SESHASAYEE INSTITUTE OF TECHNOLOGY

(AUTONOMOUS) TRICHY-10

NBA Accredited Programmes - Mechanical, ICE,Computer, Paper Tech.

DIPLOMA IN ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

G-SCHEME

IMPLEMENTED FROM 2023-2024

Your paragraph text

CONTENTS

1. PREFACE

The wave of liberalization and globalization has created an environment for free flow of information and technology through fast and efficient means the world over. This has lead to shrinking of world, bringing people from different cultures and environment together, giving rise to a global village. A shift has been taking place in India from closed economy to knowledge based and open economy. In order to cope-up with the challenges of handling new technologies, materials and methods, we have to develop human resources having appropriate knowledge, professional skills and attitude. Technical education system is one of the significant components for human resource development. **Polytechnics** play an important role in meeting the requirements of trained technical manpower for industries and field organizations. The initiatives being taken by the State Board of Technical Education, Tamilnadu to revise the curriculum of existing diploma programmes as per the needs of the industry are laudable.

In order to meet the requirements of future technical manpower, constant efforts have to be made to identify new employment opportunities, carryout activity analysis and design need based curricula of diploma programmes. This curriculum document has been designed by identifying job potential and competency profile of diploma holders leading to identification of curriculum areas for the course.

It is needless to emphasize that the real success of the diploma programme depends upon its effective implementation. This will require harnessing and effective utilization of resources. In addition to acquisition of appropriate physical resources, the availability of competent and qualified faculty is essential.

It is time for the managers of technical education system to reorganize the system to accept the challenges of both quantitative and qualitative expansion of technical education. The creation of EDUSAT facilities in the country must be exploited to its fullest extent to reap the benefits of interactive electronic media for teaching-learning process.

It is hoped that polytechnics will carry out job market research on a continuous basis to identify the new skill requirements and develop innovative methods of course offering and thereby infuse dynamism in the system.

Principal

Seshasayee Institute of Technology

2. ACKNOWLEDGEMENT

We gratefully acknowledge the assistance and guidance received from the following persons:

i) Commissioner Technical Education and Special Officer Curriculum Development centre, DOTE, Chennai for taking keen interest and support in the design of this curriculum.

ii) Programme Advisory Committee members:

DR.G.BALASUBRAMANIAN, Sr Asst Professor, School of EEE, and SASTRA Deemed University, Tanjore.

DR.M.SUNDARARAJAN, Lecturer / EEE, Government Polytechnic College, Trichy

TMT. M.RENGANAYAGI, TANGEDCO, Vazhavanthan Kottai SS, Trichy

For their professional inputs and guidance in execution of the Curriculum and syllabus.

iii) Principal of this Institute for his Guidance and Academic freedom provided to the Department in design of this curriculum.

iv) All the faculty members from Department of Electrical and Electronics Engineering for their untiring assistance and support in curriculum design and documentation.

Coordinator

3. DEPARTMENT VISION, MISSION, PEO AND PO

VISION

To meet the challenges of new technological advances and to provide update knowledge in the state of the art technology, re-orientation and up gradation of the curriculum to the level of industry relevant learning and training and thus to be a premier technical department that strives continuously for excellence in education

MISSION

- To produce Electrical Engineers of high Caliber to serve the Society and Nation.
- To bridge the gap between industry and academic by framing curriculum and syllabus based on industrial needs
- To create and sustain environment of learning in which students acquire knowledge and learn to apply it professionally with due consideration of social and economical issues.
- To provide opportunity to enhance the creative talents of students and faculty members
- To inculcate moral and ethical values among the faculty and students

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Electrical and Electronics Engineering programme of Seshasayee Institute of Technology will prepare its diploma students

PEO1: To have fundamental and broad knowledge in Electrical and Electronics Engineering

PEO2: To apply creatively their understanding of engineering principles to the Solution of problems arising in whatever career they choose

PEO3: To communicate their ideas and positions clearly and concisely

PEO4: To practice their Professions conforming to Ethical Values and Environmental friendly policies

