specified diameters in the workpiece using the lathe machine.Perform thread cutting operations on the workpiece as per the provided specifications.	E5545.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
8	Operate the CNC machine to perform plain turning on a work piece. Program the CNC machine to achieve the desired dimensions and surface finish of the work piece.	E5545.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7
9	Perform arc welding to create lap joints and butt joints as per the provided instructions and Ensure proper fusion and weld quality in the joints.	E5545.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7
10	Perform arc welding to create butt joints with specified welding parameters and Inspect the welded joints for defects and ensure weld integrity.	E5545.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7

EEE5546- ESTIMATION, STANDARDS AND REGULATIONS

L	T	P	C
1	0	4	3

Programme Name : EEE

Course Code : EEE5546

Semester : V SEMESTER

Course Title : ESTIMATION, STANDARDS AND REGULATIONS

Course Type : PRACTICUM

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Estimation, Standards And Regulations	5	75	40	100*	100	3Hrs

***** Examinations will be conducted for 100 marks will be converted to 60 marks.

COURSE DESCRIPTION:

In most countries, electrical installations shall comply with more than one set of regulations, issued by National Authorities or by recognized private bodies. It is essential to take into account these local constraints before starting the design. The purpose of these Regulations is to provide guidelines and technical standards that promote the installation of safe and efficient systems of wiring in buildings and other Premises. In estimating, calculation of quantity of material is estimated by the estimator. This course is meant for learning the estimation process by the final semester students.

COURSE OBJECTIVES

The objective of this course is to enable the student to

- Understand regulations involved in Indian Electricity ACT.
- Familiarize to do the plan lay out using electrical symbols.
- Write down the detailed specification and numbers required of different materials.
- Select size of conductor and prepare list of materials required.
- Understand the electrical safety measures and guidelines.

COURSE OUTCOMES

On successful completion of this course, the student will be able to	
E5546.1	Involved in Explain the regulations Indian Electricity ACT.
E5546.2	Prepare the electrical pipe layout for domestic, commercial and industrial building.
E5546.3	Estimate the quantity of Electrical materials required for various types of internal wiring.
E5546.4	Get familiar about the determination of the size and material of conductor and cable from electrical and mechanical consideration.
E5546.5	Familiarize electrical safety measures and guidelines.

Pre-requisites

Knowledge of Electrical Engineering.

CO-PO & PSOs Mapping Matrix:

CO / PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E5546.1	3	3	3	3	3	3	3	3	3	3
E5546.2	3	3	3	3	3	3	3	3	3	3
E5546.3	3	3	3	3	3	3	3	3	3	3
E5546.4	3	3	3	3	3	3	3	3	3	3
E5546.5	3	3	3	3	3	3	3	3	3	3
Total	15	15	15	15	15	15	15	15	15	15
Correlation Level	3	3	3	3	3	3	3	3	3	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Ex. 1 to 6	Ex. 7 to 12	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 hours	3 hours	3 hours
Exam Marks	60	60	100	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the exam. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test
- Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

SCHEME OF EVALUATION – Practical Test

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Pipe Layout & Load Calculation	10
C	Wiring Diagram & Material Calculation	20
D	Schedule of Materials and Approximate Cost	15
TOTAL		50
E	Practical Documents (As per the portions)	10
TOTAL		**60**

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 10 Marks for internal assessment. The question setting details are as follows.

	Description	Pattern	Marks
PART-A	30 Multiple Choice Questions (MCQ)	30 x 1 Mark	30
PART-B	7 Questions to be answered out of 10 Questions	7 x 10 Mark	70
TOTAL			**100**

- **CA 4:** All the exercises/experiments should be completed and kept for the Model Practical Examination. The students shall be permitted to select any one by lot for the exam .The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test The model practical examination should be conducted as per the End Semester Examination question pattern as given below. The marks awarded should be converted to 10 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical and End Semester Examination- Practical Exam

Part	Description	Marks
A	Aim & Apparatus Required	05
B	Pipe Layout & Load Calculation	20
C	Wiring Diagram & Material Calculation	20
D	Schedule of Materials and Approximate Cost	25
E	MCQ from Theory Portions	20
F	Viva Voce	10
TOTAL		**100**

EE5546- ESTIMATION STANDARDS AND REGULATIONS

L	T	P	C
1	0	4	3

THEORY:

Unit I	**INDIAN ELECTRICITY RULES**	**[5Hrs]**
Definitions: Ampere - Apparatus – Accessible - Bare conductor – Cable Circuit -Circuit Breaker - Conductor Voltage (Low, Medium, High, EH) – Live Dead - Cut-out– Conduit – System Danger _ Installation - Earthing System – Span Volt - SwitchGear.IE Rules 1956: 28, 30, 31, 54, 56 & 87 - BEE PAT rules 2012 - Standards and Labellingscheme of BEE.		[1Hr] [1Hr] [1Hr] [1Hr] [1Hr]
Unit II	**ELECTRICAL INSTALLATIONS**	**[5Hrs]**
Electrical installations, domestics, industrial, Wiring System, Internal distribution of Electrical Energy - Methods of wiring - Systems of wiring - conductor materials used in cables - Types of cables used in internal wiring. ACCESSORIES: Main switch and distribution boards - conduit accessories and fittings - lighting accessories and fittings – fuses - determination of size of fuse wire, fuse units - Earthing - IS specifications regarding earthing of electrical installations - points to be earthed - Determination of size of earth wire and earth plate for domestic and industrial installations - Material required for GI pipe earthing.		[1Hr] [1Hr] [1Hr] [1Hr] [1Hr]
Ex.No	**Name of the Experiment**	
1.	Estimate the quantity of material required in Electrical Installation for Small residential building/Flat. (1BHK)	[30Hrs]
2.	Estimate the quantity of material required in Electrical Installation for Computer centre having 10 computers, a/c unit, UPS, light and fan.	
3.	Estimate the quantity of material required in Electrical Installation for Street Light service having 12 lamp light fitting.	
4.	Estimate the quantity of material required in Electrical Installation for Workshop with one number of 3 phase, 15hp induction motor.	
5.	Estimate the quantity of material required in Electrical Installation for Small Workshop with 3 or 4 Machines.	
6.	Estimate the quantity of material required for CCTV wiring with 4 channel DVR for commercial building.	
Unit III	**ELECTRICAL SAFETY GUIDELINES**	[5Hrs]
Electrical Safety in Residential, Commercial and Agricultural Installations: Wiring and fitting – Domestic appliances – water tap giving shock – shock from wet wall – fan firing shock – multi-storied building – Temporary installations – Agricultural pump installation – Do's and Don'ts for safety in the use of domestic electrical appliances - Electrical safety sign and posters. Fire Extinguishers: Fundamentals of fire-initiation of fires, types - extinguishing techniques - prevention of fire - types of fire extinguishers - fire detection and alarm system.		[1Hr] [1Hr] [1Hr] [1Hr] [1Hr]

Practical Exercises: Estimation of Materials using Software		
Ex.No	Name of the Experiment	
7.	Using any supporting Software, Estimate the quantity of material required in Electrical Installation for Small residential building/Flat.(1BHK)	[30Hrs]
8.	Using any supporting Software, Estimate the quantity of material required in Electrical Installation for Computer centre having 10 computers, a/c unit, UPS, light and fan.	
9.	Using any supporting Software, Estimate the quantity of material required in Electrical Installation for Street Light service having 12 lamp light fitting.	
10.	Using any supporting Software, Estimate the quantity of material required in Electrical Installation for Workshop with one number of 3 phase, 15hp induction motor.	
11.	Using any supporting Software, Estimate the quantity of material required in Electrical Installation for Small Workshop with 4 Machines.	
12.	Using any supporting Software, Estimate the quantity of material required for CCTV wiring with 4 channel DVR for commercial building.	
	TOTAL PERIODS	**75Hrs**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments basedon the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.

Text Books

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	A course in Electrical Installation, Estimating and costing, 9th Edition	J.B. Gupta	S.K.Kataria and Sons, Reprint 2022
2.	Electrical Safety, Fire Safety Engineering and SafetyManagement, Second Edition,	S. Rao, R.K. Jain, Prof. H.L. Saluja,	Khanna Publishers, 2012
3.	Electrical Design Estimating and Costing	K.B. Raina & S.K. Battacharya	New ageinternational (P) Ltd, reprint edition 2011.

Web-based/Online Resources

S.No	Websites
1.	https://cea.nic.in/old/cei_rgn.html
2.	https://cea.nic.in/cei-regulations/?lang=en
3.	https://aerc.assam.gov.in/documents-detail/indian-electricity-rule1956
4.	https://electricity.py.gov.in/indian-electricity-rules
5.	Bureau of Energy Efficiency: https://beeindia.gov.in
6.	https://cea.nic.in/old/cei_rgn.html

MODEL QUESTION PAPER

EEE5546- ESTIMATION STANDARDS AND REGULATIONS

Duration : 3Hrs **Max Marks :100**

Ex.No	Name of the Experiment	CO	PO
1	Estimate the quantity of material required in Electrical Installation for Small residential building/Flat. (1BHK)	E5546.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
2	Estimate the quantity of material required in Electrical Installation for Computer centre having 10 computers, a/c unit, UPS, light and fan.	E5546.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
3	Estimate the quantity of material required in Electrical Installation for Street Light service having 12 lamp light fitting.	E5546.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
4	Estimate the quantity of material required in Electrical Installation for Workshop with one number of 3 phase, 15hp induction motor.	E5546.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
5	Estimate the quantity of material required in Electrical Installation for Small Workshop with 3 or 4 Machines.	E5546.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
6	Estimate the quantity of material required for CCTV wiring with 4 channel DVR for commercial building.	E5546.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
7	Using any supporting Software, Estimate the quantity of material required in Electrical Installation for Small residential building/Flat. (1BHK)	E5546.1	PO1,PO2,PO3,PO4, PO5,PO6,PO7
8	Using any supporting Software, Estimate the quantity of material required in Electrical Installation for Computer centre having 10 computers, a/c unit, UPS, light and fan.	E5546.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7
9	Using any supporting Software, Estimate the quantity of material required in Electrical Installation for Street Lightservice having 12 lamp light fitting.	E5546.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7
10	Using any supporting Software, Estimate the quantity of material required in Electrical Installation for Small Workshop with 4 Machines.	E5546.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7
11	Using any supporting Software, Estimate the quantity of material required for CCTV wiring with 4 channel DVRfor commercial building.	E5546.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7
12	Using any supporting Software, Estimate the quantity of material required for CCTV wiring with 4 channel DVR for commercial building.	E5546.2	PO1,PO2,PO3,PO4, PO5,PO6,PO7

EEE5654 - INNOVATION AND START -UPS

L	T	P	C
1	0	2	2

Programme Name : EEE

Course Code : EEE5654

Semester : V SEMESTER

Course Title : INNOVATION AND START -UPS

Course Type : PRACTICUM

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	**Instructions**		**Examination**			
			Marks			**Duration**
	Hours / Week	**Hours / semester**	**Internal Assessment**	**Autonomous Examination**	**Total**	
Innovation and Start -UPS	3	45	40	100*	100	3Hrs

* Examinations will be conducted for 100 marks will be converted to 60 marks.

COURSE DESCRIPTION:

The integration of Innovation and Start-ups concept within the syllabus is testament to the forward thinking nature of educational institutions. By introducing this concept, students are provided with a solid foundation upon which they can build their skills in Innovation and Start- ups. This course can bridge the gap between theory and practice. It allows students to apply the knowledge they have acquired in a real world context, thereby enhancing their understanding and retention of the above concept. This experimental learning approach not only fosters a deeper level of engagement but also trains student with practical skills necessary to navigate the complexities of the business world. This also empowers students to become an Innovator or Entrepreneur. With necessary tools and knowledge, educational institutions are preparing the next generation of entrepreneurs to tackle the challenges and opportunities that lie ahead. This syllabus will explore the different facets of innovation, including its importance, types and strategies for fostering a culture of innovation within organization.

COURSE OBJECTIVES:

The objective of this course is to enable the student to

- Understand the concept of Innovation and Start-ups.
- Acquire knowledge of Prototype development, IPR, Patents and Copyrights.
- Have Practical experience in preparing Business plan for Start-ups.
- Prepare project report about the present challenges of that industry.
- Know the different funding supports available from Government and Non-Government schemes for Start-ups.

COURSE OUTCOMES

On successful completion of this course, the student will be able to	
E5654.1	Differentiate between Innovation and Start-ups.
E5654.2	Explain the importance of IPR, Patents and Copyrights.
E5654.3	Describe the methodology to be adopted for preparing the Business Plan.
E5654.4	Gain practical experience by Industrial training and visiting the nearby industry.
E5654.5	Explore and identify various funding facilities available from Government and Non-Government Schemes for Start-ups.

Pre-requisites

There are no specific prerequisites for this course, although a basic understanding of business and technology concepts would be beneficial.

CO-PO & PSOs Mapping :

CO / PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E5654.1	3	3	3	3	3	3	3	3	3	3
E5654.2	3	3	3	3	3	3	3	3	3	3
E5654.3	3	3	3	3	3	3	3	3	3	3
E5654.4	3	3	3	3	3	3	3	3	3	3
E5654.5	3	3	3	3	3	3	3	3	3	3
Total	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**
Correlation Level	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

Assessment Methodology:

	Continuous Assessment (40 Marks)			End Semester Examination (60 Marks)
	CA1	**CA2**	**CA3**	
Mode	Theory Test	Seminar Presentation	Submission of Industry Visit Project Report	Practical Examination
Portion	Unit I, II & III	Unit IV	Unit V	Project
Duration	2 Periods	--	--	3 Hours
Exam Marks	50	20	30	100
Converted to	10	10	20	60
Marks	10	10	20	60
Internal Marks	40			60
Tentative Schedule	14^{th} Week	15^{th} Week	16^{th} Week	-

S. No	Description	Marks
CA 1	**Class Assessment (50 marks) - Unit – I, II & III** Written Examination - Theory Questions 10 questions out of 15 questions (10 x 3 marks :30 marks) 4 questions out of 6 questions (4 x 5 marks : 20 marks)	10 marks
CA 2	**Seminar Presentations** **(20 marks- each topic carries 10 marks) - Unit IV** Students should present any two topics with PPTs	10 marks
CA 3	Submission of Industry Visit Project Report **(30 marks) - Unit V**	20 marks
Total		**40 marks**

SCHEME OF EVALUATION

End Semester Examination- Practical Exam

Part	Description	Marks
A	Written Examination: Theory question from Unit I,II & III Answer any 10 questions out of given 15 Questions. Each question carries 3 Marks. (10 x 3 = 30 marks)	30
B	Written Examination: Theory question from Unit I, II & III Answer all 3 questions in Either or pattern. Each question carries 5 Marks. (3 x 5=15)	15
C	Presentation of Industry Visit Project Report	25
D	Interaction and Evaluation	30
TOTAL MARKS		**100**

EEE5654- INNOVATION AND START - UPS

L	T	P	C
1	0	2	2

THEORY:

Unit I	**INTRODUCTION TO INNOVATION**	**[6Hrs]**
An Introduction to Innovation and Creativity		[1Hr]
Innovation in current Environment		[1Hr]
Types of Innovation - Challenges of Innovation		[1Hr]
Steps of Innovation Management Divergent v/s Convergent thinking		[2Hrs]
Design thinking and Entrepreneurship.		[1Hr]
Unit II	**INCUBATION CLUBS, IPR, PATENTS AND COPYRIGHTS**	**[6Hrs]**
Idea Generation - Incubation Clubs		[1Hr]
Prototype Development - Marketing of Innovation		[1Hr]
Management of Innovation - Creation of IPR -Types of IPR		[2Hrs]
Patents and Copyrights - Patents in India		[1Hr]
Technological and Non-Technological Innovation Process.		[1Hr]
Unit III	**GOVERNMENT AND NON-GOVERNMENT FUNDING SCHEMES FOR START-UPS**	**[6Hrs]**
An introduction to Start-up - Start-ups in India		[1Hr]
Procedure for registration of Start- ups Business Model- Business Plan –		[1Hr]
Case Studies Opportunities and Challenges		[1Hr]
Funding supports from Government Schemes - MUDRA, TANSEED, NEEDS, PMEGP, UYEGP – Non-Government Schemes - CSR Fund - Angel Investors - Venture Capitalist.		[1Hr] [1Hr] [1Hr]
Unit IV	**SEMINAR**	**[9Hrs]**
	All the students have to select a minimum of 2 topics from the list given below. They are expected to collect the resources with the help of faculty assigned to them to prepare PPTs for presentation. Idea Generation ,Innovation Management Product Development,Business Model Innovation Organizational Culture and Change Management Leadership and Innovation,Barriers to Innovation Innovation Marketing,E-Commerce success stories (any one) Role of Start-ups in Higher Education Professional Networking in Building Brands,How to start a start-up in India	[9 Hrs]
Unit V	**EXPOSURE TO INDUSTRY**	**[18Hrs]**
	All the students should visit and study the nearby industries, incubation centres, start-ups etc., and select any one to prepare a project report which covers the Name of the Industry/Organization, Introduction of the Industry, Type of the Industry, Scope of the Industry, Plant Layout and Location, Details of Plant and Machineries, Process flow chart, Manufacturing Methods, Process of Manufacturing, Product Manufacturing, Quality Control, Marketing, Product selling – Conclusion.	[18Hrs]
	TOTAL PERIODS	**45 hrs**

Reference Books:

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Creativity for Innovation Management	Ina Goller, John Bessant	First Edition,Routledge, 2017.
2.	Design Thinking for Innovation	Walter Brenne and Falk Uebernickel	Research andPractice, Springer, 2016.
3.	Henri Charmasson, John Buchaca	Patents, Copyrights & Trademarks for Dummies	Second Edition, Wiley Publishing Inc.

Web-based/Online Resources

S.No	Websites
1.	https://www.startupindia.gov.in/
2.	https://www.mudra.org.in/
3	https://startuptn.in/tanseed/
4	https://www.msmetamilnadu.tn.gov.in/needs.php
5	https://www.kviconline.gov.in/pmegpeportal/pmegphome/index.jsp
6	https://msmeonline.tn.gov.in/uyegp/

EEE5773 - INDUSTRIAL TRAINING

Summer Vacation	C
	2

Programme Name : EEE

Course Code : EEE5773

Semester : V SEMESTER

Course Title : INDUSTRIAL TRAINING

Course Type : INTERNSHIP

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Industrial Training	5	75	40	100*	100	3Hrs

COURSE DESCRIPTION:

Industrial training is a crucial component of the diploma engineering curriculum, designed to bridge the gap between theoretical knowledge and practical application. Typically conducted during vacation periods, this two- week training program provides students with hands-on experience in their respective engineering fields. The primary objectives are to enhance practical skills, familiarize students with industry standards, and prepare them for future employment.

Two-week industrial training during vacation periods is an invaluable part of diploma engineering education. It not only equips students with practical skills but also provides a comprehensive understanding of the industry, preparing them for successful engineering careers.

COURSE OBJECTIVES:

1. Practical Exposure: Students gain direct exposure to real-world engineering practices, tools, and technologies.
2. Skill Enhancement: The training helps in developing technical and soft skills that are essential for professional growth.
3. Industry Insight: Students learn about the working environment, operational procedures, and challenges faced by industries.
4. Professional Networking: The training offers opportunities to interact with industry professionals, which can be beneficial for career prospects.
5. Application of Knowledge: It allows students to apply classroom knowledge to solve practical problems, enhancing their understanding and retention of engineering concepts.

Structure of the Training Program

- Orientation: Introduction to the company, its operations, and safety protocols.
- Project Assignment: Students are assigned specific projects or tasks relevant to their field of study.
- Supervision and Mentorship: Industry professional's guide and mentor students throughout the training.
- Skill Development Workshops: Sessions on technical skills, software tools, and industry best practices.
- Assessment and Feedback: Performance evaluations and constructive feedback to help students improve.

Benefits for Students

- Enhanced Employability: Practical experience makes students more attractive to potential employers.
- Confidence Building: Working in a real-world setting boosts confidence and professional demeanor.
- Clarified Career Goals: Exposure to various roles and responsibilities helps students define their career paths.

COURSE OUTCOMES

E5773.1	Demonstrate proficiency in using industrial machinery, tools, and software.
E5773.2	Able to identify, analyze, and solve engineering problems using industry-standard methods and practices.
E5773.3	Gain a comprehensive understanding of industrial manufacturing processes, quality control, and safety practices.
E5773.4	Exhibit improved communication, teamwork, and professional behavior in an industrial setting.
E5773.5	Apply theoretical concepts learned in their coursework to practical engineering tasks and projects.

Duties Responsibilities of the Faculty Mentor.

One faculty mentor should be assigned for every 30 students by the HOD / Principal. Faculty mentors shall play a crucial role in overseeing and guiding students during their industrial training program in Diploma engineering.

Pre-Training Responsibilities:

1. Orientation and Preparation:
   - Conduct orientation sessions to familiarize students with the objectives, expectations, and guidelines of the industrial training program.
   - Assist students in understanding the importance of industrial training in their academic and professional development.
2. Placement Coordination:
   - Collaborate with the placement cell or industry liaison office to secure suitable training placements for students that align with their academic specialization and career interests.
   - Facilitate communication between the institution and host organizations to ensure smooth coordination of training arrangements.

3. Training Plan Development:
    - Help students develop a detailed training plan outlining learning objectives, tasks, and expected outcomes for the training period.
    - Guide students in setting SMART (Specific, Measurable, Achievable, Relevant, Time-bound) goals for their training experience.

During Training Responsibilities:

4. Monitoring and Support:
    - Regularly monitor the progress of students during their industrial training. Maintain communication with both students and industry supervisors to track performance and address any issues that may arise.
    - Provide ongoing support and guidance to students, offering advice on technical challenges, professional conduct, and workplace etiquette.
5. Technical Guidance:
    - Offer technical guidance and mentorship related to the specific engineering discipline or specialization of the students. Help them apply theoretical knowledge to practical situations encountered in the industry.
6. Problem-Solving Assistance:
    - Assist students in overcoming obstacles or challenges encountered during their training. Encourage them to develop problem-solving skills and resilience in real-world engineering scenarios.
7. Feedback and Evaluation:
    - Provide constructive feedback on students' performance based on reports, assessments, and observations gathered from industry supervisors.
    - Evaluate students' achievements in relation to their training objectives and competencies developed during the program.

Post-Training Responsibilities:

8. Reflection and Debriefing:
    - Conduct debriefing sessions with students to reflect on their training experiences, discuss lessons learned, and identify areas for further improvement.
    - Help students articulate their learning outcomes and how these experiences contribute to their professional growth.
    - Documentation and Reporting:
    - Ensure comprehensive documentation of students' training activities, achievements, and feedback received from industry supervisors.
    - Prepare reports summarizing students' performance and submit these to relevant departments or committees for review and assessment.
9. Career Counseling:
    - Provide career guidance and counseling to students based on their industrial training experiences. Assist them in leveraging these experiences for future job applications or further academic pursuits.
10. Continuous Improvement:
    - Collaborate with industry partners to continuously improve the quality and relevance of the industrial training program.

- Incorporate feedback from students and industry supervisors to enhance the effectiveness of future training placements.
- By fulfilling these duties and responsibilities, faculty mentors contribute significantly to the overall educational experience and professional development of Diploma engineering students during their industrial training program.

Instructions to the students

Before Starting Industrial Training:

1. Orientation and Preparation:
    - Attend orientation sessions conducted by the institution or faculty mentors to understand the objectives, expectations, and guidelines of the industrial training program.
    - Familiarize yourself with the specific policies, procedures, and safety regulations of the host organization where you will be undergoing training.
2. Setting Goals:
    - Set clear and specific goals for your industrial training period. Define what skills, knowledge, and experiences you aim to gain during this time.
    - Discuss your goals with your faculty mentor and seek their guidance in developing a training plan that aligns with your career aspirations.
3. Professional Attire and Conduct:
    - Dress appropriately and professionally according to the standards of the industry and host organization.
    - Maintain a positive attitude, demonstrate punctuality, and adhere to workplace etiquette and norms.

During Industrial Training:

4. Learning and Engagement:
    - Actively engage in all assigned tasks and projects. Seek opportunities to learn new skills and technologies relevant to your field of study.
    - Take initiative in asking questions, seeking clarification, and participating in discussions with supervisors and colleagues.
5. Adaptability and Flexibility:
    - Adapt to the work environment and demonstrate flexibility in handling various responsibilities and challenges that arise during your training.
    - Be open to different roles and tasks assigned to you, as this will broaden your experience and skill set.
6. Professionalism and Communication:
    - Communicate effectively with supervisors, colleagues, and clients as required. Practice clear and concise verbal and written communication.
    - Demonstrate professionalism in all interactions, respecting confidentiality, and adhering to company policies and procedures.
7. Safety and Compliance:
    - Prioritize safety at all times. Familiarize yourself with safety protocols, procedures, and emergency exits in the workplace.
    - Follow all safety guidelines and regulations to ensure your well- being and that of others around you.