PEO5: To work as a team in multi-cultural and multi-disciplinary Environments

PEO6: To adapt evolving Technologies, innovations and stay current with their Professions

PROGRAMME OUTCOMES (POs)

Students of Diploma in Electrical and Electronics Engineering course at our institute will be

PO1: Able to identify, analyze and provide solutions to problems in the field of Electrical and Electronic Engineering

PO2: Able to adopt energy conservation and renewable energy in order to promote eco- friendly electrical energy production

PO3: Able to communicate effectively in order to compete globally

PO4: Able to handle any situation with ethical and social responsibility

PO5: Able to work as an individual and as a team member in multi-cultural and multi-disciplinary Environments

PO6: Able to apply modern techniques and IT tools in Engineering

4. REGULATIONS

DIPLOMA COURSES IN ENGINEERING

(TERM PATTERN - Implemented from 2023-2024)

G-SCHEME (Common to all Programmes)

PREAMBLE

Polytechnic colleges contribute significantly to the state's talent pipeline, and it is known that polytechnic was initially started with the primary objective of producing skilled technicians to support mass industrialization.

Today there is a changing manpower need, as TN's economy is beginning to focus on advanced technology and knowledge-based industries, rather than low-cost labour-intensive manufacturing. To produce future- ready talent and bridge the industry-academia gap, it is only pertinent to rethink the existing curriculum and revamp the syllabi.

The current dynamic ecosystem poses challenges that span across fields and demands multidisciplinary knowledge to address them; this has propelled the need for higher technical education to cover diverse areas such as STEM, arts, humanities, design, innovation, business, and entrepreneurship; hence the program is modelled to incorporate all these areas.

The challenges of the 21st century demand young diploma engineers to have a command of the ever-changing body of technical knowledge along with an array of personal, interpersonal, and system-building knowledge that will prepare them with skills & competencies to address the modern-day challenges by building a new generation of machines, methods and materials.

Higher technical institutions being the primary source for companies to source talent are under pressure to design a dynamic system of technical education to meet the demands.

The program is offered through the core, electives, certifications, capstone projects and other ways to enable a student's transformation. Each domain is carefully crafted to cater to diversified needs, dynamic contexts, and differentiated expectations in a learner-centric environment.

Objective

To retain and further strengthen the quality of the human capital produced by our higher technical education at the diploma level as the 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

(i) 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.

(ii) 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.

(iii) There is no **age limit prescribed for admissions to Diploma programs.**

(iv) 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.

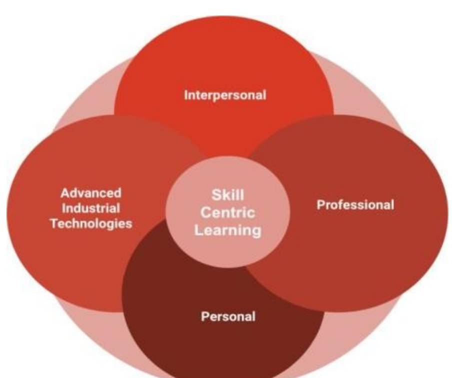
Various Dimensions for Transformation

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

(1) Foundation (F), (2) Concentration (C) and the (3) Specialization (S) 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.
- **Specialization(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 (PO) as per the Outcome Based Education (OBE) model. The content of each course is designed based on the intended Course Outcomes (CO). Every program shall have a distinct curriculum with syllabi consisting of courses broadly categorized under:

1. 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.

2. 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.

3. 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.

4. 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.

5. 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.

6. In-House Projects (J) - 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 multi- domains / 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.

7. 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.

8. 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 re- do the same course whenever offered.

9. 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.

10. 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.

11. 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".

Definition 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) - 45 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
Programme 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	Industrial visit
Health & Wellness	PT,Yoga
Student-Led Initiative	Non-Credits Course
Special Interest Groups (Placement Training)	Non-Credits Course
Emerging Technology Seminars	TED, NPTEL Videos

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. **Professional 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 Elective:** 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 organized. Effective learning outcomes are student-centered, 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 behavioral) 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/realize 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 PO 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

CO 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 organizing talks from the industry, bridge courses, organizing 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 Diploma 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 HoD, COE of the institution, and 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 Board comprising the Head of the department, COE, the Principal & Chairman Autonomous Examinations along with the Equivalent Credit(s). (Online Courses offered by Swayam, NPTEL.)