After Completing Industrial Training:

8. Reflection and Documentation:
    - Reflect on your training experience. Evaluate what you have learned, the challenges you faced, and how you have grown professionally.
    - Maintain a journal or log documenting your daily activities, achievements, and lessons learned during the training period.
9. Feedback and Evaluation:
    - Seek feedback from your industry supervisor and faculty mentor on your performance and areas for improvement.
    - Use constructive feedback to enhance your skills and competencies for future career opportunities.
10. Career Planning:
    - Use your industrial training experience to inform your career planning and decision-making process.
    - Discuss your career goals and aspirations with your faculty mentor or career counselor for guidance on next steps after completing your diploma.
    - By following these instructions, Diploma engineering students can make the most of their industrial training experience, gain valuable insights into their chosen field, and prepare themselves effectively for future professional endeavors.

Attendance Certification

- Every student has to get their attendance certified by the industrial supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and submit it to the institution faculty mentor.

Training Reports

- The students have to prepare reports: The report in the form of a diary to be submitted to the concerned faculty mentor of the institution. This will be reviewed while awarding Internal assessment.

Industrial Training Diary

- Students are required to maintain the record of day-to-day work done. Such a record is called Industrial training Diary. Students have to write this report regularly. All days for the week should be accounted for clearly giving attendance particulars (Presence, absence, Leave, Holidays etc.). The concern of the Industrial supervisor is to periodically check these progress reports.
- In addition to the diary, students are required to submit a comprehensive report on training with details of the organization where the training was undergone after attestation by the supervisors. The comprehensive report should incorporate study of plant / product / process / construction along with intensive in-depth study on any one of the topics such as processes, methods, tooling, construction and
- Equipment, highlighting aspects of quality, productivity and system. The comprehensive report should be completed in the last week of Industrial training. Any data, drawings etc. should be incorporated with the consent of the Organization.

SCHEME OF EVALUATION

INTERNAL ASSESSMENT

Students should be assessed for 40 Marks by industry supervisor and polytechnic facultymentor for the Internal Assessment.

S No.	Description	Marks
A	Punctuality and regularity. (Attendance)	10
B	Level / proficiency of practical skills acquired. Initiative in learning / working at site	10
C	Ability to solve practical problems. Sense of responsibility	10
D	Self expression / communication skills. Interpersonal skills / Human Relation.	10
E	Report and Presentation.	10
Total		50

END SEMESTER EXAMINATION - PROJECT EXAM

Students should be assessed for 100 Marks both by the internal examiner and external examiner appointed by the Chairperson Autonomous of Examinations after the completion of industrial training. The marks scored will be converted to 60 marks for the End Semester Examination.

Sl. No.	Description	Marks
A	Daily Activity Report and Attendance certificate.	20
B	Comprehensive report on Internship, Relevant Internship Certificate from the concerned department.	30
C	Presentation by the student at the end of the Internship.	30
D	Viva Voce	20
Total		100

EEE6111-ADVANCED ENGINEERING MATHEMATICS

L	T	P	C
3	0	0	3

Programme Name : EEE
Course Code : EEE6111
Semester : VI SEMESTER
Course Title : ADVANCED ENGINEERING MATHEMATICS
Course Type : THEORY

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
			Marks			
	Hours / Week	Hours / semester	Internal Assessment	Autonomous Examination	Total	Duration
Advanced Engineering Mathematics	3	45	40	100*	100	3Hrs

* Examinations will be conducted for 100 marks will be converted to 60 marks.

TOPICS AND ALLOCATION OF HOURS

Unit	Topics	Time (Hrs)
I	Eigen values and eigenvectors	9
II	Functions of several variables	9
III	Vector calculus	9
IV	Differential equations	9
V	Laplace transforms	9
Total		45

COURSE DESCRIPTION:

Mathematics is essential for engineering students to understand core engineering subjects. It provides the framework for engineers to solve problems in engineering domains. This course is designed to bridge the gap between diploma mathematics and B.E/B. Tech mathematics in matrix algebra, differential calculus, vector calculus, differential equations, and Laplace transforms.

COURSE OBJECTIVES:

The objective of this course is to enable the student to

- Understand the concepts of Eigen-Values and Eigen-Vectors of matrices.
- Learn the notation of partial differentiation and determine the extremities of functions of two variables.
- Acquire knowledge in vector calculus which is significantly used to solve engineering problems.
- Formulate and solve differential equations.
- Understand Laplace transformation and its engineering applications.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to	
E6111.1	Find eigen values and corresponding eigenvectors of a square matrix
E6111.2	Apply the knowledge of partial differentiation to evaluate Jacobian and extremities of two variable functions.
E6111.3	Evaluate the gradient of a scalar field and the divergence and curl of vector fields.
E6111.4	Solve ordinary differential equations using various techniques.
E6111.5	Use Laplace transforms to solve first-order ordinary differential equations.

Pre-requisites

Matrices, Determinants, Differentiation, Integration and Vector Algebra.

CO/PO & PSO Mapping Matrix:

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E6111.1	3	2	3	2	3	2	2	3	2	3
E6111.2	2	2	2	2	2	2	2	3	2	3
E6111.3	3	2	3	2	2	2	2	3	2	3
E6111.4	2	2	2	2	2	2	2	3	2	3
E6111.5	3	2	3	2	3	2	2	3	2	3
Total	13	10	13	10	12	10	10	15	10	15
Correlation Level	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**3**

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- A theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome-based.
- All demonstrations/Hands-on practices might be under a simulated environment.
- Use inducto-deductive approach to achieve the desired learning objectives.

- Use open-ended questions to nurture the problem-solving and reasoning skills among students.
- Support and guide the students for self-study.
- State the need for mathematics with engineering studies and provide real-life examples.

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Unit 1 & 2)	Written test (Unit 3 & 4)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	6^{th} Week	12^{th} Week	13^{th} -14^{th} Week	16^{th} Week	-

CONTINUOUS ASSESSMENT

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 10 Marks for the internal assessment.

CA1and CA2, Assessment test should be conducted for two units as below

- PART A: (5 X 10 Marks = 50 Marks).
- Eight questions will be asked, students should write five questions. Four questions can be asked from each unit.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 10 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 10 marks for the internal assessment.

Question Pattern:

- Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.
- Four questions will be asked from every unit. Students should write any two questions.

Question Pattern - Model Examination and End Semester Examination Theory Exam

PART- A (5 X 2X10 Marks = 100 Marks)

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.

Sample:

I	1.
	2.
	3.
	4.
II	5.
	6.
	7.
	8.
III	9.
	10.
	11.
	12.
IV	13.
	14.
	15.
	16.
V	17.
	18.
	19.
	20.

QUESTION PAPER SETTING:

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **AP-**Apply	**An-** Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

EEE6111- ADVANCED ENGINEERING MATHEMATICS

L	T	P	C
3	0	0	3

THEORY

Unit I	**EIGENVALUES AND EIGENVECTORS**	**[9 Hrs]**
Characteristic equation Eigen-values of 2×2 and 3×3 real matrices Eigen-vectors of 2×2 real matrices Properties of eigen-values (excluding proof) Cayley-Hamilton theorem (excluding proof) Simple problems.		[1 Hr] [1 Hr] [1 Hr] [2 Hrs] [4 Hrs]
Unit II	**FUNCTIONS OF SEVERAL VARIABLES**	**[9 Hrs]**
Partial derivatives of two variable and three variable functions (up to second order) – Homogeneous functions Euler's theorem (excluding proof) Jacobian matrix and determinant Maxima and minima of functions of two variables Simple problems.		[1 Hr] [2 Hrs] [1 Hr] [1 Hr] [2 Hrs] [2 Hrs]
Unit III	**VECTOR CALCULUS**	**[9 Hrs]**
Scalar field and Vector field Vector differential operator Gradient of a scalar field ,Directional derivative Divergence and curl of a vector field (excluding properties) Solenoidal and irrotational vector fields –Simple problems.		[1 Hr] [1 Hr] [2 Hrs] [2 Hrs] [3 Hrs]
Unit IV	**DIFFERENTIAL EQUATIONS**	**[9 Hrs]**
Differential equation – Formation –Order and degree Solution of a differential equation – Equations of first order and first degree Variable separable method – Leibnitz's Linear equations Second order equations of the form $(aD^2 + bD + c)y = e^{nx}$ where a, b, c and n are constants and the auxiliary equation $am^2 + bm + c = 0$ has only real roots) Complementary function – Particular integral- General solution Simple problems.		[1 Hr] [1 Hr] [1 Hr] [2 Hrs] [1 Hr] [3 Hrs]
Unit V	**LAPLACE TRANSFORMS**	**[9 Hrs]**
Definition of Laplace transform Laplace transforms of standard functions – Linearity and change of scale property (excluding proofs) First shifting property Laplace transforms of derivatives Properties (excluding proofs) Inverse Laplace transforms Properties (excluding proofs) Solving first order ordinary differential equation using Laplace transforms Simple problems.		[2 Hrs] [1 Hr] [1 Hr] [1 Hr] [4 Hrs]
TOTAL HOURS		**45**

Suggested List of Students Activity

- Demonstrate the applications of Eigen-Values in stability analysis, decouple of three-phase systems and vibration analysis.
- Demonstrate maxima and minima of two variable functions using Geo Gebra graphing calculator.
- Demonstrate solenoidal vector field and irrotational vector field using engineering applications.
- Demonstrate the applications of differential equations in solving engineering problems.
- Presentation /Seminars by students and Quizzes

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Text Books

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Higher Engineering Mathematics	John Bird	Routledge 9th edition,2021
2.	Higher Engineering Mathematics,	B.S.Grewal	Khanna Publishers 42nd edition, 2012
3.	Differential Equations andApplications	S. Arumugam, A. Thangapandi Isaac, & A. Somasundaram	Yes Dee Publishing Pvt. Ltd., 2020.
4	Vector Analysis	P.Durai pandian and Kayalal Pachaiyappa	S. Chand and Company Limited, 1st edition, 2017
5	Calculus Volume I and II	S. Narayanan, & T.K. Manicavachagom Pillai,	S. ViswanathanPublishers Pvt.Ltd., 2007

Web-based/Online Resources

S.NO	Websites
1.	https://www.khanacademy.org/math/
2.	https://www.mathportal.org/
3.	https://openstax.org/subjects/math
4.	https://www.mathhelp.com/
5.	https://www.geogebra.org/
6.	https://www.desmos.com/
7.	https://phet.colorado.edu/

MODEL QUESTION PAPER

EEE6111- ADVANCED ENGINEERING MATHEMATICS

Time : 3 Hrs. **Max.Marks : 100**

PART – A (5X2X10Marks=100 MARKS)					
Note :Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.					
S. NO	**QUESTIONS**	**UNIT**	**BLOOM'S LEVEL**	**CO**	**PO**
I	1.Find all eigen values and corresponding eigenvectors for the matrix A if $\begin{pmatrix} 2 & -3 & 0 \\ 2 & -5 & 0 \\ 0 & 0 & 3 \end{pmatrix}$	I	R	E6111.1	PO2,PO5, PO7
	2. Find eigen values and eigenvectors Corresponding to counterclockwise rotation through the angle $\pi/2$ about the origin in R^{2}.	I	R	E6111.1	PO2,PO5, PO7
	3.The following matrix represents a rotation of a drone in three-dimensional space. Find its axis of rotation. A=$\begin{pmatrix} \sqrt{3}/2 & -0 & 0.5 \\ 0 & 1 & 0 \\ -0.5 & 0 & \sqrt{3}/2 \end{pmatrix}$	I	U	E6111.1	PO2,PO5, PO7
	4.Given the matrices $A=\begin{pmatrix} 0 & 2 \\ 1 & 1 \end{pmatrix}$ and $A^{-1}=\begin{pmatrix} -0.5 & 1 \\ 0.5 & 0 \end{pmatrix}$ find their eigen values and the eigenvectors. How are the trace and the eigen values of a matrix related?	I	R	E6111.1	PO2,PO5, PO7
II	5. Determine the partial derivative of the functions: $f(x,y) = 3x + 4y$ $f(x,y) = x^2y + \sin x + \cos y$.	II	R	E6111.2	PO2,PO5, PO7
	6. Find the 1st order partial derivative of $f(x,y,z)=4x^3y^2-e^zy^4+\frac{z3}{x2}+4y-x^{16}$.	II	U	E6111.2	PO2,PO5, PO7
	7. Find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ for the following function. $x^2\sin(y^3)+xe^{3z}-\cos(z^2)=3y-6z+8$	II	R	E6111.2	PO2,PO5, PO7
	8.Find the second partial derivatives of $f(x, y) = \sin(x)y^2$	II	R	E6111.2	PO2,PO5, PO7

III.	9.Calculate the angle between two vectors $\vec{i} - 2\vec{j} + 3k$ and $3\vec{i} - 2\vec{j} + k$.	III	R	E6111.3	PO2,PO5, PO7
	10.A girl walks 4 kilometers west, then 3 kilometers in a direction 30 degrees east of north, before coming to a halt. Determine the girl's distance from her starting position.	III	U	E6111.3	PO2,PO5, PO7
	11.Prove that the given point A, B, C are collinear using vector method A(6,−7,−1), B(2,−3,1) and C(4,−5,0).	III	U	E6111.3	PO2,PO5, PO7
	12.Show that the parallelogram on the same base and between the same parallels are equal in area using the vector method.	III	R	E6111.3	PO2,PO5, PO7
IV.	13.Form the differential equation of the family of circles having a centre on y-axis and radius 3 units.	IV	R	E6111.4	PO2,PO5, PO7
	14.Find the equation of a curve passing through (1, $\pi/4$) if the slope of the tangent to the curve at any point P (x, y) is $y/x - \cos^2(y/x)$.	IV	U	E6111.4	PO2,PO5, PO7
	15.Given that $dy/dx = e^{-2y}$ and y = 0 when x = 5. Find the value of x when y = 3.	IV	R	E6111.4	PO2,PO5, PO7
	16.Solve the initial value problem: cos(a+b)dy =dx, y(0) = 0.	IV	R	E6111.4	PO2,PO5, PO7
V.	17.Find the Laplace transform of 3+t5+sin(πt)	V	U	E6111.5	PO2,PO5, PO7
	18.Solve x″+x=u(t−1) for initial conditions x(0)=0(0)=0 and x′(0).	V	R	E6111.5	PO2,PO5, PO7
	19.Findthe transfer function for mx″+cx′+kx=f(t) (assuming the initial conditions are zero).	V	R	E6111.5	PO2,PO5, PO7
	20.Solve $x(t)=e^{-t}+\int_0^t \cos(t-\tau)x(\tau)\,d\tau$.	V	U	E6111.5	PO2,PO5, PO7

QUESTION PAPER SETTING :

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	Lower order thinking skills (LOTs)	Higher Order Thinking Skills (HOTs)
	R-Remember, **U**-Understand, **Ap**-Apply	**An**- Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

.

EEE6112 -ENTREPRENEURSHIP

L	T	P	C
3	0	0	3

Programme Name : EEE
Course Code : EEE6112
Semester : VI SEMESTER
Course Title : ENTREPRENEURSHIP
Course Type : THEORY

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
			Marks			
	Hours / Week	Hours / semester	Internal Assessment	Autonomous Examination	Total	Duration
Entrepreneurship	3	45	40	100*	100	3Hrs

* Examinations will be conducted for 100 marks will be converted to 60 marks.

TOPICS AND ALLOCATION OF HOURS

Unit	Topics	Time (hrs)
I	Entrepreneurship – introduction and process	9
II	Business idea	9
III	Banking	9
IV	Pricing and cost analysis	9
V	Business plan preparation	9
Total		45

COURSE DESCRIPTION:

Development of a diploma curriculum is a dynamic process responsive to the society and reflecting the needs and aspirations of its learners. Fast changing society deserves changes in educational curriculum particularly to establish relevance to emerging socio-economic environments; to ensure equity of opportunity and participation and finally promote concern for excellence. In this context the course on entrepreneurship and start ups aims at instilling and stimulating human urge for excellence by realizing individual potential for generating and putting to use the inputs relevant to social prosperity and thereby ensuring good means of living for every individual, providing jobs and developing the Indian economy.

COURSE OBJECTIVES:

The objective of this course is to enable the student to

- Acquire entrepreneurial spirit and resourcefulness
- Familiarize Acquire knowledge about the business idea and product selection
- Analyze the banking and financial institutions
- Understand the pricing policy and cost analysis
- Get knowledge about the business plan preparation

COURSE OUTCOMES:

E6112.1	Explain the process of entrepreneurship
E6112.2	Analyze the importance of generation of ideas and product selection
E6112.3	Familiarization of various financial and non financial schemes
E6112.4	Acquire various cost components to arrive pricing of the product
E6112.5	Learn the preparation of project feasibility report

Pre-requisites

Knowledge of basics of Engineering and Industrial engineering

CO/PO & PSO Mapping Matrix:

CO/PO & PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
E6112.1	3	3	3	3	3	1	3	3	3	3
E6112.2	3	3	3	3	3	3	3	3	3	3
E6112.3	3	3	3	3	3	3	2	3	3	3
E6112.4	3	3	3	3	3	3	2	3	3	3
E6112.5	3	3	3	3	3	3	3	3	3	3
Total	15	15	15	15	15	14	13	15	15	15
Correlation Level	3	3	3	3	3	3	3	3	3	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice- activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real- world scenarios when possible.

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Unit1&2)	Written test (Unit 3 & 4)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	-

CONTINUOUS ASSESSMENT

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 10 Marks for the internal assessment.

CA1and CA2, Assessment test should be conducted for two units as below

- PART A: (5 X 10 Marks = 50 Marks).
- Eight questions will be asked, students should write five questions. Four questions can be asked from each unit.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 10 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 10 marks for the internal assessment.

Question Pattern:

- Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.
- Four questions will be asked from every unit. Students should write any two questions.

Question Pattern - Model Examination and End Semester Examination Theory Exam

PART- A (5 X2X 10 Marks = 100 Marks)

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.

Sample:

I	1.
	2.
	3.
	4.
II	5.
	6.
	7.
	8.
III	9.
	10.
	11.
	12.
IV	13.
	14.
	15.
	16.
V	17.
	18.
	19.
	20.

QUESTION PAPER SETTING:

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **Ap**-Apply	**An**- Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

EEE6112 – ENTREPRENEURSHIP

L	T	P	C
3	0	0	3

THEORY

Unit I	**ENTREPRENEURSHIP – INTRODUCTION AND PROCESS**	**[9 Hrs]**
Concept of entrepreneurship - Importance, Myths about Entrepreneurship, Pros and Cons of Entrepreneurship, Process of Entrepreneurship, Competencies and characteristics of an entrepreneur, Ethical Entrepreneurship, Entrepreneurial Values and Attitudes, Creativity, Innovation and entrepreneurship- Entrepreneurs - as problem solvers, Mindset of an employee and an entrepreneur, Risk Taking-Concepts		[1 Hr] [2 Hr] [1 Hr] [1 Hr] [2 Hrs] [2 Hrs]
Unit II	**BUSINESS IDEA**	**[9 hrs]**
Types of Business: Manufacturing, Trading and Services, Stakeholders: sellers, vendors and consumers and Competitors, E-commerce Business Models, business idea generation -Types of Resources Human, Capital and Entrepreneurial tools and resources, etc.,-setting business goals Patent, copyright and Intellectual property rights, Customer Relations and Vendor Management, -Business Ideas vs. Business Opportunities, Opportunity SWOT ANALYSIS of a business idea Business Failure –causes and remedies.- Types of business risks		[1 Hr] [1 Hr] [2Hr] [1 Hr] [1 Hr] [2 Hrs] [1 Hr]
Unit III	**BANKING**	**[9 Hrs]**
Size and capital based classification of business enterprises Role of financial institutions, Role of Government policy, Entrepreneurial support systems, Incentive schemes for state government, Incentive schemes for Central governments.		[3 Hrs] [3 Hrs] [3 Hrs]
Unit IV	**PRICING AND COST ANALYSIS**	**[9 Hrs]**
Types of Costs - Variable - Fixed- Operational Costs Break Even Analysis - for single product or service, financial Business Case Study, Understand the meaning and concept of the term Cash Inflow Cash Outflow- Pricing- Calculate Per Unit Cost of a single product, Understand the importance and preparation of Income Statement, Prepare a Cash Flow Projection Factors affecting pricing.- GST.		[1 Hr] [2 Hr] [1 Hr] [1 Hr] [2 Hrs] [2 Hrs]
Unit V	**BUSINESS PLAN PREPARATION**	**[7 hrs]**
Feasibility Report – Technical analysis, financial analysis Market Research –Concept, Importance and Process- tools for market research Market Sensing and Testing, Marketing and Sales strategy, Digital marketing, Branding - Business name, logo, tag line, Promotion strategy, Business Plan Preparation, -Concept and Importance, Execution of Business Plan.		[1 Hr] [2 Hrs] [2 Hrs] [2 Hrs]
TOTAL HOURS		**45**

Suggested list of Students Activity.

1. Students can explore app development or web design. They'll learn about technology, user experience, and marketing.
2. Hosting events, workshops, or conferences allows students to practice project management, networking, and marketing skills.
3. Encourage students to address social or environmental issues through innovative business solutions. This fosters empathy and creativity.
4. Part of entrepreneurship clubs or organizations provides networking opportunities, mentorship, and exposure to real-world challenges.
5. Competitions like business plan contests or pitch events allow students to showcase their ideas and receive feedback.
6. Students can create and sell handmade crafts, artwork, or other products. This teaches them about production, pricing, and customer relations.
7. Students can provide consulting services in areas they're knowledgeable about, such as social media marketing or financial planning.
8. Encourage students to create and manage their own small business or offer freelance services. This hands-on experience helps them understand various aspects of entrepreneurship.

Text and Reference Books:

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Fundamentals of Entrepreneurship	G.K. Varshney	SahityaBhawan Publications, Agra,2019.
2.	Fundamentals of Entrepreneurship	H.Nandan	Prentice Hall India Learning Private Limited Third Edition, 2013
3.	Entrepreneurship Development & Management	R.K. Singal	S K Kataria and Sons,2013

Web Reference:

S.NO	Websites
1.	https://ocw.mit.edu/courses/15-390-new-enterprises-spring- 2013/resources/lecture-1/
2.	https://onlinecourses.nptel.ac.in/noc20_ge08/preview

MODEL QUESTION PAPER

EEE 6112-ENTREPRENEURSHIP

Time :3 Hrs **Max.Marks:100**

Note : Answer any 10 questions in PART A. Each question carries 10 mark.

<table>
<tr><th colspan="6">PART- A (5 X 2X10= 100 Marks)</th></tr>
<tr><th colspan="2">Answer any Fifteen questions</th><th>Unit</th><th>Bloom's Level</th><th>CO</th><th>PO</th></tr>
<tr><td rowspan="4">1.</td><td>1.(i)Explain about the Process of Entrepreneurship
(ii)Explain about the Pros and Cons of Entrepreneurship</td><td>I</td><td>R</td><td>E6112.1</td><td>PO1,PO2, PO3</td></tr>
<tr><td>2.(i)Explain about the Competencies and characteristics of an entrepreneur
(ii)Explain about the Ethical Entrepreneurship</td><td>I</td><td>U</td><td>E6112.1</td><td>PO1, PO2</td></tr>
<tr><td>3Explain about the Entrepreneurial Values and Attitudes
(ii)Explain about the Mind set of an employee and an entrepreneur</td><td>I</td><td>R</td><td>E6112.1</td><td>PO1,PO2, PO3</td></tr>
<tr><td>4)Explain about Risk Taking
(ii)Write shot notes on Myths about Entrepreneurship</td><td>I</td><td>U</td><td>E6112.1</td><td>PO1,PO2, PO3</td></tr>
<tr><td rowspan="4">2.</td><td>5Explain about the Types of Business</td><td>II</td><td>R</td><td>E6112.2</td><td>PO1,PO2, PO3</td></tr>
<tr><td>6Explain about the E-commerce Business Models</td><td>II</td><td>R</td><td>E6112.2</td><td>PO1,PO2, PO3</td></tr>
<tr><td>7.Explain about the SWOT ANALYSIS of a business idea</td><td>II</td><td>U</td><td>E6112.2</td><td>PO1,PO2, PO3</td></tr>
<tr><td>8. Explain about the Causes and remedies Business Failure.</td><td>II</td><td>R</td><td>E6112.2</td><td>PO1, PO2</td></tr>
<tr><td rowspan="4">3.</td><td>9.Explain about the classification of business enterprises</td><td>III</td><td>U</td><td>E6112.3</td><td>PO1, PO2</td></tr>
<tr><td>10.Explain about the Role of financial institutions & Government policy</td><td>III</td><td>U</td><td>E6112.3</td><td>PO2, PO3</td></tr>
<tr><td>11.Explain about the Incentive schemes for state government</td><td>III</td><td>U</td><td>E6112.3</td><td>PO2, PO3</td></tr>
<tr><td>12. Explain about the Incentive schemes for Central governments.</td><td>III</td><td>U</td><td>E6112.3</td><td>PO2, PO3</td></tr>
<tr><td rowspan="3">4.</td><td>13Explain about the Break Even Analysis for single product or service</td><td>IV</td><td>U</td><td>E6112.4</td><td>PO2, PO3</td></tr>
<tr><td>14)Explain about Cash Inflow and Cash Outflow</td><td>IV</td><td>R</td><td>E6112.4</td><td>PO2,PO3, PO4</td></tr>
<tr><td>15.How to Prepare a Cash Flow Projection.</td><td>IV</td><td>An</td><td>E6112.4</td><td>PO2,PO3, PO4</td></tr>
</table>

	16Explain about the Factors affecting pricing.	IV	U	E6112.4	PO1,PO2, PO3,PO4
5.	17.Explain about the Technical analysis & financial analysis	V	U	E6112.5	PO1,PO2 ,PO3,PO4
	18.Explain about the Market Sensing and Testing,	V	R	E6112.5	PO1,PO2, PO3,PO4, PO5
	19.(i)Explain about the Sales strategy (ii)Explain about the Digital marketing	V	R	E6112.5	PO2,PO3, PO4
	20.(i)Explain about Branding. (ii)Explain about Execution of Business Plan.	V	U	E6112.5	PO1,PO2, PO3,PO4

QUESTION PAPER SETTING :

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **AP**-Apply	**An**- Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

EEE 6113 – PROJECT MANAGEMENT

Programme Name : EEE
Course Code : EEE6113
Semester : VI SEMESTER
Course Title : PROJECT MANAGEMENT
Course Type : THEORY

L	T	P	C
3	0	0	3

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
			Marks			
	Hours / Week	Hours / semester	Internal Assessment	Autonomous Examination	Total	Duration
Project Management	3	45	40	100*	100	3Hrs

* Examinations will be conducted for 100 marks will be converted to 60 marks.

TOPICS AND ALLOCATION OF HOURS

Unit	Topics	Time (Hrs)
I	Project Management – An Overview, Project Portfolio Management System and Structure, Steps in Defining Project and Project Delays	9
II	Various Stages and Components of Project Feasibility Studies, Phases of a Project, Stages in Project Life Cycle and Project Constraints	9
III	Project Evaluation Under Certainty and Uncertainty, Project Evaluation, Commercial and Social Cost Benefit Analysis	9
IV	Developing Project Network Using Pert and CPM, Project Appraisal and Control Process	9
V	Project Managing Versus Leading of Project, Qualities of Project Manager and Managing Project Teams, Team Building Models and Performance Teams and Team Pitfalls	9
Total		**45**

COURSE DESCRIPTION:

Project management is the systematic application of knowledge, skills, tools, and techniques to project activities to meet specific project requirements. It involves planning, organizing, and managing resources to achieve project goals within defined scope, time, and budget constraints. Project management encompasses several key processes and phases, including initiation, planning, and execution, monitoring and controlling, and closing. It is essential across various industries to ensure projects are completed successfully, efficiently, and effectively, aligning with organizational objectives and stakeholder expectations. Project managers play a crucial role in leading teams, managing risks, ensuring quality, and communicating with stakeholders to drive project success.

COURSE OBJECTIVES:

The objective of this course is to enable the student

- To understand the concept, characteristics and elements of projects.
- To understand the stages in Project Life Cycle.
- To appreciate the need for Project Portfolio Management System.
- To know the considerations in choosing appropriate project management structure.
- To understand the components of techno-economic feasibility studies.
- To know about the detailed project report
- To learn about project constraints.
- To understand the techniques of evaluation.
- To get insight into the Social Cost Benefit Analysis Method.
- To know how to construct project networks using PERT and CPM.
- To learn how to crash project networks
- To understand the meaning of project appraisal.
- To understand the meaning of project audits.
- To know the qualities of an effective project manager.
- To understand the stages in Team Development model.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to	
E6113.1	Understand the Project Management Principles.
E6113.2	Learn to create and manage project schedules.
E6113.3	Create structure and manage the project commitments.
E6113.4	Gain enterprise support
E6113.5	Prepare Detailed Project Report (DPR).

Pre-requisites

Basic Knowledge

CO/PO & PSO Mapping Matrix:

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E6113.1	3	3	3	3	3	3	3	3	3	3
E6113.2	3	3	3	3	3	3	3	3	3	3
E6113.3	3	3	3	3	3	3	3	3	3	3
E6113.4	3	3	3	3	3	3	3	3	3	3
E6113.5	3	3	3	3	3	3	3	3	3	3
Total	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**
Correlation Level3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- It is advised that teachers take steps to pique pupils' attention and boost their curiosity to learn.
- Implement task-based learning activities where students work on specific tasks or projects.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- All demonstrations/Hand-on practices may be followed in the real environment as far as possible.

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Unit 1& 2)	Written test (Unit 3 & 4)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	6th Week	12th Week	13th -14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 10 Marks for the internal assessment.

CA1and CA2, Assessment test should be conducted for two units as below

- PART A: (5 X 10 Marks = 50 Marks).
- Eight questions will be asked, students should write five questions. Four questions can be asked from each unit.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 10 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 10 marks for the internal assessment.

Question Pattern:

- Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.
- Four questions will be asked from every unit. Students should write any two questions.

Question Pattern - Model Examination and End Semester Examination Theory Exam

PART- A (5 X2X 10 Marks = 100 Marks)

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.

Sample:

I	1.
	2.
	3.
	4.
II	5.
	6.
	7.
	8.
III	9.
	10.
	11.
	12.
IV	13.
	14.
	15.
	16.
V	17.
	18.
	19.
	20.

QUESTION PAPER SETTING :

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **AP**-Apply	**An-** Analyse, **E**-Evaluate, **C-**Create
% to be included	90 %	10 %

EEE 6113-PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

THEORY

Unit I	Project Management – An Overview, Project Portfolio Management System and Structure, Steps in Defining Project and Project Delays **[9 Hrs]**
Project – Classification – Importance of Project Management	[1 Hr]
An Integrated Approach – Project Portfolio Management System –	[2Hrs]
The Need Choosing the appropriate Project Management Structure:	[1 Hr]
Organizational considerations and project considerations	[1 Hr]
steps in defining the project Rollup Process breakdown structure Responsibility	[2 Hrs]
Matrices External causes of delay and internal constraints.	[2 Hrs]
Unit II	Various Stages and Components of Project Feasibility Studies, Phases of a Project, Stages in Project Life Cycle and Project Constraints **[9Hrs]**
Project feasibility studies - Opportunity studies, General opportunity studies,	[1 Hr]
specific opportunity studies, pre-feasibility studies,	[1 Hr]
functional studies or support studies, feasibility study	[2 Hrs]
components of project feasibility studies – Managing Project resources flow	[1 Hr]
project planning to project completion: Pre-investment phase, Investment Phase	[2 Hrs]
operational phase Project Life Cycle – Project constraints	[2 Hrs]
Unit III	Project Evaluation Under Certainty and Uncertainty, Project Evaluation, Commercial and Social Cost Benefit Analysis **[9 Hrs]**
Project Evaluation under certainty - Net Present Value (Problems - Case Study),	[1 Hr]
Benefit Cost Ratio, Internal Rate of Return, Urgency, Payback Period, ARR –	[2 Hrs]
Project Evaluation under uncertainty	[1 Hr]
Methodology for project evaluation Commercial vs. National Profitability	[1 Hr]
Social Cost Benefit Analysis, Commercial or National Profitability,	[2 Hrs]
social or national profitability	[2 Hrs]
Unit IV	Developing Project Network Using Pert and CPM, Project Appraisal and Control Process **[9 Hrs]**
Developing a Project Plan - Developing the Project Network Constructing a Project	[1 Hr]
Network (Problems) – PERT – CPM Crashing of Project Network	[2 Hrs]
(Problems - Case Study) Resource Leveling and Resource Allocation –	[1 Hr]
how to avoid cost and time overruns Steps in Project Appraisal Process –	[1 Hr]
Project Control Process – Control Issues –Project Audits – the Project Audit Process –	[2 Hrs]
project closure team, team member and project manager evaluations	[2 Hrs]
Unit V	Project Managing Versus Leading of Project, Qualities of Project Manager and Managing Project Teams, Team Building Models and Performance Teams and Team Pitfalls **[9 Hrs]**

Managing versus leading a project - managing project stakeholders	[2 Hrs]
social network building (Including management by wandering around)	[1 Hr]
qualities of an effective project manager	[1 Hr]
managing project teams	[2 Hrs]
Five Stage Team Development Model	[1 Hr]
Situational factors affecting team development	[1 Hr]
project team pitfalls	[1 Hr]
TOTAL HOURS	**45**

Suggested List of Students Activity

A Project Simulation and Role-Playing:

- Activity: Participate in simulated project scenarios where students take on different roles within a project team (e.g., project manager, team member, stake holder).
- Purpose: This helps students understand the dynamics of project management, including leadership, communication, and team collaboration.

Case Study Analysis:

- Activity: Analyze real-world case studies of successful and failed projects.
- Purpose: This activity enables students to apply theoretical knowledge to practical situations, identify best practices, and learn from the challenges and solutions implemented in real projects.

Project Plan Development:

- Activity: Develop a comprehensive project plan for a hypothetical or real project, including scope, schedule, budget, risk management, and quality management plans.
- Purpose: This allows students to practice creating detailed and structured project plans, honing their skills in planning and organizing project activities.

Group Project:

- Activity: Work in teams to manage a project from initiation to closure, simulating a real project environment.
- Purpose: Group projects help students learn how to work collaboratively, manage group dynamics, and apply project management tools and techniques in a team setting.

Project Management Software Training:

- Activity: Gain hands-on experience with project management software such as Microsoft Project, Asana, or Trello.
- Purpose: This activity equips students with practical skills in using technology to plan, track, and manage project tasks and resources efficiently.

Text Books:

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Project Management: The Managerial Process	Clifford F. Gray and Erik W. Larson	Tata Mcgraw Hill 6th edition,2017
2.	Project Management Toolbox: Tools and Techniques for the Practicing Project Manager	Dragan Z. Milosevic	John Wiley & Sons 2nd edition, 2016
3.	Textbook of Project Management	P. Gopalakrishnan and V.E. Ramamoorthy	Laxmi Publications, 1st edition,s2022
4	Project Management: A Systems Approach To Planning, Scheduling,And Controlling	Harold Kerzner,	John Wiley & Sons 2nd edition,
5	Visualizing Project Management: A Model For Business And Technical Success, Second Edition, Pmp And Howard Cotterman,	Kevin Forsberg, Ph.D, Hal Mooz	John Wiley & Sons 2nd edition, 2016
6	Project Management Methodologies: Selecting, Implementing, And Supporting Methodologies And Processes For Projects,	Jason Charvat	John Wiley & Sons 2nd edition, 2016

Web-based/Online Resources:

S.NO	Online Resources
1	https://youtu.be/pc9nvBsXsuM
2	NPTEL Courses
3	https://youtu.be/PqQqTAu_FiM

MODEL QUESTION PAPER

EEE 6113-PROJECT MANAGEMENT

Time :3 Hrs **Max.Marks:100**

PART – A (5 X2X 10=100MARKS)					
Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10					
S.No	**QUESTIONS**	**Unit**	**Bloom's Level**	**Course Outcome**	**Program Outcomes**
I	1. Analyze the Importance of Project Management?	I	An	E6113.1	PO1,PO5,PO7
	2. Explain Project Portfolio Management System	I	U	E6113.1	PO1,PO5,PO7
	3. Explain Process breakdown structure	I	U	E6113.1	PO1,PO5,PO7
	4. Explain External causes of delay and internal constraints	I	R	E6113.1	PO1,PO5,PO7
II	5. Explain General opportunity studies	II	R	E6113.2	PO1,PO5,PO7
	6. Explain components of project feasibility studies	II	R	E6113.2	PO1,PO5,PO7
	7. Explain Pre-investment phase	II	U	E6113.2	PO1,PO5,PO7
	8. Explain Project Life Cycle	II	R	E6113.2	PO1,PO5,PO7
III	9. What are the Benefit of Cost Ratio	III	U	E6113.3	PO1,PO5,PO7
	10. Explain Internal Rate of Return	III	U	E6113.3	PO1,PO5,PO7
	11. Explain Methodology for project evaluation	III	U	E6113.3	PO1,PO5,PO7
	12. Explain Commercial or National Profitability	III	U	E6113.3	PO1,PO5,PO7
IV	13. Explain PERT	IV	R	E6113.4	PO1,PO5,PO7
	14. Explain Crashing of Project Network	IV	U	E6113.4	PO1,PO5,PO7
	15. Explain Steps in Project Appraisal Process	IV	R	E6113.4	PO1,PO5,PO7
	16. Explain project manager evaluations	IV	R	E6113.4	PO1,PO5,PO7
V	17. Explain social network building	V	U	E6113.5	PO1,PO5,PO7

	18. Explain qualities of an effective project manager	V	U	E6113.5	PO1,PO5,PO7
	19. Evaluate Five Stage Team Development Model	V	An	E6113.5	PO1,PO5,PO7
	20. Explain project team pitfalls	V	U	E6113.5	PO1,PO5,PO7

QUESTION PAPER SETTING :

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **Ap**-Apply	**An-** Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

EEE 6114- FINANCE FUNDAMENTALS

L	T	P	C
3	0	0	3

Programme Name : EEE
Course Code : EEE6114
Semester : VI SEMESTER
Course Title : FINANCE FUNDAMENTALS
Course Type : THEORY

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Finance Fundamentals	3	45	40	100*	100	3Hrs

***** Examinations will be conducted for 100 marks will be converted to 60 marks.

TOPICS AND ALLOCATION OF HOURS

Unit	Topics	Time (Hrs)
I	Personal finance	9
II	Business funding	9
III	Finance language	9
IV	Budgeting	9
V	Marginal costing	9
Total		**45**

COURSE DESCRIPTION:

This course gives a deep insight into the finance fundamentals such as money management and the process of acquiring needed funds. It also encompasses the oversight, creation, and study of money, banking, credit, investments, assets, liabilities that make up financial systems and improves overall financial literacy.

COURSE OBJECTIVES:

The objective of this course is to enable the student to

- Identify different ways to save money for future
- Understand various techniques to raise capital

- Get acquainted with the essential terminologies used in finance language
- Get exposed to different types of budgeting
- Instill the concept of costing and its impact on profitability

COURSE OUTCOMES:

After successful completion of this course, the students should be able to	
E6114.1	Manage financial resources effectively to achieve personal goals
E6114.2	Ensure that the business has enough money to meet its obligations and that it can recover in the future
E6114.3	Exhibit financial literacy through the usage of different terminologies appropriate to the context
E6114.4	Differentiate different types of budgeting and allocate the resource
E6114.5	Apply the idea of marginal costing in decision making

Pre-requisites

Knowledge of basic industries

CO/PO & PSO Mapping Matrix:

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E6114.1	3	3	3	3	3	3	3	3	3	3
E6114.2	3	3	3	3	3	3	3	3	3	3
E6114.3	3	3	3	3	3	3	3	3	3	3
E6114.4	3	3	3	3	3	3	3	3	3	3
E6114.5	3	3	3	3	3	3	3	3	3	3
Total	15	15	15	15	15	15	15	15	15	15
Correlation Level	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice- activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real- world scenarios when possible.

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Units 1&2)	Written test (Unit 3 & 4)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	6th Week	12th Week	13th -14th Week	16th Week	

CONTINUOUS ASSESSMENT

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 10 Marks for the internal assessment.

CA1and CA2, Assessment test should be conducted for two units as below

- PART A: (5 X 10 Marks = 50 Marks).
- Eight questions will be asked, students should write five questions. Four questions can be asked from each unit.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 10 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 10 marks for the internal assessment.

Question Pattern:

- Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.
- Four questions will be asked from every unit. Students should write any two questions.

Question Pattern - Model Examination and End Semester Examination Theory Exam

PART- A (5 X2X 10 Marks = 100 Marks)

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.

Sample:

I	1.
	2.
	3.
	4.
II	5.
	6.
	7.
	8.
III	9.
	10.
	11.
	12.
IV	13.
	14.
	15.
	16.
V	17.
	18.
	19.
	20.

QUESTION PAPER SETTING :

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **AP**-Apply	**An**- Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

EEE 6114- FINANCE FUNDAMENTALS

L	T	P	C
3	0	0	3

THEORY

Unit I	**PERSONAL FINANCE**	**[9 Hrs]**
	Personal Finance – Meaning, Objectives and advantages	[1 Hr]
	Individual Perspective – Family Perspective	[1 Hr]
	Time Value of Money Personal Savings: Meaning,	[2 Hrs]
	Different modes of Saving Bank Deposit, Online Investments, Insurance, Stocks,	[2 Hrs)
	Gold, Real Estate Returns Vs Risk	[1 Hr]
	Financial Discipline Setting Alerts for commitments (With Real time Examples)	[2 Hrs]
Unit II	**BUSINESS FUNDING**	**[9 Hrs]**
	Sources: Personal Savings Borrowings	[3 Hrs]
	Venture Capital Venture Capital Process	[3 Hrs]
	Commercial Banks Government Grants and Scheme	[3 Hrs]
Unit III	**FINANCE LANGUAGE**	**[9Hrs]**
	Capital – Drawing – Income – Expenditure	[1 Hr]
	Revenue Vs Capital Items Assets – Fixed Assets Current Assets – Fictitious Assets –	[2 Hrs]
	Liabilities Long-term Liabilities – Current Liabilities Internal Liabilities –	[1 Hr]
	External Liabilities Share holders fund: Equity Share capital, Preference Share Capital,	[2 Hrs]
	Reserve & Surplus – Borrowings: Debentures, Bank Loan,	[2 Hrs]
	Other Loan – Depreciation – Reserve Vs Provision.	[1 Hr]
Unit IV	**BUDGETING**	**[9 Hrs]**
	Budgetary Control Meaning Preparation of various budgets	[3 Hrs]
	Purchase budget Sales Budget	[2 Hrs]
	Production budget Cash Budget	[2 Hrs
	Flexible budgets.	[2 Hrs
Unit V	**MARGINAL COSTING**	**[9 Hrs]**
	Marginal Costing – Meaning	[1 Hr]
	Marginal Costing Vs Absorption Costing	[1 Hr]
	Concepts of Variable Cost, Fixed Cost and Contribution	[1 Hr]
	PV Ratio – Break Even Point – Margin of Safety	[1 Hr]
	Key Factor – Application of Marginal Costing in decision making	[1 Hr]
	Make or Buy – Shutdown or Continue	[1 Hr]
	Exploring New Markets (With Problems)	[1 Hr]
	TOTAL HOURS	**45**

Suggested List of Students Activity Financial Statement Analysis:

- Activity: Analyze and interpret financial statements, including balance sheets, income statements, and cash flow statements of different companies.
- Purpose: This activity helps students understand the financial health and performance of organizations, developing skills in financial analysis and critical thinking.

Investment Portfolio Management:

- Activity: Create and manage a simulated investment portfolio, making decisions on asset allocation, stock selection, and diversification.
- Purpose: This allows students to apply theoretical concepts in a practical setting, learning how to evaluate investment opportunities and manage financial risk.

Case Study Analysis:

- Activity: Examine real-world case studies involving financial decisions made by companies, such as capital budgeting, mergers and acquisitions, and financial restructuring.
- Purpose: Case studies provide insights into the application of finance principles in business scenarios, enhancing problem-solving and decision-making skills.

Financial Modeling:

- Activity: Build financial models using spreadsheets to forecast future financial performance, conduct sensitivity analysis, and evaluate business projects.
- Purpose: Financial modeling is a critical skill in finance, enabling students to project financial outcomes and support strategic decision- making with quantitative analysis.

Classroom Discussions and Debates:

- Activity: Participate in discussions and debates on current financial issues, market trends, and economic policies.
- Purpose: Engaging in discussions helps students stay informed about the latest developments in finance, develop their communication skills, and form well-rounded opinions on financial matters.

Text Books

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Banking Theory, Law & Practice	L. Natarajan	Margham Publications 1st edition, 2019
2.	Management Accounting	T.S. Reddy and Dr. Y. Hariprasad Reddy	Margham Publications 1st edition, 2005
3.	Cost Accounting,	T.S. Reddy and Dr. Y. Hariprasad Reddy	Margham Publications 1st edition, 2012

MODEL QUESTION PAPER

EEE 6114-FINANCE FUNDAMENTALS

Time :3 Hrs **Max.Marks:100**

Note : Answer any 10 questions in PART A. Each question carries 10 mark.

PART- A (5 X2X10= 100 Marks)					
Answer any Fifteen questions		**Unit**	**Bloom's Level**	**CO**	**PO**
1.	1.Write the Objectives and advantages of Personal Finance.	I	R	E6114.1	PO1, PO2, PO3
	2.(i)Explain about the Different modes of Saving. (ii)Explain about the Setting Alerts for commitments	I	U	E6114.1	PO1, PO2
	3.(i)Explain about the Individual Perspective. (ii)Write short notes on Time Value of Money	I	R	E6114.1	PO1, PO2, PO3
	4.(i)Explain about the Financial Discipline. (ii)Differentiate Returns and Risk.	I	U	E6114.1	PO1, PO2, PO3
2.	5. Explain about the Personal Savings.	II	R	E6114.2	PO1, PO2, PO3
	6.(i)Explain Borrowings. (ii)Explain about the Commercial Banks.	II	R	E6114.2	PO1, PO2, PO3
	7. Explain about the process of Venture Capital. .	II	U	E6114.2	PO1, PO2, PO3
	8.Briefly Explain about the Government Grants and Scheme.	II	R	E6114.2	PO1, PO2
3.	9. Explain about Assets.	III	U	E6114.3	PO1, PO2
	10. Describe about Liabilities.	III	U	E6114.3	PO2, PO3
	11.(i)Explain about the Share holders fund. (ii)Differentiate Reserve & Provision. Reserve & Surplus	III	U	E6114.3	PO2, PO3
	12.(i)Explain about the Depreciation (ii)Explain Expenditure	III	U	E6114.3	PO2, PO3
4.	13. Explain about the Budgetary Control.	IV	U	E6114.4	PO2, PO3
	14. Explain about the Preparation of various budgets.	IV	R	E6114.4	PO2, PO3, PO4
	15. (i)Explain about the Purchase budget.. (ii)Explain about the Production budget.	IV	R	E6114.4	PO2, PO3, PO4
	16.(i)Explain about the Sales Budget. (ii)Explain about the Cash Budget.	IV	U	E6114.4	PO1, PO2,PO3,PO4
5.	17.(i)Explain about the Marginal Costing. (ii)Differentiate Marginal Costing & Absorption Costing	V	U	E6114.5	PO1, PO2,PO3,PO4
	18.(i)Explain about the Concepts of Variable Cost. (ii)Explain about the Fixed Cost and Contribution.	V	R	E6114.5	PO1,PO2,PO3, PO4, PO5

	19.(i)Explain about the PV Ratio. (ii)Explain about the Break Even Point.	V	R	E6114.5	PO2, PO3, PO4
	20(i).Explain about the Exploring New Markets (ii)Explain about the Application of Marginal Costing in decision making	V	U	E6114.5	PO1,PO2,PO3, PO4

QUESTION PAPER SETTING:

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **AP-**Apply	**An-** Analyse, **E**-Evaluate, **C-**Create
% to be included	90 %	10 %

EEE 6115-INDUSTRIAL MANAGEMENT AND SAFETY

L	T	P	C
3	0	0	3

Programme Name : EEE
Course Code : EEE6115
Semester : VI SEMESTER
Course Title : INDUSTRIAL MANAGEMENT AND SAFETY
Course Type : THEORY

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Industrial Management And Safety	3	45	40	100*	100	3Hrs

***** Examinations will be conducted for 100 marks will be converted to 60 marks**.**

TOPICS AND ALLOCATION OF HOURS

Unit	Topics	Time (Hrs)
I	Electrical safety, shocks and their prevention	9
II	Safety during installation of plant and equipment	9
III	Electrical safety in residential, commercial and Agricultural	9
IV	Equipment earthing and system neutral earthing	9
V	Safety management of electrical systems & IE rules and acts	9
Total		45

COURSE DESCRIPTION:

A safety management system (SMS) is defined as an organization-wide process designed to manage safety risk in the workplace. A safety management system can be created to fit any business type and/or industry sector. Industrial safety in the context of occupational safety and health refers to the management of all operations and events within an industry, for protecting its employees and assets by minimizing hazards, risks, accidents and near misses. The relevant laws, compliance and best practices in the industry have most of the issues addressed for the best protection possible. Employers are to make sure that these are strictly adhered to have maximum safety.