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/DoTE).

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 and COE with intimation to DoTE.

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.

Note: Exam fee paid will be adjusted in the subsequent semester.

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, specialization, and capstone project and deferred placement option.

Peer 2 Peer Learning

P2P 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, and 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 result in learning hands-on skills as it gives the students an opportunity to try out new methods and fail 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 organized 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 organized 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 degree. The minimum and maximum period of study shall be;

Diploma program	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

Attendance Requirements

- A student who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a Term.
- Ideally every student is expected to attend all classes of all the attendance.

1. However, in order to make provision for certain unavoidable reasons 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 overall attendance for each semester.

2. 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.

3. 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.

4. Students who secure less than 50% 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.

Award of Marks for Course Attendance

Award of marks for Course attendance to each Course Theory / Practical /Practicum /Project will be as per the range given below

Sl.No	Course Attendance (%)	(Theory / Practical / Practicum) Marks	(Health & Wellness) Marks
1	75 % - 70 %	1	4
2	81 % - 85 %	2	8
3	86 % - 90 %	3	12
4	91 % - 95 %	4	16
5	96 % - 100 %	5	20

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:

- 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.

- Analyzing 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 adviser(s) 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.

- 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 Marks Supervisor: 5 Marks	Committee: 7.5 Marks Supervisor: 7.5 Marks	Committee: 7.5 Marks Supervisor: 7.5 Marks	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 Requirements for Award of Diploma

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 Term examination answer paper in a theory course, as per the guidelines of Autonomous Exam cell, SIT on payment of a prescribed fee along with prescribed application to the Autonomous Examination account.

The Autonomous Examination cell will arrange for the revaluation and the results will be intimated to the student concerned through institute web site.

Revaluation is not permitted for laboratory courses and projects.

Award of Grades

The award of letter grades will be decided using absolute 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
O (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 degree. These courses will be monitored by

the central committee constituted by DoTE. 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.

$$\text{CGPA} = \frac{\sum_{i=1}^{n} CiGPi}{\sum_{i=1}^{n} Ci}$$

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 by the Directorate of Technical education whenever the student is readmitted under Regulations 2023 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 degree 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 Board of 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.

Revision of Regulation, Curriculum and Syllabi

The Directorate of Technical Education may from time-to-time revise, amend or change the regulations, curriculum, syllabus and scheme of examinations through the Leadership Committee with the approval of the Board.

5. SALIENT FEATURES

Name of the Programme	:	Diploma Programme in Electrical and Electronics Engineering
Duration of the Programme	:	Three years (Six Semesters)
Entry Qualification	:	Matriculation or equivalent as prescribed by State Board of Technical Education,Tamilnadu
Intake	:	60
Pattern Of the Programme	:	Term (Semester) Pattern
Ratio Between Theory & Practical Classes	:	40 : 60 (Approximately)

6. EMPLOYMENT OPPORTUNITIES FOR DIPLOMA HOLDERS IN ELECTRICAL AND ELECTRONICS ENGINEERING

It is observed that employment in government/public sector undertakings are dwindling day by day. Keeping present scenario in view, following employment opportunities are visualized in different sectors of employment for diploma holders in electrical and electronics engineering.