COURSE OBJECTIVES:

The objective of this course is to enable the student to

- Ensure protection of worker's rights and to redress their grievances.
- Prevent not only the major industrial accidents.
- Prevent the accidents causing permanent or partial disablement.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to	
E6115.1	Explain the objectives and precautions of Electrical Safety, effects of Shocks and their Prevention.
E6115.2	Summarize the Safety aspects during Installation of Plant and Equipment.
E6115.3	Describe the electrical safety in residential, commercial and agricultural installations.
E6115.4	Describe the various Electrical Safety in Hazardous Areas, Equipment Earthing and System Neutral Earthing.
E6115.5	State the electrical systems safety management and IE rules.

Pre-requisites:

- Knowledge of basic Industries and Safety system.

CO/PO & PSO Mapping Matrix:

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E6115.1	3	3	3	3	3	3	3	3	3	3
E6115.2	3	3	3	3	3	3	3	3	3	3
E6115.3	3	3	3	3	3	3	3	3	3	3
E6115.4	3	3	3	3	3	3	3	3	3	3
E6115.5	3	3	3	3	3	3	3	3	3	3
Total	15	15	15	15	15	15	15	15	15	15
Correlation Level	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.

- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Units 1&2)	Written test (Unit 3 & 4)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	6^{th} Week	12^{th} Week	13^{th} -14^{th} Week	16^{th} Week	

CONTINUOUS ASSESSMENT

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 10 Marks for the internal assessment.

CA1and CA2, Assessment test should be conducted for two units as below

- PART A: (5 X 10 Marks = 50 Marks).
- Eight questions will be asked, students should write five questions. Four questions can be asked from each unit.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 10 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 10 marks for the internal assessment.

Question Pattern:

- Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.
- Four questions will be asked from every unit. Students should write any two questions.

Question Pattern - Model Examination and End Semester Examination Theory Exam

PART- A (5 X 2X10 = 100 Marks)

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.

Sample:

I	1.
	2.
	3.
	4.
II	5.
	6.
	7.
	8.
III	9.
	10.
	11.
	12.
IV	13.
	14.
	15.
	16.
V	17.
	18.
	19.
	20.

QUESTION PAPER SETTING :

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **AP**-Apply	**An-** Analyse, **E-**Evaluate, **C-**Create
% to be included	90 %	10 %

EEE 6115-INDUSTRIAL MANAGEMENT AND SAFETY

Unit I	**ELECTRICAL SAFETY, SHOCKS AND THEIR PREVENTION**	**[9Hrs]**
Terms and definitions - Objectives of safety and security measures		[1Hr]
Hazards associated with electric current and voltage		[1Hr]
Principles of electrical safety - Approaches to prevent Accidents		[1Hr]
Scope of subject electrical safety. Primary and secondary electrical shocks		[1Hr]
possibilities of getting electrical shock and its severity		[1Hr]
medical analysis of electric shocks and its effects shocks due to flash/ Spark over's -		[1Hr]
prevention of shocks safety precautions against contact shocks, flash shocks, burns,		[1Hr]
residential buildings and shops.		[2Hrs]
Unit II	**SAFETY DURING INSTALLATION OF PLANT AND EQUIPMENT**	**[9Hrs]**
Introduction - preliminary preparations - preconditions for start of installation work –		[1Hr]
risks during installation of electrical plant and equipment –		[1Hr]
safety aspects during installation - field quality and safety during erection-		[2Hrs]
personal protective equipment for erection personnel –		[1Hr]
installation of a large oil immersed power transformer –		[1Hr]
installation of outdoor switchyard equipment –		[1Hr]
safety during installation of electrical rotating machines –		[1Hr]
drying out and insulation resistance measurement of rotating machines.		[1Hr]
Unit III	**ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL AND AGRICULTURAL**	**[9Hrs]**
Wiring and fitting – Domestic appliances –		[2Hrs]
water tap giving shock – shock from wet wall – fan firing shock –		[2Hrs]
multi-storied building – Temporary installations –		[2Hrs]
Agricultural pump installation –		[1Hr]
Do's and Don'ts for safety in the use of domestic electrical appliances.		[2Hrs]
Unit IV	**EQUIPMENT EARTHING AND SYSTEM NEUTRAL EARTHING**	**[9Hrs]**
Introduction Distinction between system grounding and Equipment Grounding		[2Hrs]
Equipment Earthing Functional Requirement of earthing system description of a		[2Hrs]
earthing system.Neutral grounding (System Grounding)		[2Hrs]
Types of Grounding, Methods of Earthing Generators Neutrals.		[3Hrs]

Unit V	SAFETY MANAGEMENT OF ELECTRICAL SYSTEMS & IE RULES AND ACTS [9Hrs]

SAFETY MANAGEMENT OF ELECTRICAL SYSTEMS: Management Safety Policy - Safety organization - safety auditing – Motivation to managers, Supervisors and Employees. REVIEW OF IE RULES AND ACTS AND THEIR SIGNIFICANCE: Objective and scope –ground clearances and section clearances – standards on electrical safety - safe limits of current, voltage – Rules regarding first aid and fire fighting facility – The Electricity Act, 2003, (Part 1, 2, 3,4 & 5)	[2Hrs] [1Hr] [2Hrs] [1Hr] [1Hr] [1Hr] [1Hr]
TOTAL PERIODS	**45**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments basedon the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

Textbook

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Electrical safety, fire safety Engineering and safety management	Prof. S. Rao, H.L. Saluja	Khanna Publishers, 1997.
2.	Energy management policy, planning and utilization	Pradeep Chaturvedi	Concept Publishing company, 1997.

MODEL QUESTION PAPER

EEE6115-INDUSTRIAL MANAGEMENT AND SAFETY

Time :3 Hrs **Max.Marks:100**

Note : Answer any 10 questions in PART A. Each question carries 10 mark.

PART- A (5 X2X 10= 100 Marks)					
Note: answer ten questions by selecting two questions from each unit. Each question carries 10 marks					
Questions		**Unit**	**Bloom's Level**	**CO**	**PO**
I	1.What is the objective of safety and security measures in electrical safety?	I	R	E6115.1	PO1, PO2, PO3
	2.What are the basic electrical safety principles?	I	U	E6115.1	PO1, PO2
	3.What are primary and secondary shocks?	I	R	E6115.1	PO1, PO2, PO3
	4.What is prevention of shock and explain the ways of prevention?	I	U	E6115.1	PO1, PO2, PO3
II	5.What are the hazards when installing electrical equipment?	II	R	E6115.2	PO1, PO2, PO3
	6.What are the safety aspects during installation of industrial plants?	II	R	E6115.2	PO1, PO2, PO3
	7.Explain about the installation of outdoor switchyard equipment?	II	U	E6115.2	PO1, PO2, PO3
	8.What are the common safety hazards associated with rotating equipment?	II	R	E6115.2	PO1, PO2
III	9.Which type of circuit used in domestic appliances and why?	III	U	E6115.3	PO1, PO2
	10.Which type of wiring is suitable for multi storey building and explain it?	III	U	E6115.3	PO2, PO3
	11.What are the temporary electrical	III	U	E6115.3	PO2, PO3
	12.What are the steps to installing Agricultural pump?	III	U	E6115.3	PO2, PO3
IV	13.What is the difference between equipment grounding and system grounding?	IV	U	E6115.4	PO2, PO3
	14.What are the requirements for an earthing system?	IV	R	E6115.4	PO2, PO3, PO4
	15.How many types of grounds are there and explain?	IV	R	E6115.4	PO2, PO3, PO4
	16.Define earthing and explain the methods of earting?	IV	U	E6115.4	PO1, PO2,PO3,PO4
V	17.What is safety management policy?	V	U	E6115.5	PO1, PO2,PO3,PO4

	18.What are all the purposes of an electrical safety auditing?	V	R	E6115.5	PO1, PO2,PO3,PO4, PO5
	19.What is the maximum voltage a human can withstand?	V	R	E6115.5	PO2, PO3, PO4
	20.What are the standards of electrical safety at work place?	V	U	E6115.5	PO1, PO2,PO3,PO4

QUESTION PAPER SETTING:

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **Ap**-Apply	**An-** Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

EEE 6116-BATTERY MANAGEMENT SYSTEM

L	T	P	C
3	0	0	3

Programme Name : EEE
Course Code : EEE6116
Semester : VI SEMESTER
Course Title : BATTERY MANAGEMENT SYSTEM
Course Type : THEORY

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Battery Management System	3	45	40	100*	100	3Hrs

***** Examinations Will Be Conducted For 100 Marks Will Be Converted To 60 Marks.

TOPICS AND ALLOCATION OF HOURS

Unit	Topics	Time (Hrs)
I	Introduction to battery management system	9
II	Energy storage system	9
III	Battery parameters & charging	9
IV	EV battery efficiency	9
V	Battery testing, disposal & recycling	9
Total		**45**

COURSE DESCRIPTION:

Battery management system (BMS) is technology dedicated to the oversight of a battery pack, which is an assembly of battery cells, electrically organized in a row x column matrix configuration to enable delivery of targeted range of voltage and current for a duration of time against expected load scenarios. Energy storage systems play a crucial role in enhancing the stability, reliability, and flexibility of electrical grids by providing a buffer that can balance energy supply and demand. They can store energy in various forms, such as electrical, mechanical, chemical, or thermal, and release it when needed.

COURSE OBJECTIVES:

The objective of this course is to enable the student to

- Understand the different types of energy storage system.
- Study about the battery characteristic & parameters.
- Model the types of batteries.
- Know the concepts of battery management system and design the battery.
- Study about the battery testing, disposal and recycling.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to	
E6116.1	Discuss about the different types of energy storage system.
E6116.2	Describe about the battery characteristic & parameters.
E6116.3	Model different types of batteries.
E6116.4	Apply the concepts of battery management system and design the battery pack.
E6116.5	Explain about the battery testing, disposal and recycling.

Pre-requisites:

- Basics of Science
- Basics of Batteries

CO/PO & PSO Mapping Matrix:

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E6116.1	3	3	3	3	3	3	3	3	3	3
E6116.2	3	3	3	3	3	3	3	3	3	3
E6116.3	3	3	3	3	3	3	3	3	3	3
E6116.4	3	3	3	3	3	3	3	3	3	3
E6116.5	3	3	3	3	3	3	3	3	3	3
Total	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**
Correlation Level	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications

to help students understand and appreciate course concepts.

- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Units 1&2)	Written test (Unit 3 & 4)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	6th Week	12th Week	13th -14th Week	16th Week	

CONTINUOUS ASSESSMENT

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 10 Marks for the internal assessment.

CA1and CA2, Assessment test should be conducted for two units as below

- PART A: (5 X 10 Marks = 50 Marks).
- Eight questions will be asked, students should write five questions. Four questions can be asked from each unit.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 10 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 10 marks for the internal assessment.

Question Pattern:

- Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.

- Four questions will be asked from every unit. Students should write any two questions.

Question Pattern - Model Examination and End Semester Examination Theory Exam

PART- A (5 X 2X10Marks = 100 Marks)

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.

Sample:

I	1.
	2.
	3.
	4.
II	5.
	6.
	7.
	8.
III	9.
	10.
	11.
	12.
IV	13.
	14.
	15.
	16.
V	17.
	18.
	19.
	20.

QUESTION PAPER SETTING :

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **AP**-Apply	**An-** Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

EEE 6116-BATTERY MANAGEMENT SYSTEM

L	T	P	C
3	0	0	3

Theory Portion :		
Unit I	**INTRODUCTION TO BATTERY MANAGEMENT SYSTEM**	**[9 Hrs]**
Definition of Battery Management System		[1Hr]
Block Diagram of Battery Management System		[1Hr]
Battery Management System parts – Why a BMS is required in any Energy storage system – PLC based BMS Safety Management: Over current protection		[2Hrs]
Over charge and over discharge protection – Over temperature protection		[2Hrs]
Topological relationship between a Battery Monitoring Circuit (BMC) and a cell		[1Hr]
Topological relationship between a Battery Monitoring Circuit (BMC) and a Battery		[1Hr]
Control Unit (BCU) The benefits of battery management systems.		[1Hr]
Unit II	**ENERGY STORAGE SYSTEM**	**[9 Hrs]**
Batteries: Lead Acid Battery, Nickel based batteries, Sodium based batteries, Lithium based batteries		[2Hrs]
Li-ion & Li-poly, Metal Air Battery, Zine Chloride battery		[2Hrs]
Ultra capacitors - Flywheel Energy Storage System		[2Hrs]
Hydraulic Energy Storage System		[2Hrs]
Comparison of different Energy Storage System.		[1Hr]
Unit III	**BATTERY PARAMETERS & CHARGING**	**[9 Hrs]**
General definitions: Cell and Battery – Energy Density –		[1Hr]
Power Density – Rated Capacity - Specific Energy - Specific Power –		[1Hr]
Efficiency of batteries - State of Charge (SOC) - C-rate - State of Health (SOH) –		[1Hr]
Cycle Life - Cut-off voltage - Self-Discharge - Nominal Voltage.		[1Hr]
Charging modes: Low rate charging – Quick charging – Fast Charging - Top-off or equalization charging –		[2Hrs]
Trickle or maintenance charging - Reflex or ‘burp’ charging.		[1Hr]
End-of-charge triggers: Timed end-of-charge trigger - Maximum temperature end-of-charge trigger - Maximum voltage end-of-charge trigger.		[2Hrs]
Unit IV	**EV BATTERY EFFICIENCY**	**[9 Hrs]**
Factors affecting battery efficiency		[1Hr]
Regenerative Braking - Variation of battery cell voltage during early formation cycles		[1Hr]
Battery failure modes due to operating conditions		[1Hr]
Failure modes associated with excessive battery charging		[1Hr]
Failure modes associated with inadequate battery charging		[1Hr]
Failure modes associated with battery storage conditions		[1Hr]
Self discharge of NiMH battery stored at 100%		[1Hr]
SOC - Traction Battery Pack Design		[1Hr]
General approach of Battery modeling.		[1Hr]
Unit V	**BATTERY TESTING, DISPOSAL & RECYCLING**	**[9 Hrs]**

Battery Testing: Constant current discharge test – Peak Power Test	[1Hr]
Constant Power Test - Variable Power Discharge Test - Partial Discharge Test	[1Hr
Stand loss Test- Thermal Performance Test - Battery Vibration Test - Fast Charge Test.	[1Hr]
Limitations for transport and storage of cells and batteries	[1Hr]
Battery Leakage: gas generation in batteries, leakage path, leakage rates	[1Hr]
Explosions: Causes of battery explosions, explosive process	[1Hr]
Thermal Runway: High discharge rates, Short circuits, charging and discharging	[1Hr]
Environment and Human Health impact assessments of batteries	[1Hr]
General recycling issues and drivers –methods of recycling of EV batteries.	[1Hr]
TOTAL PERIODS	**45**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application

Textbook

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Thermal Management of Electric Vehicle Battery Systems	Ibrahim Dinçer, Halil S. Hamut and Nader Javani,	First Edition, John Wiley& Sons Ltd., 2016.
2.	Battery Management SystemsDesign by Modelling	H.J. Bergveld, Wanda S. Kruijt and Peter P.H.L	Springer Science Business Media, 2001.
3.	Electric Vehicle battery systems	Sandeep Dhameja	Newnes, 2001.
4.	“Electric Vehicle Technology Explained”	James Larminie, John Lowry,	John Wiley & SonsLtd, 2003.

Web-based/Online Resources:

S.NO	Web-based/Online Resources
1	https://mnre.gov.in/energy-storage-systemsess-overview/

MODEL QUESTION PAPER

EEE6116-BATTERY MANAGEMENT SYSTEM

Time :3 Hrs **Max.Marks:100**

Note : Answer any 10 questions in PART A. Each question carries 10 mark.

PART- A (5 X2X10= 100 Marks)

Note: answer ten questions by selecting two questions from each unit. Each question carries 10 marks

	Questions	Unit	Bloom's Level	CO	PO
I	1.Explain about battery management system?	I	R	E6116.1	PO1, PO2, PO3
	2.Explain why BMS is required in any storage system?	I	U	E6116.1	PO1, PO2
	3.Explain the topological relationship between BMC?	I	R	E6116.1	PO1, PO2, PO3
	4.Explain the benefits of battery management system?	I	U	E6116.1	PO1, PO2, PO3
II	5. Explain about Lead acid battery, Lithium based battery?	II	R	E6116.2	PO1, PO2, PO3
	6.Explain about ultra capacitors	II	R	E6116.2	PO1, PO2, PO3
	7.Explain the flywheel energy storage system	II	U	E6116.2	PO1, PO2, PO3
	8.Explain hydraulic energy storage system.	II	R	E6116.2	PO1, PO2
III	9.Briefly explain SOC,SOH	III	U	E6116.3	PO1, PO2
	10.Explain the efficiency of batteries .	III	U	E6116.3	PO2, PO3
	11.Explain about battery charging modes	III	U	E6116.3	PO2, PO3
	12.Explain about maintenance of charging	III	U	E6116.3	PO2, PO3
IV	13. State and explain what are all the factors affecting battery efficiency?	IV	U	E6116.4	PO2, PO3
	14. Explain the battery failure modes?	IV	R	E6116.4	PO2, PO3, PO4
	15. Explain about failure modes of battery storage?	IV	R	E6116.4	PO2, PO3, PO4
	16. Explain briefly about approach of battery modeling?	IV	U	E6116.4	PO1, PO2,PO3,PO4
V	17. Explain about battery testing?	V	U	E6116.5	PO1, PO2,PO3,PO4

	18.Explain briefly about battery leakage?	V	R	E6116.5	PO1, PO2,PO3,PO4,
	19.State and explain thermal runway?	V	R	E6116.5	PO2, PO3, PO4
	20.Explain about methods of recycling of EV batteries?	V	U	E6116.5	PO1, PO2,PO3,PO4

QUESTION PAPER SETTING:

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **Ap**-Apply	**An-** Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

EEE 6117-INDUSTRIAL AUTOMATION

L	T	P	C
3	0	0	3

Programme Name : EEE
Course Code : EEE6117
Semester : VI SEMESTER
Course Title : INDUSTRIAL AUTOMATION
Course Type : THEORY

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / semester	Internal Assessment	Autonomous Examination	Total	
Industrial Automation	3	45	40	100*	100	3Hrs

* Examinations will be conducted for 100 marks will be converted to 60 marks.

TOPICS AND ALLOCATION OF HOURS

Unit	Topics	Time (Hrs)
I	Introduction to automation	07
II	Detroit – type automation	12
III	Material handling and identification technologies	12
IV	Control technologies in automation	07
V	Automated assembly and testing	07
TOTAL		45

COURSE DESCRIPTION:

Industrial automation can make production lines safe and uses logic-based programs to operate machinery and other industrial equipment technologies. Industrial automation offers a number of benefits over traditional manual labour. Automated facilities can work faster and more accurately than human workers, and they can operate around the clock without tiring and can collect data for monitoring the health status of the equipment and reduce waste. Automation can also help to improve safety in hazardous environments.

COURSE OBJECTIVES:

The objective of this course is to enable the students to

- Impart the basic knowledge in automation of industrial processes.
- Learn the different automated flow lines in manufacturing industries.
- Explore the material handling and part identification techniques.
- Learn about control system, assembly system and testing in modern manufacturing industries

COURSE OUTCOMES:

On successful completion of this course, the student will be able to	
E6117.1	Understand the basics of automation and analyze the cost effective of automated system.
E6117.2	Identify the suitable flow lines and understand the computer simulation for the Automation of given application.
E6117.3	Describe material handling and relevant technologies for the automation.
E6117.5	Differentiate various control aspects of automation.
E6117.6	Demonstrate the automation for assembly line and testing of manufacturing industry.

Pre-requisites

Basic Electrical and Electronics Engineering.

CO-POs & PSOs MAPPING

CO-POs &PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E6117.1	3	3	3	3	2	2	3	3	2	2
E6117.2	3	3	3	3	2	2	3	3	2	2
E6117.3	3	3	3	3	2	2	3	3	2	2
E6117.5	3	3	3	3	2	2	3	3	2	2
E6117.6	3	3	3	3	2	2	3	3	2	2
Total	**15**	**15**	**15**	**15**	**10**	**10**	**15**	**15**	**10**	**10**
Correlation Level	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Units 1&2)	Written test (Unit 3 & 4)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	6th Week	12th Week	13th -14th Week	16th Week	-

CONTINUOUS ASSESSMENT

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 10 Marks for the internal assessment.

CA1and CA2, Assessment test should be conducted for two units as below

- PART A: (5 X 10 Marks = 50 Marks).
- Eight questions will be asked, students should write five questions. Four questions can be asked from each unit.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 10 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 10 marks for the internal assessment.

Question Pattern:

- Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.
- Four questions will be asked from every unit. Students should write any two questions.
- Question Pattern - Model Examination and End Semester Examination Theory Exam

  PART- A (5 X 2X10 Marks = 100 Marks)

  Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.

Sample:

I	1.
	2.
	3.
	4.
II	5.
	6.
	7.
	8.
III	9.
	10.
	11.
	12.
IV	13.
	14.
	15.
	16.
V	17.
	18.
	19.
	20.

QUESTION PAPER SETTING :

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **AP**-Apply	**An-** Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

MODEL QUESTION PAPER

EEE6117-INDUSTRIAL AUTOMATION

Time :3 Hrs **Max.Marks:100**

Note : Answer any 10 questions in PART A. Each question carries 10 mark.

PART- A (5 X2X10= 100 Marks)					
Note: answer ten questions by selecting two questions from each unit. Each question carries 10 marks					
	Questions	**Unit**	**Bloom's Level**	**CO**	**PO**
I	1.Explain industrial automation principle and strategies?	I	R	E6117.1	PO1, PO2, PO3
	2.What are the method of evaluating investment alternatives?	I	U	E6117.1	PO1, PO2
	3.What are the advanced automation function?	I	R	E6117.1	PO1, PO2, PO3
	4.Explain unit cost of production?	I	U	E6117.1	PO1, PO2, PO3
II	5.Explain different method of work part transport?	II	R	E6117.2	PO1, PO2, PO3
	6.What are the control function of industrial automation?	II	R	E6117.2	PO1, PO2, PO3
	7.An analysis of automated flow lines?	II	U	E6117.2	PO1, PO2, PO3
	8.Explain computer simulation process of automated flow lines?	II	R	E6117.2	PO1, PO2
III	9.Explain different types of material handling equipment?	III	U	E6117.3	PO1, PO2
	10.Briefly explain automated guided vehicle system?	III	U	E6117.3	PO2, PO3
	11.Explain automated storage systems?	III	U	E6117.3	PO2, PO3
	12.Explain interfacing handling and storage with manufacturing?	III	U	E6117.3	PO2, PO3
IV	13.Explain industrial control system?	IV	U	E6117.4	PO2, PO3
	14.Draw and explain automatic process control?	IV	R	E6117.4	PO2, PO3, PO4
	15.What are the building blocks of automation system?	IV	R	E6117.4	PO2, PO3, PO4
	16.Write short notes on 1.Scada system 2.RTU?	IV	U	E6117.4	PO1,PO2,PO3
V	17.Draw and explain design for automated assembly system?	V	U	E6117.5	PO1,PO2,PO3
	18.Explain analysis of single station assembly machine?	V	R	E6117.5	PO1,PO2,PO3,
	19.What are the automated inspection methods?	V	R	E6117.5	PO2, PO3, PO4
	20.Explain sensor technology for automated inspection?	V	U	E6117.5	PO1 PO2,PO3

QUESTION PAPER SETTING:

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **Ap**-Apply	**An**- Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

EEE6231- HVAC (R & AC)

L	T	P	C
2	0	2	3

Programme Name : EEE
Course Code : EEE6231
Semester : VI SEMESTER
Course Title : HVAC(R&AC)
Course Type : PRACTICUM

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
HVAC (R & AC)	4	60	40	100*	100	3Hrs

* Examinations will be conducted for 100 marks will be converted to 60 marks.

TOPICS AND ALLOCATION OF HOURS

Unit	Topics	Time (Hrs)
I	Compressor	12
II	Condenser	12
III	Expansion device and cooling tower	12
IV	Evaporator	12
V	HVAC controls and wiring circuit	12
	Total	60

COURSE DESCRIPTION:

To impart knowledge about HVAC system, handling the components and testing the performance is very much needed. This content would be useful to select the various types of components to be used in HVAC systems with different capacities. The knowledge about VFD compressor and capacity calculation of cooling coil is very essential in the present scenario.

COURSE OBJECTIVES

The objective of this course is to enable the students to

- Find the CSR terminals and test the pumping capacity of sealed compressor
- Determine the heat transfer of air cooled condenser.
- Determine the capacity of cooling tower.
- Determine the capacity of sealed system by capillary tube and thermostatic expansion device.
- Determine the heat transfer of evaporator.
- Set and adjust the low pressure cut out in VCR system.