6.1 Manufacturing Industry (Mechanical)

The Electrical diploma holder will be involved in following activities in mechanical manufacturing industry:

- Planning and execution for Electrical installation
- Distribution of Electrical Power
- Maintenance of Industrial Electrical System
- Repair and Maintenance of Electrical Machines and Equipment
- Repair and Maintenance of Electronic Control Circuitry
- Testing and Standardization for Quality Control
- Energy Conservation

6.2 Manufacturing Industry (Electrical and Electronics)

The Electrical diploma holder will be involved in following activities in Electrical and Electronics manufacturing industry:

- Assistance in Research and Development
- Assistance in Planning, Designing and Detailing
- Shop-floor Management including Quality Control
- Power Generation and Distribution
- Installation of Electrical Power Supply Systems
- Maintenance of Electrical and Electronic System(s)
- Repair and Maintenance of Electrical Machines/Equipment (including testing)
- Production
- Inventory Management
- Marketing and Sales

6.3 Government Departments such as Electricity Board, MES, PWD, Railways, Air bases, Airports, Defence, Thermal, Hydro and Nuclear Power Stations and other Boards and Corporations.

The Electrical diploma holder will be involved in following type of activities in above mentioned Government Departments:

- Assistance in Planning and Design of Electrical generation, transmission, distribution and protection system including testing, quality control
- Estimating for electrical installation Construction, erection and commissioning of lines and Sub-stations
- Electrical Safety measures
- Operation and Maintenance of Lines and Sub-stations/underground cables
- Tariffs and Calculations of bills for consumption of electricity
- Inventory Management
- Repair and Maintenance of Electrical Machines/ Equipment
- Operation and maintenance of Thermal, Hydro and Nuclear Power Stations

6.4 Hospitals, Commercial Complexes, Service Sector Organizations like Hotels, Tourist-Resorts, high-rise buildings, Cinema/Theater Halls etc.

Diploma holder in electrical engineering will be involved in following type of activities in above mentioned Service Sector Organizations:

- Layout of wiring circuit, planning and execution for Electrical Installation
- Standby or captive Power Generation and its Distribution
- Maintenance of Electrical and Electronic Equipment
- Preventive Maintenance of Communication System, Lifts, Air-Conditioning
- Plants and Water Supply System
- Inventory Management
- Estimation for electrical repair and maintenance work

6.5 Self-Employment

Following type of self-employment opportunities are available to the diploma holder in electrical engineering:

- Trading of Electrical Goods
- Establishing Repair and Maintenance Unit/ Centre
- Free Lancer for Repair and Maintenance of House-hold Electrical and Electronic Gadgets such as: Washing Machines, Geysers, Air Conditioners, Coolers and electrical installations etc.
- Electrical contractor
- Motor Winding Unit
- Auto-electrical Work
- Service sector

Can work as:

- Service and marketing engineer in the field of automation.
- Trainer of PLC & SCADA system.
- TSE (Technical Support Executive)

6.6 JOB PROFILE/ ACTIVITY PROFILE

(01) Reading and interpreting drawings related to electrical machines, equipment, wiring installations
(02) Selecting right kind and quality of materials
(03) Using measuring instruments, tools and testing devices for varied field Applications.
(04) Understanding of constructional details, principle of working, characteristics and application of electrical machines, equipment, appliances and instruments
(05) Understanding of salient features and working principles of generation, transmission, distribution, protection and utilization of electrical power in different sectors
(06) Understanding of practices involved in erection, testing/installation and commissioning of electrical machines, equipment, control panels and systems
(07) Troubleshooting of electrical machines, wiring installations, equipment and control systems
(08) Knowledge and awareness of: Power Tariff (Power Trade and Control), Indian Electricity rules, codes and Standards, Electrical Safety and Shock Prevention Measures, Labour Management,
(09) Understanding of safety practices such as earthing, fire and shock prevention measures adopted in industry and service sector
(10) Understanding the principles of basic and digital electronics, microprocessors and micro-controller-based systems and their applications in electrical control circuits
(11) Uses Information Technology and computers for various applications in the field of electrical engineering
(12) Knowledge and awareness of upcoming technologies of their field like PLC, SCADA & DCS System
(13) Good knowledge of Electrical AutoCAD.
(14) Competencies in supervising shop floor/ work site operations
(15) Awareness about the environment, use of non-conventional energy sources, external financial and technical support system and energy conservation techniques
(16) Knowledge of latest trends in the field of electronic controls, communication and instrumentation

7. COMPETENCY PROFILE OF DIPLOMA HOLDER IN ELECTRICAL AND ELECTRONICS ENGINEERING

Keeping in view the employment scenario and requirement of four domains of learning viz. Professional Development Domain, Continued Learning Domain, Human Relations Domain and Personal Development Domain, a diploma holder in Electrical and Electronics Engineering should have the:

(01) Understanding of constructional details, principle of working, characteristics and application of electrical machines, equipment, appliances and instruments

(02) Understanding of salient features and working principles of generation, transmission, distribution, protection and utilization of electrical power in different sectors

(03) Ability to read and interpret drawings related to sub stations, electrical machines, equipment, wiring installations for light and power.