- Draw the wiring diagram of RSIR and CSIR starting circuit.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to	
E6231.1	Check the CSR terminals and test the pumping capacity of sealed compressor.
E6231.2	Determine the heat transfer of air cooled condenser for window and split air conditioner.
E6231.3	Determine the capacity of cooling tower and capacity of sealed system by expansion devices.
E6231.4	Determine the heat transfer of evaporator for window and split air conditioner.
E6231.5	Set and Adjust the low pressure cut out in VCR system and draw the wiring diagram of RSIR and CSIR starting circuit.

Pre-requisites:

- Basics of Science and Engineering.

CO/PO & PSO Mapping Matrix:

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E6231.1	3	3	3	-	-	-	-	3	-	1
E6231.2	3	3	3	2	-	-	-	3	-	1
E6231.3	3	3	3	-	-	-	-	3	-	1
E6231.4	3	3	3	-	-	-	-	3	-	1
E6231.5	3	3	3	2	-	-	-	3	-	1
Total	15	15	15	4	-	-	-	15	-	5
Correlation Level	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**-**	**1**

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- It is advised that teachers take steps to pique pupils' attention and boost their learning confidence.
- To help students learn and appreciate numerous concepts and principles in each area, teachers should provide examples from daily life, realistic situations, and real-world engineering and technological applications.
- The demonstration can make the subject exciting and foster in the students a scientific mindset. Student activities should be planned on all the topics.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices are under a simulated environment (may be followed by a real environment as far as possible).

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written Test Theory (Two Units)	Written Test Theory (Another Two Units)	Practical Test (All Exercises)	Written Test (Complete Theory Portions)	Written Examination (Complete Theory Portions)
Duration	2 Periods	2 Periods	3 hour	3 hours	3 hours
Exam Marks	50	50	100	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	6th Week	12th Week	15th Week	16th Week	-

CONTINUOUS ASSESSMENT

Note:

- **CA1 and CA2:** Assessment written test should be conducted for 50 Marks. The marks scored will be converted to 10 Marks for each test. CA1 and CA2, Assessment written test should be conducted for two units as below. Answer any five questions. (5 X 10 Marks = 50 Marks). Eight questions will be asked, students should write five questions.
  Each unit Four questions can be asked.
- **CA 3:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one experiment by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded for 100 marks will be converted to 10 Marks for the internal mark.
  Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. Each exercise/experiment should be evaluated for 10 Marks. The total marks awarded should be converted to 30 Marks for the practical test as per the scheme of evaluation as below.

The details of the practical documents to be prepared as per the instruction below.

Each exercise observation and calculations should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next exercise.

This documentation can be carried out in a separate notebook or printed manual or file. The reading and calculations and graph should be written by the student manually. The evaluated practical document should be submitted for the Practical Test (CA3). The mark scored by the students should be converted to 30 marks. The same should be included as per the allocation in the practical test.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad.

SCHEME OF EVALUATION - Practical Test

S.No	Description	Marks
A	Aim & Apparatus Required	10
B	Diagram & Procedure	20
C	Execution	15
D	Output/Result	15
E	Practical Documents (All Exercises)	30
F	Viva Voce	10
TOTAL		100

- **CA4:** Model examination should be conducted for complete theory portions as per the end semester question pattern. The marks awarded should be converted to 10 marks for the internal assessment.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions.

QUESTION PAPER SETTING:

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **AP**-Apply	**An-** Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

Question Pattern - Model Examination and End Semester Examination - Theory Exam

PART- A (5X2X 10 Marks = 100 Marks)

Note: Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each.

The questions are to be numbered from 1 to 20. All the units are to be covered with equal weightage.

PART – A	**5X2** X 10 = **100** marks
Total	**100** Marks *

Note: * Autonomous Examinations will be conducted for 100 Marks and converted to 60 Marks**.**

EEE6231 – HVAC (R & AC)

L	T	P	C
2	0	2	3

THEORY:

Unit I	**COMPRESSOR**	[6Hrs]
Compressor – Introduction - functions of a compressor		[1Hr]
Classification - open type reciprocating compressor – Compression ratio, Clearance volume, Volumetric Efficiency		[1Hr]
Definition only. Construction & working of single acting and single stage reciprocating compressor.		[1Hr]
Hermetically sealed compressors – construction and working		[1Hr]
Differences between open type and hermetically sealed type compressor		[1Hr]
Variable frequency driven motor.		[1Hr]
Ex no	**Name of the experiment**	
1.	Determination of CSR terminal of a refrigeration compressor.	[6Hrs]
2.	Testing the pumping capacity of sealed compressor.	
Unit II	**CONDENSER**	[6Hrs]
Condenser - Introduction – Functions		[1Hr]
Classification of condensers		[1Hr]
Air cooled condenser, Water cooled condenser		[1Hr]
Working of air cooled condensers - Types of air-cooled condenser		[1Hr]
Natural convection air cooled condenser - forced convection air cooled condenser		[1Hr]
Base mounted air-cooled condenser and Remote air-cooled.		[1Hr]
3.	Determination of heat transfer of air cooled condenser for window air conditioner.	[6Hrs]
4.	Determination of heat transfer of air cooled condenser for split air conditioner.	
Unit III	**EXPANSION DEVICE AND COOLING TOWER**	[6Hrs]
Expansion devices- Introduction – Functions – Types of expansion devices		[1Hr]
Capillary tube, Automatic expansion valve, Thermostatic expansion valve - Construction and working only.		[1Hr]
Cooling tower - Functions of a cooling tower –. Types of cooling towers		[1Hr]
Natural draft cooling towers – Construction and working of Atmospheric natural draft (spray type) cooling tower		[1Hr]
Mechanical draft cooling tower – Construction and working of forced draft cooling		[1Hr]
tower - Definition of cooling tower range, approach and efficiency.		[1Hr]

5.	Determination of range, approach and efficiency of cooling tower.	[6Hrs]
6.	Determination of COP for sealed system by using capillary and thermostatic expansion device.	
Unit IV	**EVAPORATOR**	[6Hrs]
Evaporator - Introduction – Functions		[1Hr]
Types of evaporators –		[1Hr]
Bare tube coil evaporators- Finned evaporators		[1Hr]
Plate evaporators - Shell and tube evaporators – Shell and coil evaporators		[1Hr]
Natural convection evaporators - forced convection evaporators		[1Hr]
Construction and working only.		[1Hr]
7.	Determination of heat transfer of evaporator for window air conditioner.	[6Hrs]
8.	Determination of heat transfer of evaporator for split air conditioner.	
Unit V	**HVAC CONTROLS AND WIRING CIRCUIT**	[6Hrs]
Motor Operating Components: Selector switch		[1Hr]
OLP – Relay – Capacitor – Starting, Running.		[1Hr]
System Controls: LP, HP cutout		[1Hr]
Humidity control – Thermostat switch– Solenoid valve		[2Hrs]
CSIR and RSIR wiring circuit.		[1Hr]
9.	Setting and Adjusting of low pressure cut out in VCR system.	[6Hrs]
10.	Wiring, Starting and Running of air conditioner with RSIR starting circuit and CSIR circuit.	
TOTAL PERIODS		**60**

Suggested List of Students Activity:

- Prepare/Download a specification of the following: Various tools, Equipments and controls used in HVAC systems.
- Presentation/Seminars by students on any recent technological developments based on the course.

Textbook

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	A Course in Refrigeration and Air-conditioning	Arora and Domkundwar	Dhanpat Rai & Sons Publication, 2018.
2.	Textbook of Refrigeration and Air-conditioning,	R.S Khurmi and J.K. Gupta	Fifth Edition, S. Chand & Co., 2020
3.	Refrigeration and Air-conditioning	C.P. Arora	Third Edition, Mc Graw Hill, 2017.

Equipment / Facilities required to conduct the Practical Portions.

S.No	Name of the Equipment's	QuantityRequired
1.	VCR experimental setup with LP Cutout, Capillary tube and TEV	1 No
2.	Sealed compressor, Multimeter and Pressure gauge	1 No
3.	Window air conditioner	6 Nos
4.	Split air conditioner	6 Nos
5.	Cooling tower	As Required

MODEL QUESTION PAPER

EEE6231 – HVAC (R & AC)

Time : 3 Hrs. **Max. Marks : 100**

PART- A (5 X 2X10= 100 Marks)					
Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks		**Unit**	**Bloom's Level**	**CO**	**PO**
I.	1. Explain the functions of a compressor and its Classification.	I	R	E6231.1	PO2, PO5,PO7
	2. Construction & working of single acting and single stage reciprocating compressor.	I	U	E6231.1	PO2, PO5,PO7
	3. Differences between open type and hermetically sealed type compressor.	I	R	E6231.1	PO2, PO5,PO7
	4. Explain the variable frequency driven motor.	I	U	E6231.1	PO2, PO5,PO7
II.	5. Explain about Classification of condensers	II	R	E6231.2	PO2, PO5,PO7
	6. Explain the Working of air cooled condensers.	II	R	E6231.2	PO2, PO5,PO7
	7. Explain briefly about Natural convection air cooled condenser.	II	U	E6231.2	PO2, PO5,PO7
	8. Explain the Base mounted air cooled condenser.	II	R	E6231.2	PO2, PO5,PO7
III.	9.Explain the Functions and Types of cooling towers.	III	U	E6231.3	PO2, PO5,PO7
	10. Explain the Construction and working of Atmospheric natural draft (spray type) cooling tower.	III	U	E6231.3	PO2, PO5,PO7
	11. Explain the Construction and working of forced draft cooling tower.	III	An	E6231.3	PO2, PO5,PO7
	12. Explain briefly about Definition of cooling tower range, approach and efficiency	III	U	E6231.3	PO2, PO5,PO7
IV.	13. Types of evaporators and explain any two types.	IV	U	E6231.4	PO2, PO5,PO7
	14. Explain the Shell and tube evaporators and Shell and coil evaporators.	IV	R	E6231.4	PO2, PO5,PO7
	15. Explain the Natural convection evaporators.	IV	R	E6231.4	PO2, PO5,PO7
	16. Explain the forced convection evaporators.	IV	U	E6231.4	PO2, PO5,PO7

V.	17. Explain the motor operating components.	V	U	E6231.5	PO2, PO5,PO7
	18. Explain about the system controls.	V	R	E6231.5	PO2, PO5,PO7
	19. Explain the Solenoid valve.	V	R	E6231.5	PO2, PO5,PO7
	20. Explain the CSIR and RSIR wiring circuit.	V	U	E6231.5	PO2, PO5,PO7

QUESTION PAPER SETTING :

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **AP**-Apply	**An**- Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

EEE6232- PCB DESIGN & ASSEMBLY

L	T	P	C
2	0	2	3

Programme Name : EEE
Course Code : EEE6232
Semester : VI SEMESTER
Course Title : PCB DESIGN & ASSEMBLY
Course Type : PRACTICUM

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
PCB Design & Assembly	4	60	40	100*	100	3Hrs

* Examinations will be conducted for 100 marks will be converted to 60 marks.

TOPICS AND ALLOCATION OF HOURS

Unit	Topics	Time (Hrs)
I	Introduction to PCB Design	12
II	Introduction to schematic design	12
III	PCB Design	12
IV	PCB Assembly	9
V	Manual PCB Fabrication	9
REVISION		6
Total		60

COURSE DESCRIPTION:

Printed Circuit Boards (PCBs) are the core component in almost all the electronic gadgets used either for domestic or industrial purposes. PCBs hold almost all electronic components necessary for a device to function. Apart from electrically connecting, it also gives mechanical support to the electrical components. Using PCBs, a highly complicated circuit can be designed in a very small package which helps in reducing the size of electronic devices. PCB design can be done either manually or using software. Electronic design automation tools are software tools used for designing the schematic and layout of PCB.

COURSE OBJECTIVES:

The objective of this course is to enable the students to

- Learn about different types of printed circuit boards and Electronic Design Automation tool.
- Familiarize with drawing schematic for a given circuit.
- Familiarize with PCB layout design and generating Gerber file.
- Study the PCB assembling process.
- Study manual fabrication of a given circuit

COURSE OUTCOMES

On successful completion of this course, the student will be able to	
E6232.1	Identify different types of Printed Circuit Boards (PCB), list the differences between
E6232.2	Select the right components for a given analog circuit, draw the schematic and generate net list.
E6232.3	Draw the PCB layout for an analog circuit & verify using design rule check. Identify the problems while designing the PCB and troubleshoot them. Generate gerber file, BOM.
E6232.4	List out the steps involved in PCB assembly process
E6232.5	Fabricate a simple analog circuit manually.

Pre-requisites

- Knowledge of working of electronic components and devices.

CO/POs & PSOs MAPPING MATRIX

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E6232.1	3	3	3	3	2	2	3	3	2	2
E6232.2	3	3	3	3	2	2	3	3	2	2
E6232.3	3	3	3	3	2	2	3	3	2	2
E6232.4	3	3	3	3	2	2	3	3	2	2
E6232.5	3	3	3	3	2	2	3	3	2	2
Total	**15**	**15**	**15**	**15**	**10**	**10**	**15**	**15**	**10**	**10**
Correlation Level	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice- activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real- world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written Test Theory (Two Units)	Written Test Theory (Another Two Units)	Practical Test (All Exercises)	Written Test (Complete Theory Portions)	Written Examination (Complete Theory Portions)
Duration	2 Periods	2 Periods	3 hour	3 hours	3 hours
Exam Marks	50	50	100	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	6^{th} Week	12^{th} Week	15^{th} Week	16^{th} Week	

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks. The marks scored will be converted to 10 Marks for each test. CA1 and CA2, Assessment written test should be conducted for two units as below. Answer any Five questions. (5 X 10 Marks = 50 Marks).Eight questions will be asked, students should write Five questions .Each unit Four questions can be asked.

CA 3: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one experiment by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded for 100 marks will be converted to 10 Marks for the internal mark.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. Each exercise/experiment should be evaluated for 10 Marks. The total marks awarded should be converted to 30 Marks for the practical test as per the scheme of evaluation as below.

The details of the practical documents to be prepared as per the instruction below.

Each exercise observation and calculations should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next exercise.

This documentation can be carried out in a separate notebook or printed manual or file. The reading and calculations and graph should be written by the student manually. The evaluated practical document should be submitted for the Practical Test (CA3). The mark scored by the students should be converted to 30 marks. The same should be included as per the allocation in the practical test.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad.

SCHEME OF EVALUATION-Practical Test

Part	Description	Marks
A	Aim & Apparatus Required	10
B	Circuit Diagram in Software	20
C	Import & Preparation	10
D	Execution and Output/Result	20
E	Practical Documents (All Exercises)	30
F	Viva Voce	10
TOTAL		100

CA4: Model examination should be conducted for complete theory portions as per the end semester question pattern. The marks awarded should be converted to 10 marks for the internal assessment.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each. Four questions will be asked from every unit, students should write any two questions.

QUESTION PAPER SETTING:

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **AP**-Apply	**An**- Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

Question Pattern - Model Examination and End Semester Examination - Theory Exam

PART- A (5X2X 10 Marks = 100 Marks)

Note: Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each.

The questions are to be numbered from 1 to 20. All the units are to be covered with equal weightage.

PART – A	**5X2** X **10** = **100** marks
Total	**100** Marks *

Note: * Autonomous Examinations will be conducted for 100 Marks and converted to 60 Marks**.**

EEE6232- PCB DESIGN & ASSEMBLY

L	T	P	C
2	0	2	3

THEORY:

Unit I	**INTRODUCTION TO PCB DESIGN**	**[6 Hrs]**
Basics of electronic components and circuits		[1 Hr]
Introduction to PCB design		[1 Hr]
Types - Single layer - Double layer – Multi layer		[1 Hr]
Applications - Overview of PCB design process		[1 Hr]
Electronic Components and Footprints – Understanding		[1 Hr]
Component data sheets - Introduction to PCB design software (e.g KiCAD or any open source EDA Software).		[1 Hr]
Ex.no	**Name of the Experiment**	
1	Familiarization of any Electronic design automation (EDA) software and Solder an analog circuit (Half wave rectifier) in a PCB with plated hole.	
2	Create a schematic, generate net list and simulate an RC coupled amplifier.	**[6 Hrs]**
Unit II	**INTRODUCTION TO SCHEMATIC DESIGN**	**[6 Hrs]**
Introduction to schematic design		[1 Hr]
Drawing circuit schematics using EDA (Electronic Design Automation) tools		[1 Hr]
Net-list generation and Connectivity verification		[1 Hr]
Understanding PCB layer stack up - Board materials - Materials used for multilayer PCBs -		[1 Hr]
PCB thickness - Units - Aspect ratio - Importance of grounding in PCBs		[1 Hr]
Impedance matching - Reflection- Ground Bounce - SSN.		[1 Hr]
Ex.no	**Name of the experiment**	
3	Create a schematic, generate net list and simulate a High pass filter.	
4	Place the components of RC coupled amplifier and route the connections between the components manually and verify using designrule check.	[6 Hrs]
Unit III	**PCB DESIGN**	**[3 Hrs]**
PCB layout and routing using software tools		[1 Hr]
Vias - Solder Mask - Silk Screen Jumper		[1 Hr]
Design rule check		[1 Hr]
Troubleshooting and debugging common issues		[1 Hr]
Creation of accurate and comprehensive design documentation		[1 Hr]
Gerber file - Bill of Materials.		[1 Hr]
Ex.no	**Name of the experiment**	
5	Place the components of RC coupled amplifier and route the connections between the components using auto routing option.	
6	Design a PCB layout for Astable Multivibrator circuit and verify using design rule check.	[6 Hrs]

Unit IV	PCB ASSEMBLY	[6Hrs]
Flowchart for PCB assembly process		[1 Hr]
Steps involved in fabrication of single sided PCB		[1 Hr]
double sided PCB & multilayer PCB		[1 Hr]
Testing of PCB - Importance of RoHS(Restriction of use of Hazardous Substances)		[1 Hr]
Waste management of hazardous materials in PCB		[1 Hr]
Environment Management Standards (EMS) - RF PCB.		[1 Hr]
Ex.no	**Name of the experiment**	
7	Design a PCB layout for regulated power supply, verify using design rule check and generate gerber file, BOM.	[3 Hrs]
Unit V	**Manual PCB Fabrication**	**[6Hrs]**
Schematic-PCB Layout		[1 Hr]
Transfer to copper clad board		[1 Hr]
Etching-Drilling		[1 Hr]
component placement		[1 Hr]
Testing		[1 Hr]
Finishing.		[1 Hr]
Ex.no	**Name of the experiment**	
8	Create symbols and foot print for 1n4007diode and IC741.	[3 Hrs]
REVISION		6
TOTAL HOURS		**60**

Suggested Activity

- Presentation/Seminars by students on any recent technological developments basedon the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Viva Voce will be conducted before conducting an experiment.

Textbook

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Printed Circuit Boards: Design–Fabrication,	R.S.Khandpur,	McGraw Hill Education,1st edition, 2017
2.	Printed Circuits Handbook	Clyde F. Coombs	McGraw Hill,6th edition, 2008
3.	Electronic Product Design,	S.D.Mehta	S Chand & Company,1st edition, 2011

Equipment / Facilities required to conduct the Practical Portions.

S.No	Name of the Equipment’s	Quantity Required
1.	Desktop Computer	15 Nos
2.	Printer	1 No
3.	Soldering Iron & Multimeter	6 Nos
4.	PCB Drilling Machine	6 Nos
5.	Plain PCB & Ferric Chloride	As Required
6.	Open Source Software – EDA	As Required

MODEL QUESTION PAPER

EEE6232- PCB DESIGN & ASSEMBLY

Time : 3 Hrs. **Max. Marks : 100**

PART- A (5 X 2X10= 100 Marks)					
Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks		**Unit**	**Bloom's Level**	**CO**	**PO**
I.	1. Explain the PCB Design and its types.	I	R	E6232.1	PO2, PO5,PO7
	2. Explain the PCB design process.	I	U	E6232.1	PO2, PO5,PO7
	3. Explain about Electronic components and footprints.	I	R	E6232.1	PO2, PO5,PO7
	4.Explain the PCB design software.	I	U	E6232.1	PO2, PO5,PO7
II.	5. Explain drawing circuit schematics using EDA.	II	R	E6232.2	PO2, PO5,PO7
	6. Explain about board material.	II	R	E6232.2	PO2, PO5,PO7
	7. Briefly explain the importance of grounding in PCBs.	II	U	E6232.2	PO2, PO5,PO7
	8. Explain about the impedance matching.	II	R	E6232.2	PO2, PO5,PO7
III.	9. Explain the PCB layout and routing using software tools.	III	U	E6232.3	PO2, PO5,PO7
	10. Explain the silk screen jumper.	III	U	E6232.3	PO2, PO5,PO7
	11. Explain troubleshooting and debugging common issues.	III	U	E6232.3	PO2, PO5,PO7
	12. Explain the bill of material.	III	U	E6232.3	PO2, PO5,PO7
IV.	13. Explain about PCB assembly process.	IV	An	E6232.4	PO2, PO5,PO7
	14. Explain about fabrication of single sided PCB, double sided PCB.	IV	R	E6232.4	PO2, PO5,PO7
	15. Explain about waste management of hazardous materials in PCB.	IV	R	E6232.4	PO2, PO5,PO7
	16. Explain environment management standards(EMS)	IV	U	E6232.4	PO2, PO5,PO7

V.	17. Explain PCB layout.	V	U	E6232.5	PO2, PO5,PO7
	18. Explain about etching.	V	R	E6232.5	PO2, PO5,PO7
	19. Explain about drilling.	V	R	E6232.5	PO2, PO5,PO7
	20. Explain about testing.	V	U	E6232.5	PO2, PO5,PO7

QUESTION PAPER SETTING :

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **Ap**-Apply	**An**- Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

EEE6233-ELECTRONIC PRODUCT DESIGN

Programme Name : EEE
Course Code : EEE6233
Semester : VI SEMESTER
Course Title : ELECTRONIC PRODUCT DESIGN
Course Type : PRACTICUM

L	T	P	C
2	0	2	3

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Electronic product Design	4	60	40	100*	100	3Hrs

* Examinations will be conducted for 100 marks will be converted to 60 marks.

TOPICS AND ALLOCATION OF HOURS

Unit	Topics	Time (Hrs)
I	Overview of electronic product design	12
II	Design of power sources	12
III	Amplifiers and function generators	12
IV	Electronic automation design	9
V	Semiconductor packages and electronic board design	9
	Revision	6
Total		**60**

COURSE DESCRIPTION:

This subject covers the basics design of electronic systems from the ground up will enable the students in electronic system design. It deals with the challenges any modern system designer faces: the design process and its fundamentals, such as designing power source, electronic system like amplifiers, function generators etc. Assembly of electronic automation design and semiconductor packaging with PCB design signal integrity, power integrity and thermal analysis, power distribution and noise signaling convention requirements and environmental-friendly design principles.

COURSE OBJECTIVES:

The objective of this course is to enable the students to

- Understand the overview of electronic system design.
- Learn the design principle of power sources.
- Interpret design of amplifiers and function generator.

- Study about electronic automation design.
- Study semiconductor package and electronic board design.

COURSE OUTCOMES

On successful completion of this course, the student will be able to	
E6233.1	Explain overview of electronic system design.
E6233.2	Design principle of power sources.
E6233.3	Design of amplifiers and function generator.
E6233.4	Describe the function of electronic automation design.
E6233.5	Analyse the semiconductor package and electronic board design.

Pre-requisites:

- Fundamental knowledge on electronic devices and circuits.

CO- POs & PSOs MAPPING

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E6233.1	2	3	3	-	-	-	-	3	-	1
E6233.2	2	3	3	2	-	-	-	3	-	1
E6233.3	3	3	3	-	-	-	-	3	-	1
E6233.4	3	3	3	-	-	-	-	3	-	1
E6233.5	3	1	3	2	-	-	-	3	-	1
Total	**13**	**13**	**15**	**4**	**-**	**-**	**-**	**15**	**-**	**5**
Correlation Level	**2.6**	**2.6**	**3**	**2**	**-**	**-**	**-**	**3**	**-**	**1**

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- It is advised that teachers take steps to pique pupils' attention and boost their curiosityto learn.
- Implement task-based learning activities where students work on specific tasks or projects.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- Incorporate formative and summative assessments to gauge student progress and provide targeted feedback.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices may be followed in the real environment as far as possible.

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test Theory (Two Units)	Written Test Theory (Another Two Units)	Practical Test (All Exercises)	Written Test (Complete Theory Portions)	Written Examination (Complete Theory Portions)
Duration	2 Periods	2 Periods	3 hour	3 hours	3 hours
Exam Marks	50	50	100	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	6th Week	12th Week	15th Week	16th Week	

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks. The marks scored will be converted to 10 Marks for each test. CA1 and CA2, Assessment written test should be conducted for two units as below. Answer any Five questions. (5 X 10 Marks = 50 Marks). Eight questions will be asked, students should write Five questions. Each unit Four questions can be asked.

CA 3: All the exercises/experiments should be completed and kept for the practical test. **The students shall be permitted to select any one experiment by lot for the test.** The practical test should be conducted as per the scheme of evaluation as below. The marks awarded for 100 marks will be converted to 10 Marks for the internal mark.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. Each exercise/experiment should be evaluated for 10 Marks. The total marks awarded should be converted to 30 Marks for the practical test as per the scheme of evaluation as below.

The details of the practical documents to be prepared as per the instruction below.

Each exercise observation and calculations should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next exercise.

This documentation can be carried out in a separate notebook or printed manual or file. The reading and calculations and graph should be written by the student manually. The evaluated practical document should be submitted for the Practical Test (CA3). The mark scored by the students should be converted to 30 marks. The same should be included as per the allocation in the practical test.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad.

SCHEME OF EVALUATION

Practical Test

Part	Description	Marks
A	Aim & Apparatus Required	10
B	Diagram and/or Design	20
C	Connections	10
D	Execution and Output/Result	20
E	Practical Documents (All Exercises)	30
F	Viva Voce	10
TOTAL		100

CA4: Model examination should be conducted for complete theory portions as per the end semester question pattern. The marks awarded should be converted to 10 marks for the internal assessment.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each. Four questions will be asked from every unit, students should write any two questions.

QUESTION PAPER SETTING:

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **AP**-Apply	**An-** Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

Question Pattern - Model Examination and End Semester Examination - Theory Exam

PART- A (5X2 X 10 Marks = 100 Marks)

Note: Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each.

The questions are to be numbered from 1 to 20. All the units are to be covered with equal weightage.

PART – A	**5X2 X 10 = 100 marks**
Total	**100 Marks ***

Note: * Autonomous Examinations will be conducted for 100 Marks and converted to 60 Marks**.**

EEE6233-ELECTRONIC PRODUCT DESIGN

L	T	P	C
2	0	2	3

UNIT I	**OVERVIEW OF ELECTRONIC PRODUCT DESIGN**	**[6Hrs]**
	Definition – Purpose and Scope – System Architecture for Electronic Product Designs – Breakdown of an electronic system design – Requirements – Electromagnetic interference in electronic systems and its impact – Concept of grounding and its significance.	[1Hr] [2Hrs] [1Hr] [1Hr] [1Hr]
EX.NO	**NAME OF THE EXPERIMENT**	
1	Design of Voltage to Current converter system.	
2	Design of DC Power Supply Unit for 230V/12V, 1 Amps.	**[6 Hrs]**
UNIT II	**DESIGN OF POWER SOURCES**	**[6 Hrs]**
	Introduction to low power design techniques and methodologies – Various types of power supplies – Estimation of power supply requirements and power loss in electronic products – Selection of appropriate power supplies for the given primary power sources (230VAC/Battery) Design of power scheduler.	[1Hr] [1Hr] [2Hrs] [1Hr] [1Hr]
EX.NO	**NAME OF THE EXPERIMENT**	
3	Design of Amplifier Circuit.	[6 Hrs]
4	Design of AM Modulator and De-modulator.	
UNIT III	**AMPLIFIERS AND FUNCTION GENERATORS**	**[6Hrs]**
	Amplifiers: Emitter follower - Two stage direct coupled amplifiers Design of audio power amplifier with drivers Design of simple PA system - Voltage to current converter- current to voltage converter. Function Generators : AM signal demodulation using envelope detector Design of FM signal using VCO (using IC NE566) FM signal demodulation using phase discriminator.	[1Hr] [1Hr] [1Hr] [1Hr] [1Hr] [1Hr]
EX.NO	**NAME OF THE EXPERIMENT**	
5	Design of Electronic Ammeter.	
6	Design of Electronic Voltmeter.	[6 Hrs]
UNIT IV	**ELECTRONIC AUTOMATION DESIGN**	**[6Hrs]**
	Circuit for Relay and motor control applications SCADA architecture and applications	[1Hr] [1Hr]

DCS architecture and applications Block Diagram of Analog Data Acquisition System Introduction to Transducer and types Design of Electronic voltmeter, ammeter – and Multimeter.		[1Hr] [1Hr] [1Hr] [1Hr]
EX.NO	**NAME OF THE EXPERIMENT**	
7	Design of Instrumentation Amplifier.	[6 Hrs]
UNIT V	**SEMICONDUCTOR PACKAGES AND ELECTRONIC BOARD DESIGN**	**[6Hrs]**
Semiconductor Packages: Single chip packages or modules SCM Common packages and advanced packages - Materials in packages - Current trends in Packaging - Multichip modules (MCM) – types. Electronic Board Design: Introduction to high speed PCB design Signal Integrity - Power Integrity and Thermal Analysis Power distribution and noise - Signalling convention – terminations.		[1Hr] [1Hr] [1Hr] [1Hr] [1Hr] [1Hr]
EX.NO	**NAME OF THE EXPERIMENT**	
8	Design PCB for simple street light control circuit using LDR..	[6 Hrs]
TOTAL HOURS		**60**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Viva Voce will be conducted before conducting an experiment.
- E – Resources and E-Learning for the virtual learning environment to prepare the students ready for each and every circumstance.

Textbook

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Digital Design: Principles & Practices	John F. Wakerly	Third Edition, Prentice Hall International, 1999.
2.	Printed Circuit Boards - Design & Technology	Walter C. Bosshart	First Edition; Tata McGraw Hill.
3.	Electronic Instrument Design: Architecting for the Life Cycle	Kim R. Fowler	Latest Edition; Oxford University Press.
4.	Electronic Product Design	A.E Ward and J.A.S.Angus	Stanley Thornes (Publishers)Ltd., 1999.

Web-based/Online Resources

S.NO	Websites
1.	https https://resources.pcb.cadence.com/blog/2023-electronic-product-design-and- development.
2.	https://predictabledesigns.com/how-to-develop-and-prototype-a-new-product/
3.	https://www.dsl-ltd.co.uk/what-is-electronic-product-design/

Equipment / Facilities required to conduct the Practical Portions.

S.No	Name of the Equipment's	Quantity Required
1.	Desktop Computer	15 Nos
2.	Printer	1 No
3.	Soldering Iron, Multimeter & Other Tools	6 Nos
4.	PCB & PCB Drilling Machine	6 Nos
5.	Discrete Electronic Components	As Required

MODEL QUESTION PAPER

EEE6233-ELECTRONIC PRODUCT DESIGN

Time : 3 Hrs. **Max. Marks : 100**

PART- A (5 X 2X10= 100 Marks)					
Note: Answer Ten questions by selectingtwo questions from each unit. Each question carries 10 marks		**Unit**	**Bloom's Level**	**CO**	**PO**
I.	1. Explain System Architecture for Electronic Product Designs .	I	R	E6233.1	PO2, PO5,PO7
	2. Explain the Breakdown of an electronic system design.	I	U	E6233.1	PO2, PO5,PO7
	3. Explain the Electromagnetic interference in electronic systems	I	R	E6233.1	PO2, PO5,PO7
	4.Explain the Concept of grounding.	I	U	E6233.1	PO2, PO5,PO7
II.	5. Explain the low power design techniques and methodologies.	II	R	E6233.2	PO2, PO5,PO7
	6. Explain the Various types of power supplies	II	R	E6233.2	PO2, PO5,PO7
	7. Explain the Estimation of power supply requirements.	II	U	E6233.2	PO2, PO5,PO7
	8. Explain about Design of power scheduler.	II	R	E6233.2	PO2, PO5,PO7
III.	9. Explain Two stage direct coupled amplifiers	III	U	E6233.3	PO2, PO5,PO7
	10. Explain the Design of audio power amplifier with drivers.	III	U	E6233.3	PO2, PO5,PO7
	11. Explain the Voltage to current converter- current to voltage converter.	III	U	E6233.3	PO2, PO5,PO7
	12. Explain FM signal demodulation using phase discriminator.	III	U	E6233.3	PO2, PO5,PO7
IV.	13. Explain the SCADA architecture and its application.	IV	U	E6233.4	PO2, PO5,PO7
	14. Explain DCS architecture and its application.	IV	R	E6233.4	PO2, PO5,PO7
	15. Explain Block Diagram of Analog Data Acquisition System.	IV	R	E6233.4	PO2, PO5,PO7
	16. Explain Design of Electronic voltmeter, ammeter &Multimeter.	IV	U	E6233.4	PO2, PO5,PO7

V.	17. Explain the Semiconductor Packages.	V	U	E6233.5	PO2, PO5,PO7
	18. Explain Multichip modules (MCM) & its types.	V	R	E6233.5	PO2, PO5,PO7
	19. Explain the high speed PCB design.	V	R	E6233.5	PO2, PO5,PO7
	20. Explain the Power Integrity and Thermal Analysis.	V	U	E6233.5	PO2, PO5,PO7

QUESTION PAPER SETTING :

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **Ap**-Apply	**An**- Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

EEE6234- RENEWABLE ENERGY SYSTEMS

Programme Name	: EEE				
Course Code	: EEE6234				
Semester	: VI SEMESTER				
Course Title	: RENEWABLE ENERGY SYSTEMS				
Course Type	: PRACTICUM				

L	T	P	C
2	0	2	3

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Renewable Energy Systems	4	60	40	100*	100	3Hrs

* Examinations will be conducted for 100 marks will be converted to 60 marks.

TOPICS AND ALLOCATION OF HOURS

Unit	Topics	Time (Hrs)
I	Energy scenario	12
II	Solar energy	12
III	Wind energy	12
IV	Bio energy	9
V	Ocean and geothermal energy	9
	Revision	6
Total		**60**

COURSE DESCRIPTON:

Renewable energy is energy that comes from a source that won't run out. They are natural and self-replenishing, and usually have a low- or zero-carbon footprint. Renewable resources are those resources that continue to exist despite being consumed or can replenish themselves over a period of time even as they are used. They include the sun, wind, water, geothermal, and biomass. Renewable are now cheaper in most countries, and generate three times more jobs than fossil fuels. Generation capacity has grown rapidly in recent years, driven by policy support and sharp cost reductions for solar photovoltaic and wind power in particular.

COURSE OBJECTIVES:

The objective of this course is to enable the students to

- Know the present status of Indian and global energy scenario.
- Learn the various solar energy technologies and its applications.
- Educate the various wind energy technologies.
- Explore the various bio-energy technologies.
- Study the ocean and geothermal technologies.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to	
E6234.1	Illustrate the Indian and global energy scenario.
E6234.2	Compare various solar energy technologies and identify its applications.
E6234.3	Infer wind data and compare various wind energy systems.
E6234.4	Examine various bio-energy technologies and identify their application.
E6234.5	Interpret ocean and geothermal energy conversion technologies.

Pre-requisites:

- Basics of Science and Engineering.

CO- POs & PSOs MAPPING Matrix:

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E6234.1	3	3	3	-	-	-	-	3	-	1
E6234.2	3	3	3	2	-	-	-	3	-	1
E6234.3	3	3	3	-	-	-	-	3	-	1
E6234.4	3	3	3	-	-	-	-	3	-	1
E6234.5	3	3	3	2	-	-	-	3	-	1
Total	15	15	15	4	-	-	-	15	-	5
Correlation Level	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**-**	**1**

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test Theory (Two Units)	Written Test Theory (Another Two Units)	Practical Test (All Exercises)	Written Test (Complete Theory Portions)	Written Examination (Complete Theory Portions)
Duration	2 Periods	2 Periods	3 hour	3 hours	3 hours
Exam Marks	50	50	100	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	6th Week	12th Week	15th Week	16th Week	

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks. The marks scored will be converted to 10 Marks for each test. CA1 and CA2, Assessment written test should be conducted for two units as below. Answer any Five questions. (5 X 10 Marks = 50 Marks). Eight questions will be asked, students should write Five questions. Each unit Four questions can be asked.

CA 3: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one experiment by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded for 100 marks will be converted to 10 Marks for the internal mark. Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. Each exercise/experiment should be evaluated for 10 Marks. The total marks awarded should be converted to 30 Marks for the practical test as per the scheme of evaluation as below.

The details of the practical documents to be prepared as per the instruction below.

Each exercise observation and calculations should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next exercise.

This documentation can be carried out in a separate notebook or printed manual or file. The reading and calculations and graph should be written by the student manually. The evaluated practical document should be submitted for the Practical Test (CA3). The mark scored by the students should be converted to 30 marks. The same should be included as per the allocation in the practical test.

The detailed date of the practices and its evaluations should be maintained in the course logbook.

The log book and the practical documents should be submitted for the verification by the Flying Squad.

SCHEME OF EVALUATION - Practical Test

Sl.No.	Description	Marks
A	Aim / Apparatus required	10
B	Diagram and/or Procedure	20
C	Execution	10
D	Output / Result	20
E	Practical document (All Exercises)	30
F	Viva Voce	10
Total		100

CA4: Model examination should be conducted for complete theory portions as per the end semester question pattern. The marks awarded should be converted to 10 marks for the internal assessment.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each. Four questions will be asked from every unit, students should write any two questions.

QUESTION PAPER SETTING:

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **AP**-Apply	**An**- Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

Question Pattern - Model Examination and End Semester Examination - Theory Exam

PART- A (5X2X 10 Marks = 100 Marks)

Note: Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each.

The questions are to be numbered from 1 to 20. All the units are to be covered with equal weightage.

PART – A	**5X2X 10 = 100 marks**
Total	**100 Marks ***

Note: * Autonomous Examinations will be conducted for 100 Marks and converted to 60 Marks**.**

EEE6234- RENEWABLE ENERGY SYSTEMS

L	T	P	C
2	0	2	3

THEORY

Unit I	**ENERGY SECENARIO**	**[6Hrs]**
Indian energy scenario in various sectors – domestic, industrial, commercial, agriculture, transportation and others .		[2Hrs]
Present conventional energy status – Present renewable energy status		[1Hr]
Potential of various renewable energy sources		[1Hr]
Global energy status - Per capita energy consumption		[1Hr]
Future energy plans.		[1Hr]
Ex.no	**Name of the experiment**	
1	Determining the characteristics of solar photovoltaic materials and estimation of MPP (I-V curve).	**[6 Hrs]**
2	Performance evaluation of solar cookers (box type and concentrating type).	
Unit II	**SOLAR ENERGY**	**[6 Hrs]**
Solar radiation – Measurements of solar radiation and sunshine		[1Hr]
Solar spectrum – Solar thermal collectors		[1Hr]
Flat plate and concentrating collectors		[1Hr]
Solar thermal applications – Solar thermal energy storage		[1Hr]
Fundamentals of solar photo voltaic conversion		[1Hr]
Solar cells – Solar PV Systems –Solar PV applications.		[1Hr]
Ex.no	**Name of the experiment**	
3	Testing of biomass Gasifier in up draught / down draught mode. Study of biogas plant–fixed dome and floating drum model.	[6 Hrs]
4	Proximate analysis of a given bio fuel.	
Unit III	**WIND ENERGY**	**[6Hrs]**
Wind data and energy estimation – Betz limit		[1Hr]
Site selection for wind farms – characteristics		[1Hr]
Wind resource assessment – Horizontal axis wind turbine – components		
Vertical axis wind turbine		[2Hrs]
Wind turbine generators and its performance		[1Hr]
Hybrid systems – Environmental issues - Applications.		[1Hr]
Ex.no	**Name of the experiment**	
5	Estimation of calorific value of any solid fuels using bomb calorimeter.	

6	Computation of calorific value of liquid fuels using Junkers gas calorimeter.	[6 Hrs]
UNIT IV	**BIO-ENERGY**	**[6 Hrs]**
Bio resources – Biomass direct combustion – thermo chemical conversion		[1Hr]
biochemical conversion-mechanical conversion – Biomass gasifier		[1Hr]
Types of biomass gasifiers –Cogeneration – Carbonisation		[1Hr]
Pyrolysis – Biogas plants		[1Hr]
Digesters –Biodiesel production		[1Hr]
Ethanol production – Applications.		[1Hr]
EX.NO	**NAME OF THE EXPERIMENT**	
7	Synthesis of biodiesel –energy and mass balancing.	[6 Hrs]
UNIT V	**OCEAN AND GEOTHERMAL ENERGY**	**[6 Hrs]**
Small hydro – Tidal energy		[1Hr]
Wave energy – Open and closed OTEC Cycles Limitations		[2Hrs]
Geothermal energy		[1Hr]
Geothermal energy sources		[1Hr]
Types of geothermal power plants – Applications		[1Hr]
Environmental impact.		[1Hr]
EX.NO	**NAME OF THE EXPERIMENT**	
8	Performance evaluation of engine on biodiesel.	[6 Hrs]
	TOTAL HOURS	**60**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based onthe course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course

Textbook

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Renewable Energy, Power for a Sustainable Future	Godfrey Boyle,	Oxford University Press, U.K., 2012.
2.	Renewable Energy Systems,	M. Buchla David	Pearson education publication, 2017.
3.	Solar Energy: Principles of Thermal Collection and Storage	S.P. Sukhatme	Tata McGraw Hill Publishing Company Ltd., 2009.
4.	Solar Energy–Fundamentals Design, Modelling and applications	G.N. Tiwari,	Alpha Science Intl Ltd, 2015.

Web-based/Online Resources

S.NO	Websites
1.	https://www.energy.gov/eere/renewable-energy
2.	https://www.edfenergy.com/energywise/renewable-energy-sources
3.	https://www.nrdc.org/stories/renewable-energy-clean-facts#sec-whatis

Equipment / Facilities required to conduct the Practical Portions.

S.No	Name of the Equipment's	Quantity Required
1.	Solar PV Modules	5 Nos
2.	Solar Cooker	2 Nos
3.	Biomass Experiment setup	1 No
4.	Bomb Calorimeter	1 No
5.	Gas Calorimeter	1 No
6.	Demo Model of Wind Mill	1 No
7.	Solar Charge Controller and Inverter	1 No Each
8.	Rechargeable Battery	2 Nos
9.	Digital Multimeter	6 Nos
10.	Lamp Load	1 No

MODEL QUESTION PAPER

EEE6234- RENEWABLE ENERGY SYSTEMS

Time : 3 Hrs. **Max. Marks : 100**

PART- A (5 X 2X10= 100 Marks)					
Note: Answer Ten questions by selectingtwo questions from each unit. Each question carries 10 marks		**Unit**	**Bloom's Level**	**CO**	**PO**
I.	1. Explain the Indian energy scenario in various sectors.	I	R	E6234.1	PO2, PO5,PO7
	2. Explain the Present renewable energy status.	I	U	E6234.1	PO2, PO5,PO7
	3. Explain the Global energy status.	I	R	E6234.1	PO2, PO5,PO7
	4.Explain the Per capita energy consumption.	I	U	E6234.1	PO2, PO5,PO7
II.	5. Explain the Measurements of solar radiation.	II	R	E6234.2	PO2, PO5,PO7
	6. Explain the Solar thermal collectors.	II	R	E6234.2	PO2, PO5,PO7
	7. Explain the Solar thermal energy storage.	II	U	E6234.2	PO2, PO5,PO7
	8. Explain about Fundamentals of solar photo voltaic conversion.	II	R	E6234.2	PO2, PO5,PO7
III.	9. Explain Wind data and energy estimation.	III	U	E6234.3	PO2, PO5,PO7
	10. Explain the Site selection for wind farms.	III	U	E6234.3	PO2, PO5,PO7
	11. Explain the Horizontal axis wind turbine and Vertical axis wind turbine	III	U	E6234.3	PO2, PO5,PO7
	12. Explain the Hybrid systems.	III	U	E6234.3	PO2, PO5,PO7
IV.	13. Explain the thermo chemical conversion biochemical conversion-mechanical conversion.	IV	U	E6234.4	PO2, PO5,PO7
	14. Explain Biomass gasifier.	IV	R	E6234.4	PO2, PO5,PO7
	15. Explain Biogas plants.	IV	R	E6234.4	PO2, PO5,PO7
	16. Explain Ethanol production.	IV	U	E6234.4	PO2, PO5,PO7
V.	17. Explain the Tidal energy.	V	U	E6234.5	PO2, PO5,PO7

	18. Explain the Wave energy.	V	R	E6234.5	PO2, PO5,PO7
	19. Explain the Types of geothermal power plants.	V	R	E6234.5	PO2, PO5,PO7
	20. Explain briefly about Environmental impact.	V	U	E6234.5	PO2, PO5,PO7

QUESTION PAPER SETTING :

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **Ap**-Apply	**An-** Analyse, **E-**Evaluate, **C-**Create
% to be included	90 %	10 %

EEE6235-ENERGY CONSERVATION AND AUDITING

Programme Name : EEE
Course Code : EEE6235
Semester : VI SEMESTER
Course Title : ENERGY CONSERVATION AND AUDITING
Course Type : PRACTICUM

L	T	P	C
2	0	2	3

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Energy Conservation And Auditing	4	60	40	100*	100	3Hrs

* Examinations will be conducted for 100 marks will be converted to 60 marks.

TOPICS AND ALLOCATION OF HOURS

Unit	Topics	Time (Hrs)
I	Energy Management And Audit	12
II	Electrical System	12
III	Electric Motors	12
IV	Lighting	9
V	Energy Efficient Technologies In Electrical Systems	9
	Revision	6
Total		**60**

COURSE DESCRIPTION:

Energy resource scarcity becomes one of the biggest issues in the world and leading to rise in cost. Effective utilization of Electrical energy is one of the key issues to minimize the rising cost of energy and to minimize the global warming. This course will educate the non-electrical engineers on the aspect of energy conservation in electrical equipment and Electrical Installations. It will helpful to select an energy efficient electrical system for an establishment.

COURSE OBJECTIVES

The objective of this course is to enable the students to

- Understand the basic principle of Energy Management, energy audit and benchmarking process.
- Understand the Selection of Energy Efficient gadgets for industrial applications and process involved in power factor improvement.
- Understand the energy efficiency in induction motors.
- Understand the energy efficiency in lighting systems and DG set system.
- Understand the prevailing energy efficient technologies in electrical systems.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to	
E6235.1	Explain the basic principle of Energy Management and Conservation.
E6235.2	Select Energy Efficient gadgets for domestic, commercial and industrial Applications.
E6235.3	Estimate the energy performance of Electrical Equipment.
E6235.4	Get familiar about the energy conservation practice.
E6235.5	Practice simple experiment using Soft Starter.

Pre-requisites:

- Basics of Electrical and Electronics Engineering,

CO/POs & PSOs MAPPING

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E6235.1	3	3	3	3	3	3	3	3	2	2
E6235.2	3	3	3	3	3	3	3	3	2	2
E6235.3	3	3	3	3	3	3	3	3	2	2
E6235.4	3	3	3	3	3	3	3	3	2	2
E6235.5	3	3	3	3	3	3	3	3	2	2
Total	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**10**	**10**
Correlation Level	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- Understand the audience and their current level of knowledge regarding energy conservation and audit.
- Start with foundational concepts such as the principles of energy conservation, types of energy sources, and the environmental impact of energy consumption.
- Teach participants how to conduct a thorough energy audit, including data collection, analysis techniques, and evaluation of energy-saving opportunities.
- Introduce participants to various energy-efficient technologies and strategies, such as LED lighting, HVAC optimization, and renewable energy systems.
- Incorporate hands-on activities such as energy audits, simulations, and experiments to reinforce learning. Encourage group discussions to promote peer learning, idea sharing, and problem-solving.

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written Test Theory (Two Units)	Written Test Theory (Another Two Units)	Practical Test (All Exercises)	Written Test (Complete Theory Portions)	Written Examination (Complete Theory Portions)
Duration	2 Periods	2 Periods	3 hour	3 hours	3 hours
Exam Marks	50	50	100	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	6th Week	12th Week	15th Week	16th Week	

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks. The marks scored will be converted to 10 Marks for each test. CA1 and CA2, Assessment written test should be conducted for two units as below. Answer any Five questions. (5 X 10 Marks = 50 Marks). Eight questions will be asked, students should write Five questions. Each unit Four questions can be asked.

CA 3: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one experiment by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded for 100 marks will be converted to 10 Marks for the internal mark. Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. Each exercise/experiment should be evaluated for 10 Marks. The total marks awarded should be converted to 30 Marks for the practical test as per the scheme of evaluation as below.

The details of the practical documents to be prepared as per the instruction below.

Each exercise observation and calculations should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next exercise. This documentation can be carried out in a separate notebook or printed manual or file. The reading and calculations and graph should be written by the student manually.

The evaluated practical document should be submitted for the Practical Test (CA3). The mark scored by the students should be converted to 30 marks. The same should be included as per the allocation in the practical test. The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad.

SCHEME OF EVALUATION - Practical Test

Sl.No.	Description	Marks
A	Aim / Apparatus required	10
B	Diagram	20
C	Connections	10
D	Execution and output / Result	20
E	Practical document (All Exercises)	30
F	Viva Voce	10
Total		100

Model examination should be conducted for complete theory portions as per the end semester question pattern. The marks awarded should be converted to 10 marks for the internal assessment.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each. Four questions will be asked from every unit, students should write any two questions.

QUESTION PAPER SETTING:

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **AP**-Apply	**An**- Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	[[10 %

Question Pattern - Model Examination and End Semester Examination - Theory Exam

PART- A (5X2 X 10 Marks = 100 Marks)

Note: Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each.

The questions are to be numbered from 1 to 20. All the units are to be covered with equal weightage.

PART – A	5X2 X 10 = 100 marks
Total	100 Marks *

Note: * Autonomous Examinations will be conducted for 100 Marks and converted to 60 Marks**.**

EEE6235-ENERGY CONSERVATION AND AUDITING

L	T	P	C
2	0	2	3

Theory Portion :		
Unit I	**ENERGY MANAGEMENT AND AUDIT**	**[6Hrs]**
Need of Energy Audit - Types of energy audit, Energy audit approach – understanding energy costs		[2Hrs]
Bench marking, Energy performance		[1Hr]
Matching energy use to requirement		[1Hr]
Maximizing system efficiencies - optimizing the input energy requirements		[1Hr]
Fuel and energy substitution - Energy Audit instruments.		[1Hr]
Ex.no	**Name of the experiment**	
1	Compare and verify the energy consumption for LED lamp and Incandescent lamp with same Lumens.	
2	Control the water pump motor by using sensors to avoid overflow of overhead tank.	**[6Hrs]**
Unit II	**ELECTRICAL SYSTEM**	**[6Hrs]**
Electricity billing		[1Hr]
Electrical load management and maximum demand control		[1Hr]
Power factor improvement and its benefits		[1Hr]
Selection and location of capacitors		[1Hr]
Performance assessment of PF capacitors		[1Hr]
Distribution and transformer losses.		[1Hr]
Ex.no	**Name of the experiment**	
3	Construct Automatic street light control using LDR and Arduino.	
4	Compare and verify the energy consumption of Copper Choke and Electronic Choke for same ratting tube light.	**[6Hrs]**
Unit III	**ELECTRIC MOTORS**	**[6Hrs]**
Losses in induction motors		[1Hr]
Motor efficiency Factors affecting motor performance		[1Hr]
Rewinding and motor replacement issues		[2Hrs]
Energy saving opportunities with energy efficient motors.		[2Hrs]
Ex.no	**Name of the experiment**	
5	Construct lighting circuit for a room with Occupancy sensor.	**[6Hrs]**
6	Measure the Current, Power and Energy consumption of Modern BLDC Ceiling Fan	
UNIT IV	**LIGHTING**	**[6Hrs]**
Lighting Light Source, Choice of lighting, Luminance requirements and energy conservation avenues. DG Set System Factors affecting selection, Energy performance assessment of diesel conservation avenues.		[2Hrs] [2Hrs] [2Hrs]

Ex.no	Name of the experiment	
7	Connect Soft starter with suitable rating Induction Motor and Observe its operation during starting and running. Also measure the current and power consumption.	**[3Hrs]**
Unit V	**ENERGY EFFICIENT TECHNOLOGIES IN ELECTRICAL SYSTEMS**	**[6Hrs]**
Maximum demand controllers		[1Hr]
Automatic power factor controllers - Energy efficient motors		[1Hr]
Soft starters with energy saver - Variable speed drives		[2Hrs]
Energy efficient transformers - Electronic Ballast		[1Hr]
Occupancy sensors - Energy efficient lighting controls.		[1Hr]
Ex.no	**Name of the experiment**	
8	Collect Electricity bills of typical residential or College service connections for the period of 1 year and prepare the bar chart of energy consumption and energy cost. Discuss the result.	**[3Hrs]**
	TOTAL	60Hrs

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments basedon the course.
- Practical case studies of energy conservation and Illumination system.
- Power requirement for different domestic appliances.

Text and Reference Books:

S.NO	TITLE	AUTHOR	PUBLISHER WITH EDITION
1.	Book I - General aspect of energy management and energy audit	By Bureau of Energy Efficiency,	Ministry of Power, India
2.	Book III - Energy efficiency in electrical utilities	By Bureau of Energy Efficiency	Second Edition 2005 Ministry of Power, India
3.	Energy Efficiency and Management for Engineers	Mehmet Kanoglu, Yunus A Cengel	First Edition, McGraw-Hill Education, 2020.
4.	Energy Audit of building systems	Moncefkrati	Third edition CRC Press,Dec2020
5.	Handbook of Energy Audit	Sonal Desai,	McGraw Hill Education (India) Private Limited, 2017

Web-based/Online Resources

S.NO	Websites
1.	https://youtu.be/QRT5mYp7B_g?si=yfV2VCccL8Ku5O- N
2.	https://youtu.be/RPjcgmR4USg?si=ln5wolfr4eclRaDY

List of Equipment /Required for a batch of 30students

S.No	Name of the Equipment's	Quantity Required
1.	LED Lamp, Incandescent Lamp, Digital Power Monitor	Each 2 Nos
2.	Pump Motor with Sensor arrangement	1 No
3.	Arduino Shield, LDR, Relay and Lamp	Each 1 No
4.	Copper Choke and Electronic Choke	Each 3 Nos
5.	Tube Light with accessories	3 Nos
6.	BLDC Ceiling Fan	2 Nos
7.	Soft Starter with Induction Motor	1 No
8.	Digital Power Monitor	2 Nos

MODEL QUESTION PAPER

EEE6235-ENERGY CONSERVATION AND AUDITING

Time : 3 Hrs. **Max. Marks : 100**

PART- A (5 X 2X10= 100 Marks)					
Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks		**Unit**	**Bloom's Level**	**CO**	**PO**
I.	1. Explain the Need of Energy Audit	I	R	E6235.1	PO2, PO5,PO7
	2. Explain the Types Energy Audit	I	U	E6235.1	PO2, PO5,PO7
	3. Explain the Fuel and energy substitution	I	R	E6235.1	PO2, PO5,PO7
	4.Explain the Energy Audit instruments.	I	U	E6235.1	PO2, PO5,PO7
II.	5. Explain the Electrical load management and maximum demand control	II	R	E6235.2	PO2, PO5,PO7
	6. Explain Power factor improvement and its benefits	II	R	E6235.2	PO2, PO5,PO7
	7. Explain the Performance assessment of PF capacitors	II	U	E6235.2	PO2, PO5,PO7
	8. Explain about Distribution and transformer losses.	II	R	E6235.2	PO2, PO5,PO7
III.	9. Explain Losses in induction motors	III	U	E6235.3	PO2, PO5,PO7
	10. Explain Motor efficiency	III	U	E6235.3	PO2, PO5,PO7
	11. Explain the Factors affecting motor performance	III	U	E6235.3	PO2, PO5,PO7
	12. Explain Energy saving opportunities with energy efficient motors	III	An	E6235.3	PO2, PO5,PO7
IV.	13. Explain the Luminance requirements and energy conservation avenues.	IV	U	E6235.4	PO2, PO5,PO7
	14. Explain DG Set System	IV	R	E6235.4	PO2, PO5,PO7
	15. Explain Factors affecting selection.	IV	R	E6235.4	PO2, PO5,PO7
	16. Explain Energy performance assessment of diesel conservation avenues.	IV	U	E6235.4	PO2, PO5,PO7

V.	17. Explain Automatic power factor controllers.	V	U	E6235.5	PO2, PO5,PO7
	18. Explain Soft starters with energy saver	V	R	E6235.5	PO2, PO5,PO7
	19. Explain the Energy efficient transformers	V	R	E6235.5	PO2, PO5,PO7
	20. Explain the Energy efficient lighting controls	V	U	E6235.5	PO2, PO5,PO7

QUESTION PAPER SETTING :

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **Ap**-Apply	**An-** Analyse, **E**-Evaluate, **C-**Create
% to be included	90 %	10 %

EEE6236-ELECTRIC DRIVES AND CONTROLS

L	T	P	C
2	0	2	3

Programme Name : EEE
Course Code : EEE6236
Semester : VI SEMESTER
Course Title : ELECTRIC DRIVES AND CONTROLS
Course Type : PRACTICUM

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 15 weeks

Course	Instructions		Examination			
	Hours / Week	Hours / semester	Marks			Duration
			Internal Assessment	Autonomous Examination	Total	
Electric Drives And Controls	4	60	40	100*	100	3Hrs

* Examinations will be conducted for 100 marks will be converted to 60 marks.

TOPICS AND ALLOCATION OF HOURS

Unit	Topics	Time (Hrs)
I	Electrical Drives	12
II	Dc Motor Drives	12
III	Induction Motor Drives	12
IV	BLDC Drive	9
V	Synchronous Motor Drives & Drives Application	9
	Revision	6
Total		**60**

COURSE DESCRIPTON:

In electric drive control systems, the main goal is to maintain the driving motor speed to meet the mechanism's requirements. In some practical industrial applications the mechanically-coupled load to the motor shaft has a varying mass during the system operation.

COURSE OBJECTIVES:

The objective of this course is to enable the students to

- Understand motor load dynamics.
- Study and analyze the operation of the converter fed and chopper fed dc drives.
- Study and understand braking methods of D.C. and Induction motor drive.
- Study synchronous and BLDC motor drive.
- Understand the modes of operation of drive in various applications.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to	
E6236.1	Explain motor load dynamics and multi quadrant operation of drives.
E6236.2	Analyze operation of converter fed and chopper fed DC drives.
E6236.3	Apply different braking methods of D.C. and induction motor drive.
E6236.4	Elaborate vector control for induction motor and BLDC drives.
E6236.5	Elaborate synchronous motor, reluctance motor drive & select suitable drives in various industrial applications.

Pre-requisites:

- Basics of Electrical and Electronics Engineering
- Knowledge of basic types of Drives and Control Method.

CO/PO & PSO Mapping:

CO/PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
E6236.1	2	3	3	-	-	-	-	3	-	1
E6236.2	2	3	3	2	-	-	-	3	-	1
E6236.3	3	3	3	-	-	-	-	3	-	1
E6236.4	3	3	3	-	-	-	-	3	-	1
E6236.5	3	1	3	2	-	-	-	3	-	1
Total	**13**	**13**	**15**	**4**	**-**	**-**	**-**	**15**	**-**	**5**
Correlation Level	**2.6**	**2.6**	**3**	**2**	**-**	**-**	**-**	**3**	**-**	**1**

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation Legend

Instructional Strategy:

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written Test Theory (Two Units)	Written Test Theory (Another Two Units)	Practical Test (All Exercises)	Written Test (Complete Theory Portions)	Written Examination (Complete Theory Portions)
Duration	2 Periods	2 Periods	3 hour	3 hours	3 hours
Exam Marks	50	50	100	100	100
Converted to	10	10	10	10	60
Marks	40				60
Tentative Schedule	6^{th} Week	12^{th} Week	15^{th} Week	16^{th} Week	

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks. The marks scored will be converted to 10 Marks for each test. CA1 and CA2, Assessment written test should be conducted for two units as below. Answer any Five questions. (5 X 10 Marks = 50 Marks). Eight questions will be asked, students should write Five questions. Each unit Four questions can be asked.

CA 3: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one experiment by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded for 100 marks will be converted to 10 Marks for the internal mark.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. Each exercise/experiment should be evaluated for 10 Marks. The total marks awarded should be converted to 30 Marks for the practical test as per the scheme of evaluation as below.

The details of the practical documents to be prepared as per the instruction below.

Each exercise observation and calculations should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next exercise.

This documentation can be carried out in a separate notebook or printed manual or file. The reading and calculations and graph should be written by the student manually. The evaluated practical document should be submitted for the Practical Test (CA3). The mark scored by the students should be converted to 30 marks. The same should be included as per the allocation in the practical test.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad.

SCHEME OF EVALUATION - Practical Test

Sl.No.	Description	Marks
A	Aim / Apparatus required	10
B	Circuit Diagram	20
C	Connection	10
D	Execution and output /Result	20
E	Practical document (All Practicals)	30
F	Viva Voce	10
Total		100

CA4: Model examination should be conducted for complete theory portions as per the end semester question pattern. The marks awarded should be converted to 10 marks for the internal assessment.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions.

QUESTION PAPER SETTING:

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking (HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **AP**-Apply	**An-** Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

Question Pattern - Model Examination and End Semester Examination - Theory Exam

PART- A (5X2X 10 Marks = 100 Marks)

Note: Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each.

The questions are to be numbered from 1 to 20. All the units are to be covered with equal weightage.

PART – A	5X2X 10 = 100 marks
Total	100 Marks *

Note: * Autonomous Examinations will be conducted for 100 Marks and converted to 60 Marks**.**

EEE6236-ELECTRIC DEVICES AND CONTROLS

L	T	P	C
2	0	2	3

THEORY:

Unit I	**ELECTRICAL DRIVES**	**[6Hrs]**
Definition - Components of electric drive system Types of electrical drives (DC and AC) - selection of drive parameters List of Industrial Applications. Motor - Load dynamics - speed-torque conventions and multi-quadrant operation - equivalent values of drive parameters load torque components nature and classification of load - constant power operation of a drive steady-state stability.		[1Hr] [1Hr] [1Hr] [1Hr] [1Hr] [1Hr]
Ex.no	**Name of the experiment**	
1.	Electrical braking of D.C. Shunt motor (Rheostatic, Plugging).	
2.	Closed Loop Speed Control of AC Motor	[6 Hrs]
Unit II	**DC MOTOR DRIVES**	**[6Hrs]**
Single-phase and three-phase fully controlled converter drives – Performance of converter fed separately excited DC Motor for speed control operations 12 pulse converter drives. Chopper controlled drives for separately excited and series DC Motor operations – Closed-loop speed control of DC motor below and above base speed for starting, speed control and braking.		[1Hr] [1Hr] [1Hr] [1Hr] [1Hr] [1Hr]
Ex.no	**Name of the experiment**	
3.	Closed Loop Speed Control of BLDC Motor	[6 Hrs]
4.	Closed loop control of PMSM drive.	
Unit III	**INDUCTION MOTOR DRIVES**	**[6Hrs]**
Regenerative braking - Dynamic braking – Plugging Numerical based on braking and speed control Voltage Source Inverter (VSI) control - Steady State Analysis Current Source Inverter (CSI) control - Open and closed loop - Regenerative braking Multi quadrant operation of Induction motor drives – Principle of vector control Block diagram of Vector control of induction motor - Failure modes of Drives.		[1Hr] [1Hr] [1Hr] [1Hr] [1Hr] [1Hr]
Ex.no	**Name of the experiment**	
5.	Single phase fully converter fed separately excited D.C. Motor	
6.	Simulation of Induction Motor Vector Control	[6 Hrs]

Unit IV	**BLDC DRIVE**	**[6Hrs]**
Construction (Block diagram) and working for motoring and regenerative braking Speed and torque Characteristics Closed loop control of BLDC drive (PI controller) Vector control of BLDC drive Applications in EV (descriptive treatment).		[2Hrs] [1Hr] [1Hr] [1Hr] [1Hr]
Ex.no	**Name of the experiment**	[6 Hrs]
7	VSI fed 3 phase induction motor speed control characteristics	
Unit V	**SYNCHRONOUS MOTOR DRIVES & DRIVES APPLICATIONS**	**[6Hrs]**
PMSM Drive: Construction (Block diagram) and working for motoring and regenerative braking Speed and torque Characteristics Closed loop control of PMSM drive (PI controller) Vector control of PMSM drive. Synchronous Reluctance Motor Introduction, working of SRM, application in EV(descriptive treatment).		[1Hr] [1Hr] [1Hr] [1Hr] [1Hr] [1Hr]
Ex.no	**Name of the experiment**	
8.	Simulation of closed loop control of BLDC / PMSM drive.	[6 Hrs]
TOTAL		**60**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based onthe course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.

Textbook

S.NO	**TITLE**	**AUTHOR**	**PUBLISHER WITH EDITION**
1.	Fundamentals of Electric Drives	Gopal K. Dubey	2nd Edition, Narosa Publishing House, 2010.
2.	Electric Drives	Nisit K. De, Prasanta K. Sen	Ninth Printing, Prentice Hall of India Pvt Ltd., 2006
3.	Power Electronics	M.D. Singh and K.B. Khanchandani	Second Edition, Tata Mc-Graw Hill, 2017.
4.	Electric Motors and Drives: Fundamentals, Types and Applications	Austin Huges, Bill Drury	Fifth Edition, Newnes, 2019.

Web-based/Online Resources:

S.NO	**Websites**
1.	https://instrumentationtools.com/electrical-drive-types-advantages-disadvantages/
2.	http//electrical4u.com/control-of-electrical-drives/

MODEL QUESTION PAPER

EEE6236-ELECTRIC DRIVES AND CONTROLS

Time : 3 Hrs. **Max. Marks : 100**

PART- A (5 X 2X10= 100 Marks)					
Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks		**Unit**	**Bloom's Level**	**CO**	**PO**
I.	1. Explain the Components of electric drive system.	I	R	E6236.1	PO2, PO5,PO7
	2. Explain the Types of electrical drives (DC and AC).	I	U	E6236.1	PO2, PO5,PO7
	3. Explain the load torque components nature and classification of load	I	R	E6236.1	PO2, PO5,PO7
	4.Explain the speed-torque conventions and multi-quadrant operation.	I	U	E6236.1	PO2, PO5,PO7
II.	5. Explain the Single-phase and three-phase fully controlled converter drives	II	R	E6236.2	PO2, PO5,PO7
	6. Explain 12 pulse converter drives	II	R	E6236.2	PO2, PO5,PO7
	7. Explain the Chopper controlled drives for separately excited and series DC Motor operations	II	U	E6236.2	PO2, PO5,PO7
	8. Explain about Closed-loop speed control of DC motor below and above base speed for starting, speed control and braking.	II	R	E6236.2	PO2, PO5,PO7
III.	9. Explain Numerical based on braking and speed control	III	U	E6236.3	PO2, PO5,PO7
	10. Explain Voltage Source Inverter (VSI) control.	III	U	E6236.3	PO2, PO5,PO7
	11. Explain the Current Source Inverter (CSI) control.	III	U	E6236.3	PO2, PO5,PO7
	12. Explain Block diagram of Vector control of induction motor	III	U	E6236.3	PO2, PO5,PO7
IV.	13. Explain the Construction and working for motoring and regenerative braking	IV	U	E6236.4	PO2, PO5,PO7
	14. Explain Closed loop control of BLDC drive	IV	R	E6236.4	PO2, PO5,PO7
	15. Explain Vector control of BLDC drive .	IV	R	E6236.4	PO2, PO5,PO7
	16. Explain Applications in EV (descriptive treatment).	IV	U	E6236.4	PO2, PO5,PO7
V.	17. Explain Construction and working for motoring and regenerative braking.	V	U	E6236.5	PO2, PO5,PO7

	18. Explain Closed loop control of PMSM drive	V	R	E6236.5	PO2, PO5,PO7
	19. Explain the Synchronous Reluctance Motor	V	An	E6236.5	PO2, PO5,PO7
	20. Explain the Introduction and working of SRM	V	U	E6236.5	PO2, PO5,PO7

QUESTION PAPER SETTING :

The teaching learning process and assessment are being carried out in accordance with the revised Blooms Taxonomy. The question paper should consist of 90% questions based on Lower Order Thinking (LOTs) and the remaining 10% based on Higher Order Thinking(HOTs) as detailed below.

Revised Bloom's Taxonomy Level	**Lower order thinking skills (LOTs)**	**Higher Order Thinking Skills (HOTs)**
	R-Remember, **U**-Understand, **Ap**-Apply	**An-** Analyse, **E**-Evaluate, **C**-Create
% to be included	90 %	10 %

EEE6351- INTERNSHIP

P	C
540	12

Programme Name : EEE
Course Code : EEE6351
Semester : VI SEMESTER
Course Title : INTERNSHIP
Course Type : PROJECT

COURSE DESCRIPTION:

Internships in educational institutions are designed to provide students with practical experience in their field of study and to bridge the gap between academic knowledge and professional practice.

COURSE OBJECTIVES:

After completing Internship, Interns will be able to,

- Apply the theoretical knowledge and skill during performance of the tasks assigned in internship.
- Demonstrate soft skills such as time management, positive attitude and communication skills during performance of the tasks assigned in internship.
- Document the Use case on the assigned Task.
- Enable interns to apply theoretical knowledge gained in the classroom to real-world practical applications.
- Provide hands-on experience in the industrial practices.
- Develop essential skills such as communication, organization,teamwork, and problem-solving.
- Enhance specific skills related to the intern's area of focus. Offer arealistic understanding of the daily operations and responsibilities.
- Provide opportunities to work under the guidance of experienced supervisors and administrators.
- Allow interns to explore different career paths.
- Help interns make informed decisions about their future career goals based on first hand experience.
- Facilitate the establishment of professional relationships withsupervisor, administrators, and other professionals in the field.
- Provide access to a network of contacts that can be beneficial for future job opportunities and professional growth.
- Foster personal growth by challenging interns to step out of their comfort zones andtake on new responsibilities.

- Build confidence and self-efficacy through successful completion of internship tasks and projects.
- Give insight into the policies, regulations, and administrative practices.
- Allow interns to observe and understand the implementation of standards and policies in practice.
- Provide opportunities for constructive feedback from supervisors and mentors, aiding in the intern's professional development.
- Enable self-assessment and reflection on strengths, areas for improvement, and career aspirations.
- Encourage sensitivity to the needs and backgrounds of different groups, promoting inclusive and equitable industrial practices.

Course Outcomes

On successful completion of this course, the student will be able to	
E6351.1	Demonstrate improved skills.
E6351.2	Exhibit increased professional behavior.
E6351.3	Apply theoretical knowledge and principles in real-world practices.
E6351.4	Develop and utilize assessment tools to evaluate the learning and practices.
E6351.5	Engage in reflective practice to continually improve their learning and professional growth

Facilitating the Interns by an Internship Provider

- Orient intern in the new workplace. Give interns an overview of the organization, Explain the intern's duties and introduce him or her to co-workers.
- Develop an internship job description with clear deliverables and timeline.
- Allow the interns in meetings and provide information, resources, and opportunities for professional development.
- The interns have never done this kind of work before, they want to know that their work is measuring up to organizational expectations, hence provide professional guidance and mentoring to the intern.
- Daily progress report of Intern is to be evaluated by industry supervisor. Examine what the intern has produced and make suggestions. Weekly supervision meetings can help to monitor the intern's work.

Duties Responsibilities of the Faculty Mentor

- To facilitate the placement of students for the internship
- To liaison between the college and the internship provider
- To assist the Industrial Training Supervisor during assessment

Instructions to the Interns

- Students shall report to the internship provider on the 1st day as per the internship schedule.

- Intern is expected to learn about the organization, its structure, product range, market performance, working philosophy etc.
- The interns shall work on live projects assigned by the internship provider.
- The Intern shall record all the activities in the daily log book and get the signature of the concerned training supervisor.
- Intern shall have 100% attendance during internship programme. In case of unavoidable circumstances students may avail leave with prior permission from the concerned training supervisor of the respective internship provider. However, the maximum leave permitted during internship shall be as per company norms where they are working and intern shall report the leave sanctioned details to their college faculty mentor.
- The interns shall abide all the Rules and Regulations of internship provider
- Intern shall follow all the safety Regulations of internship provider.
- On completion of the internship, the intern shall report to the college and submit the internship certificate mentioning duration of internship, evaluation of interns by internship provider, Student's Diary and Comprehensive Training Report.

Attendance Certification

Every month students have to get their attendance certified by the industrial supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and submit it to the institution supervisor. Regularity in attendance and submission of report will be duly considered while awarding the Internal Assessment mark.

Training Reports

The students have to prepare two types of reports: Weekly report in the form of diary to be submitted to the concerned staff in-charge of the institution. This will be reviewed while awarding Internal.

Industrial Training Diary

Students are required to maintain the record of day-to-day work done. Such a record is called Industrial training Diary. Students have to write this report regularly. All days for the week should be accounted for clearly giving attendance particulars (Presence, absence, Leave, Holidays etc.). The concern of the Industrial supervisor is to periodically check these progress reports.

Comprehensive Training Report

In addition to the diary, students are required to submit a comprehensive report on training with details of the organization where the training was undergone after attestation by the supervisors. The comprehensive report should incorporate study of plant/product/process/construction along with intensive in-depth study on any one of the topics such as processes, methods, tooling, construction and equipment, highlighting aspects of quality, productivity and system. The comprehensive report should be completed in the last week of Industrial training. Any data, drawings etc. should be incorporated with the consent of the Organization.

Scheme of Evaluation - Internal Assessment

Students should be assessed for 50 Marks by industry supervisor and polytechnic faculty mentor during 3rd Month and 5th Month. The total marks (50 + 50) scored shall be converted to 40 marks for the Internal Assessment.

S. No.	Description	Marks
A	Punctuality and regularity. (Attendance)	10
B	Level / proficiency of practical skills acquired. Initiative in learning / working at site	10
C	Ability to solve practical problems. Sense of responsibility	10
D	Self expression / communication skills. Interpersonal skills / Human Relation.	10
E	Report and Presentation.	10
TOTAL MARKS		**50**

End Semester Examination - Project Exam

Students should be assessed for 100 Marks both by the internal examiner and external examiner appointed by the Chairperson Autonomous of Examinations after the completion of internship period (December - May). The marks scored will be converted to 60 marks for the End Semester Examination.

S. No.	Description	Marks
A	Daily Activity Report	20
B	Comprehensive report on Internship, Relevant Internship Certificate from the concerned department	30
C	Presentation by the student at the end of the Internship	30
D	Viva Voce	20
TOTAL MARKS		**100**

EEE6353- FELLOWSHIP

Programme Name : EEE
Course Code : EEE6353
Semester : VI SEMESTER
Course Title : FELLOWSHIP
Course Type : PROJECT

P	C
540	12

COURSE DESCRIPTION:

- The Fellowship in the Diploma in Engineering program is designed to provide aspiring engineers with a comprehensive educational experience that combines theoretical knowledge with practical skills. This fellowship aims to cultivate a new generation of proficient and innovative engineers who are equipped to meet the challenges of a rapidly evolving technological landscape.
- Participants in this fellowship will benefit from a robust curriculum that covers core engineering principles, advanced technical training, and hands-on projects. The program emphasizes interdisciplinary learning, encouraging fellows to explore various branches of engineering, from mechanical and civil to electrical, electronics & communication and computer engineering. This approach ensures that graduates possess a versatile skill set, ready to adapt to diverse career opportunities in the engineering sector.
- In addition to academics, the fellowship offers numerous opportunities for professional development. Fellows will engage with industry experts through seminars, workshops, and internships, gaining valuable insights into real-world applications of their studies. Collaborative projects and research initiatives foster a culture of innovation, critical thinking, and problem-solving, essential attributes for any successful engineer.
- By offering this fellowship, participants become part of a vibrant community of learners and professionals dedicated to advancing the field of engineering. The program is committed to supporting the growth and development of each fellow, providing them with the tools and resources needed to excel both academically and professionally.
- The Fellowship in the Diploma in Engineering is more than just an educational endeavor; it is a transformative journey that equips aspiring engineers with the knowledge, skills, and experiences necessary to make significant contributions to society and the engineering profession.

COURSE OBJECTIVES

After completing, Students will be able to,

- Provide fellows with a solid foundation in core engineering principles and advanced technical knowledge across various engineering disciplines.

Equip fellows with hands-on experience through laboratory work, projects, and internships, ensuring they can apply theoretical knowledge to real-world scenarios.

- Promote interdisciplinary understanding by encouraging exploration and integration of different engineering fields, fostering versatility and adaptability in fellows.
- Encourage innovation and creativity through research projects and collaborative initiatives, enabling fellows to develop new solutions to engineering challenges.
- Facilitate professional growth through workshops, seminars, and interactions with industry experts, preparing fellows for successful careers in engineering.
- Develop critical thinking and problem-solving skills, essential for tackling complex engineering problems and making informed decisions.
- Strengthen connections between academia and industry by providing opportunities for internships, industry visits, and guest lectures from professionals.
- Foster leadership qualities and teamwork skills through group projects and collaborative activities, preparing fellows for leadership roles in their future careers.
- Instill a sense of ethical responsibility and awareness of the social impact of engineering practices, encouraging fellows to contribute positively to society.
- Promote a culture of lifelong learning, encouraging fellows to continually update their knowledge and skills in response to technological advancements and industry trends.
- Prepare fellows to work in a global engineering environment by exposing them to international best practices, standards, and cross- cultural experiences.

COURSE OUTCOMES

On successful completion of this course, the student will be able to	
E6353.1	Demonstrate a strong understanding of core engineering principles and possess the technical skills necessary to design, analyze, and implement engineering solutions across various disciplines.
E6353.2	Apply theoretical knowledge to practical scenarios, effectively solving engineering problems through hands-on projects, laboratory work, and internships.
E6353.3	Exhibit the ability to conduct research, develop innovative solutions, and contribute to advancements in engineering through critical thinking and creative approaches to complex challenges.
E6353.4	Understand and adhere to professional and ethical standards in engineering practice, demonstrating responsibility, integrity, and a commitment to sustainable and socially responsible engineering.
E6353.5	Enhance strong communication skills, both written and verbal, and be capable of working effectively in teams, demonstrating leadership and collaborative abilities in diverse and multidisciplinary environments.

Important points to consider to select the fellowship project

Selecting the right fellowship project is crucial for maximizing the educational andprofessional benefits of a Diploma in Engineering program.

- **Relevance to Future Plans**: Choose a project that aligns with your long-term career aspirations and interests. This alignment will ensure that the skills and knowledge you gain will be directly applicable to your desired career path.
- **Industry Relevance**: Consider the current and future relevance of the project within the industry. Opt for projects that address contemporary challenges or emerging trends in engineering.
- Access to Facilities: Ensure that the necessary facilities, equipment, and materials are available to successfully complete the project. Lack of resources can hinder the progress and quality of your work.
- **Mentorship and Guidance**: Select a project that offers strong mentorship and support from experienced faculty members or industry professionals. Effective guidance is crucial for navigating complex problems and achieving project objectives.
- **Project Scope**: Assess the scope of the project to ensure it is neither too broad nor too narrow. A well-defined project scope helps in setting clear objectives and achievable milestones.
- **Feasibility**: Evaluate the feasibility of completing the project within the given timeframe and with the available resources. Consider potential challenges and ensure you have a realistic plan to address them.
- **Technical Skills**: Choose a project that allows you to develop and enhance important technical skills relevant to your field of study. Practical experience in using specific tools, technologies, or methodologies can be highly beneficial.
- **Soft Skills**: Consider projects that also offer opportunities to develop soft skills such as teamwork, communication, problem-solving, and project management.
- **Innovative Thinking**: Select a project that encourages creativity and innovative problem-solving. Projects that push the boundaries of traditional engineering approaches can be particularly rewarding.
- **Societal Impact**: Consider the potential impact of your project on society or the engineering community. Projects that address significant challenges or contribute to social good can be highly fulfilling and make a meaningful difference.

Guidelines to select Fellowship

- Ensure the program is accredited by a recognized accrediting body and has a strong reputation for quality education in engineering.
- Ensure it covers core engineering principles that align with your interests and career goals.
- Investigate the qualifications and experience of the faculty mentor. Look for programs with faculty who have strong academic backgrounds, industry experience, and active involvement in research.

- Check if the program provides adequate hands-on training opportunities, such as laboratory work, workshops, and access to modern engineering facilities and equipment.
- Assess the program's connections with industry. Strong partnerships with companies can lead to valuable internship opportunities, industry projects, and exposure to real-world engineering challenges.
- Explore the availability of research opportunities. Participation in research projects can enhance your learning experience and open doors to innovative career paths.
- Look for programs that offer professional development resources, such as workshops, seminars, and networking events with industry professionals and alumni.
- Ensure the program provides robust support services, including academic advising, career counseling, mentorship programs, and assistance with job placement after graduation.
- Consider the cost of the program and available financial aid options, such as scholarships, grants, and fellowships. Evaluate the return on investment in terms of career prospects and potential earnings.
- Research the success of the program's alumni. High employment rates and successful careers of past graduates can indicate the program's effectiveness in preparing students for the engineering field.

Duties Responsibilities of the Faculty Mentor

Each student should have a faculty mentor for the Institute.

- Get the approval from the Chairperson Autonomous of Examinations with the recommendationsof the HOD/Principal for the topics.
- Provide comprehensive academic advising to help fellows select appropriate specializations, and research projects that align with their interests and career goals.

Guide fellows through their research projects, offering expertise and feedback to ensure rigorous methodology, innovative approaches, and meaningful contributions to the field

- Assist fellows in developing technical and professional skills through hands-on projects, laboratory work, and practical applications of theoretical knowledge.
- Offer career advice and support, helping fellows explore potential career paths, prepare for job searches, and connect with industry professionals and opportunities.
- Provide personal mentorship, fostering a supportive relationship that encourages growth, resilience, and a positive academic experience.
- Facilitate connections between fellows and industry professionals, alumni, and other relevant networks to enhance their professional opportunities and industry exposure.
- Ensure fellows have access to necessary resources, including research materials, lab equipment, software, and academic literature.
- Regularly monitor and evaluate the progress of fellows, providing constructive feedback and guidance to help them stay on track and achieve their goals.

- Instill and uphold high ethical and professional standards, encouraging fellows to practice integrity and responsibility in their work.
- Assist with administrative tasks related to the fellowship program, such as preparing progress reports, writing recommendation letters, and facilitating grant applications.
- Organize and participate in workshops, seminars, and other educational events that enhance the learning experience and professional development of fellows.
- Address any issues or conflicts that arise, providing mediation and support to ensure a positive and productive academic environment.

Instructions to the Fellowship Scholar

- Regularly meet with your faculty mentor for guidance on academic progress, research projects, and career planning. Be proactive in seeking advice and support from your mentor.
- Develop strong organizational skills. Use planners, calendars, and task management tools to keep track of assignments, project deadlines, and study schedules. Prioritize tasks to manage your time efficiently.
- Take advantage of opportunities to participate in research projects and hands-on activities. These experiences are crucial for applying your theoretical knowledge and gaining practical skills.Focus on improving essential professional skills such as communication, teamwork, problem-solving, and leadership. Participate in workshops and seminars that enhance these competencies.
- Actively seek networking opportunities through industry events, seminars, and meetings. Establish connections with peers, alumni, and professionals in your field to build a strong professional network.
- Seek internships, co-op programs, or part-time jobs related to your field of study. Real-world experience is invaluable for understanding industry practices and enhancing your employability.
- Uphold high ethical standards in all your academic and professional activities. Practice integrity, honesty, and responsibility. Adhere to the ethical guidelines and standards set by your institution and the engineering profession.
- Adopt a mindset of lifelong learning. Stay updated with the latest developments and trends in engineering by reading industry journals, attending conferences, and taking additional courses.

Documents to be submitted by the student to offer fellowship

- **Completed Application Form**: This is typically the standard form provided by the institution or fellowship program that includes personal information, educational background, and other relevant details.
- **Detailed CV/Resume**: A comprehensive document outlining your educational background, knowledge experience, interest in research experience, publications, presentations, awards, and other relevant achievements if any.

- **Personal Statement**: A document explaining your motivation for applying to the fellowship, your career goals, how the fellowship aligns with those goals, and what you intend to achieve through the program.
- **Recommendation Letters**: Letters from faculty mentor, employer, or professionals who can attest to your academic abilities, professional skills, and suitability for the fellowship.
- **Proposal/Description**: A detailed proposal or description of the fellowship project or study you plan to undertake during the fellowship. This should include objectives, methodology, expected outcomes, and significance of the project.
- **Enrollment Verification**: Documentation verifying your current acceptance status in the academic institution or industry where the fellowship will be conducted.
- **Funding Information**: Details about any other sources of funding or financial aid you are receiving, if applicable. Some fellowships may also require a budget proposal for the intended use of the fellowship funds.
- **Samples of Work**: Copies of the relevant work that demonstrates your capabilities and accomplishments in your field.
- **Endorsement Letter**: A letter from your current academic institution endorsing your application for the fellowship, if required.
- **Ethical Approval Documents**: If your research involves human subjects or animals, you may need to submit proof of ethical approval from the relevant ethics committee.
- **Additional Documents**: Any other documents requested by the fellowship program required by the institution.

Attendance Certification

Every month students have to get their attendance certified by the supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and submit it to the faculty mentor. Regularity in attendance and submission of report will be duly considered while awarding the Internal Assessment mark.

Rubrics for Fellowship

Sl.No.	Topics	Description
1	Alignment with Objectives	Assess how well the project aligns with the stated objectives and requirements. Determine if the student has addressed the key aspects outlined in the project guidelines.
2	Depth of Research:	Evaluate the depth and thoroughness of the literature review. Assess the student's ability to identify and address gaps in existing research.

3	Clarity of Objectives:	Check if the student has clearly defined and articulated the objectives of the project. Ensure that the objectives are specific, measurable, achievable, relevant, and time-bound (SMART).
4	Methodology and Data Collection:	Evaluate the appropriateness and justification of the research methodology. Assess the methods used for data collection and their relevance to the research questions.
5	Analysis and Interpretation:	Examine the quality of data analysis techniques used. Assess the student's ability to interpret results and draw meaningful conclusions.
6	Project Management:	Evaluate the project management aspects, including adherence to timelines and milestones. Assess the student's ability to plan and execute the project effectively.
7	Documentation and Reporting:	Check the quality of documentation, including code, experimental details, and any other relevant materials. Evaluate the clarity, structure, and coherence of the final report.
8	Originality and Creativity:	Assess the level of originality and creativity demonstrated in the project. Determine if the student has brought a unique perspective or solution to the research problem.
9	Critical Thinking:	Evaluate the student's critical thinking skills in analyzing information and forming conclusions. Assess the ability to evaluate alternative solutions and make informed decisions.
10	Problem- Solving Skills:	Evaluate the student's ability to identify and solve problems encountered during the project. Assess adaptability and resilience in the face of challenges.

Internal Marks - 40 Marks

As per the rubrics each topic should be considered for the Review 1 and Review 2. Equal weightage should be given for all the topics. It should be assessed by a faculty mentor and the industrial professional or research guide.

Review 1 shall be conducted after 8th week and Review 2 shall be conducted after 14th week in the semester. Average marks scored in the reviews shall be considered for the internal assessment of 40 Marks.

Scheme of Evaluation

Part	Description	Marks
A	Assessment as per the rubrics	30
B	Attendance	10
TOTAL MARKS		**40**

End Semester Examination - Project Exam

Students should be assessed for 100 Marks both by the internal examiner and external examiner appointed by the Chairperson Autonomous of Examinations after the completion of fellowship. The marks scored will be converted to 60 marks for the End Semester Examination.

S. No.	Description	Marks
A	Daily Activity Report	20
B	Comprehensive report of the fellowship work	30
C	Presentation by the student	30
D	Viva Voce	20
TOTAL MARKS		**100**

EEE6374- IN-HOUSE PROJECT

P	C
540	12

Programme Name : EEE
Course Code : EEE6374
Semester : VI SEMESTER
Course Title : IN-HOUSE PROJECT
Course Type : PROJECT

COURSE DESCRIPTION:

- Every student must do one major project in the Final year of their program. Students can do their major project in Industry or R&D Lab or in-house or a combination of any two for the partial fulfillment for the award of Diploma in Engineering.
- For the project works, the Department will constitute a three-member faculty committee to monitor the progress of the project and conduct reviews regularly.
- If the projects are done in-house, the students must obtain the bonafide certificate for project work from the Project supervisor and Head of the Department, at the end of the semester. Students who have not obtained the bonafide certificate are not permitted to appear for the Project Viva Voce examination.
- For the projects carried out in Industry, the students must submit a separate certificate from Industry apart from the regular bonafide certificate mentioned above. For Industry related projects there must be one internal faculty advisor / Supervisor from Industry (External), this is in addition to the regular faculty supervision.
- The final examination for project work will be evaluated based on the final report submitted by the project group of **not exceeding four students**, and the viva voce by an external examiner.

COURSE OBJECTIVES

Academic project work plays a crucial role in the education of Diploma in Engineering students, as it helps them apply theoretical knowledge to practical situations and prepares them for real-world engineering challenges.

- **Integration of Knowledge**: Consolidate and integrate theoretical knowledge acquired in coursework to solve practical engineering problems.
- **Skill Development**: Enhance technical skills related to the specific field of engineering through hands-on experience and application.
- **Problem-Solving Abilities**: Develop critical thinking and problem- solving abilities by addressing complex engineering issues within a defined scope.
- **Project Management**: Gain experience in project planning, execution, and management, including setting objectives, timelines, and resource allocation.

- **Teamwork and Collaboration**: Foster teamwork and collaboration by working in multidisciplinary teams to achieve project goals and objectives.
- **Research Skills**: Acquire research skills by conducting literature reviews, gathering relevant data, and applying research methodologies to investigate engineering problems.
- **Innovation and Creativity**: Encourage innovation and creativity in proposing and developing engineering solutions that may be novel or improve upon existing methods.
- **Communication Skills**: Improve communication skills, both oral and written, by presenting project findings, writing technical reports, and effectively conveying ideas to stakeholders.
- **Ethical Considerations**: Consider ethical implications related to engineering practices, including safety, environmental impact, and societal concerns.
- **Professional Development**: Prepare for future professional roles by demonstrating professionalism, initiative, and responsibility throughout the project lifecycle.

COURSE OUTCOMES

On successful completion of this course, the student will be able to	
E6374.1	Demonstrate the ability to apply theoretical concepts and principles learned in coursework to solve practical engineering problems encountered during the project.
E6374.2	Develop and enhance technical skills specific to the field of engineering relevant to the project, such as design, analysis, simulation, construction, testing, and implementation.
E6374.3	Apply critical thinking and problem-solving skills to identify, analyze, and propose solutions to engineering challenges encountered throughout the project lifecycle.
E6374.4	Acquire project management skills by effectively planning, organizing, and executing project tasks within defined timelines and resource constraints.
E6374.5	Improve communication skills through the preparation and delivery of project reports, presentations, and documentation that effectively convey technical information to stakeholders.

Important points to consider to select the In-house project

- Selecting a project work in Diploma Engineering is a significant decision that can greatly influence your learning experience and future career prospects.
- Choose a project that aligns with your career aspirations and interests within the field of engineering. Consider how the project can contribute to your professional development and future opportunities.
- Ensure the project aligns with your coursework and specialization within the Diploma program. It should complement and build upon the knowledge and skills you have acquired in your studies.

- Evaluate the scope of the project to ensure it is manageable within the given timeframe, resources, and constraints. Avoid projects that are overly ambitious or impractical to complete effectively.
- Assess the availability of resources needed to conduct the project, such as equipment, materials, laboratory facilities, and access to relevant software or tools. Lack of resources can hinder project progress.
- Select a project that genuinely interests and motivates you. A project that captures your curiosity and passion will keep you engaged and committed throughout the project duration.
- Consider the availability and expertise of faculty advisors or industry mentors who can provide guidance and support throughout the project. Effective mentorship is crucial for success.
- Clearly define the learning objectives and expected outcomes of the project. Ensure that the project will help you achieve specific learning goals related to technical skills, problem-solving, and professional development.
- Look for opportunities to propose innovative solutions or explore new methodologies within your project. Projects that encourage creativity can set you apart and enhance your learning experience.
- Consider ethical implications related to the project, such as safety protocols, environmental impact, and compliance with ethical guidelines in research and engineering practices.
- Evaluate whether the project offers opportunities for collaboration with peers, experts from other disciplines, or industry partners. Interdisciplinary projects can broaden your perspective and enhance your teamwork skills.
- Consider the potential impact of your project on society or the engineering community. Projects that address significant challenges or contribute to social good can be highly fulfilling and make a meaningful difference.

By carefully considering these points, Diploma Engineering students can make informed decisions when selecting project work that not only enhances their academic learning but also prepares them for successful careers in engineering.

Duties Responsibilities of the internal faculty advisor

Each group should have an internal faculty advisor assigned by the HOD/Principal.

- The in-house project should be approved by the project monitoring committee constituted by the Chairperson Autonomous of Examinations.
- The in-house project should be selected in the fifth semester itself. Each in-house project shall have a maximum of four students in the project group.
- Provide comprehensive academic advising to help in the selection of appropriate in-

house project that align with their interests and career goals.

- Offer expertise and feedback to ensure rigorous methodology, innovative approaches, and meaningful contributions to the field.
- Assist in developing technical and professional skills through hands-on projects, laboratory work, and practical applications of theoretical knowledge.
- Provide personal mentorship, fostering a supportive relationship that encourages growth, resilience, and a positive academic experience.
- Facilitate connections between students and industry professionals, alumni, and other relevant networks to enhance their professional opportunities and industry exposure.
- Ensure students have access to necessary resources, including research materials, lab equipment, software, and academic literature.
- Regularly monitor and evaluate the progress of the in-house project, providing constructive feedback and guidance to help them stay on track and achieve their goals.
- Instill and uphold high ethical and professional standards, encouraging students to practice integrity and responsibility in their work.
- Assist in preparing progress reports, writing recommendation letters, and facilitating grant applications.
- Organize and participate in workshops, seminars, and other educational events that enhance the learning experience and professional development.
- Address any issues or conflicts that arise, providing mediation and support to ensure a positive and productive academic environment.

Instructions to the students

- Regularly meet with your internal faculty advisor for guidance on academic progress, research projects, and career planning. Be proactive in seeking advice and support from your faculty advisor.
- Use planners, calendars, and task management tools to keep track of assignments, project deadlines, and study schedules. Prioritize tasks to manage your time efficiently.
- Take advantage of opportunities to participate in in-house projects and hands-on activities. These experiences are crucial for applying your theoretical knowledge and gaining practical skills.
- Focus on improving essential professional skills such as communication, teamwork, problem-solving, and leadership. Participate in workshops and seminars that enhance these competencies.
- Actively seek networking opportunities through industry events, seminars, and meetings. Establish connections with peers, alumni, and professionals in your field to build a strong professional network.
- Seek internships, co-op programs, or part-time jobs related to your field of study. Real-world experience is invaluable for understanding industry practices and enhancing your employability.
- Uphold high ethical standards in all your academic and professional activities. Practice

integrity, honesty, and responsibility. Adhere to the ethical guidelines and standards set by your institution and the engineering profession.

- Adopt a mindset of lifelong learning. Stay updated with the latest developments and trends in engineering by reading industry journals, attending conferences, and taking additional courses.

Documents to be submitted by the student for an in-house project

Submit a printed report of your in-house project work along with the fabrication model / analysis report for the End Semester Examination.

Rubrics for In-House Project Work

Sl. No.	Topics	Description
1	Objectives	Clearly defined and specific objectives outlined. Objectives align with the project's scope and purpose.
2	Literature Review	Thorough review of relevant literature. Identification of gaps and justification for the project's contribution.
3	Research Design and Methodology	Clear explanation of the research design. Appropriateness and justification of chosen research methods.
4	Project Management	Adherence to project timeline and milestones. Effective organization and planning evident in the project execution.
5	Documentation	Comprehensive documentation of project details. Clarity and completeness in recording methods, results, and challenges.
6	Presentation Skills	Clear and articulate communication of project findings. Effective use of visuals, if applicable.
7	Analysis and Interpretation	In-depth analysis of data. Clear interpretation of results in the context of research questions.
8	Problem-Solving	Demonstrated ability to identify and address challenges encountered during the project. Innovative solutions considered where applicable.
9	Professionalism and Compliance	Adherence to ethical standards in research. Compliance with project guidelines and requirements.
10	Quality of Work	Overall quality and contribution of the project to the field. Demonstrated effort to produce high-quality work.

SCHEME OF EVALUATION

The mark allocation for Internal and End Semester Viva Voce are as below.

Internal Mark Split (40 Marks)*		
Review 1 (10 Marks)	Review 2 (15 Marks)	Review 3 (15 marks)
Committee: 5 Marks. Supervisor: 5 Marks	Committee: 7.5 Marks Supervisor: 7.5 Marks	Committee: 7.5 Marks Supervisor: 7.5 Marks

Note: * The rubrics should be followed for the evaluation of the internal marks during reviews.

END SEMESTER EXAMINATION - Project Exam

The performance of each student in the project group would be evaluated in a viva voce examination conducted by a committee consisting of an external examiner and the Department project supervisor and an internal examiner.

End Semester (100)#			
Record (20 Marks)	**Presentation (20 Marks)**	**Viva Voce (20 Marks)**	**Model / Analysis Report (40 Marks)**
External: 10 Internal: 5 Supervisor: 5	External: 10 Internal: 5 Supervisor: 5	External: 10 Internal: 5 Supervisor: 5	External: 20 Internal: 10 Supervisor: 10

The marks scored will be converted to 60 Marks.

Students who are unable to complete the project work at the end of the semester can apply for an extension to the Head of the Department, with the recommendation from the project guide for a period of a maximum of two months. For those students who extend the project work for two months, Viva Voce will be carried out and results will be declared separately. If the project report is not submitted even beyond the extended time, then students are not eligible to appear for Project Viva Voce Examination.