(04) Competency in selection of right kind and quality of materials and preparation of estimates for installation of control panels used in industry.

(05) Ability to prepare tender document as per given drawings.

(06) Ability to use measuring instruments, tools and testing devices for varied field applications.

(07) Competency in the design of control circuits for electrical machine control, Control panels, wiring circuits etc.

(08) Ability to draw Ladder diagram and write Program for Control of Machines using PLC.

(09) Understanding of practices involved in erection, testing/installation and commissioning of electrical machines, equipment, control panels and systems.

(10) Ability for fault diagnosis and repair of electrical machines, wiring installations, equipment and control systems.

(11) Knowledge and awareness of:

- Power Tariff (Power Trade and Control)
- Indian Electricity rules, codes and Standards
- Safety and Shock prevention Measures
- Labour Management
- Technical Report-writing Skills
- Team Working, Interpersonal Relations and Human Values
- Entrepreneurship Development (Self Employment)
- Concern for wastage

(12) Understanding of safety practices such as earthing, fire and shock prevention measures adopted in industry and service sector

(13) Understanding the principles of basic and digital electronics, microprocessors and micro- controller-based systems and their applications in electrical control circuits.

(14) Ability to use Information Technology and computers for various applications in the field of electrical engineering.

(15) Knowledge of applied and engineering sciences for better comprehension of technologies used in electrical industry and service sector and to develop scientific temper, analytical skills and to facilitate continuing education.

(16) Competencies in general, manual and machining skills for supervising shop floor/ work site operations.

(17) Proficiency in oral and written communication, technical report writing, managing relationship with juniors, pears and seniors for effective functioning in the world of work.

(18) Competency in solving simple problems related to various functional areas of electrical and electronics engineering may it be prototype development, diagnostic and fault finding or repair and maintenance of plant and equipment

(19) Understanding of basic principles of managing men, material and equipment and techniques of achieving economy and quality

(20) Awareness about the environment, use of non-conventional energy sources, external financial and technical support system, adopting energy conservation techniques

(21) Knowledge of latest trends in the field of electronic controls, communication and instrumentation.

8. DERIVING CURRICULUM AREAS / SUBJECTS DERIVED FROM COMPETENCY PROFILE

Sl.No.	Competency Profile	Curriculum Areas
1.	Ability to read and interpret drawings related to sub stations, electrical machines, equipment, wiring installations for light and power,	✓ Basic Graphic and Drawing Skills ✓ Wiring circuits ✓ CAD drawing
2.	Ability to use measuring instruments, tools and testing devices for varied field applications	✓ Measurements and Instrumentation ✓ Electrical and Electronics Practical
3.	Competency in the design of control circuits for electrical machine control, control panels, wiring circuits etc.	✓ Control and Maintenance of Electrical Machines ✓ Electrical Workshop Practice
4.	Understanding of constructional details, principle of working, characteristics and application of electrical machines, equipment, appliances and instruments	✓ Electrical Machines ✓ Utilization of Electrical Energy (Power System)
5.	Understanding of salient features and working principles of generation, transmission, distribution, protection and utilization of electrical power in different sectors	✓ Transmission and Distribution of Electrical Power ✓ Generation and Protection of Electrical Power
6.	Understanding of practices involved in erection/installation and commissioning of electrical machines, equipment, control panels and systems	✓ Erection Commissioning and operation of Electrical Machines and Installations
7.	Ability for fault diagnosis and repair of electrical machines, wiring installations, equipment and control systems	✓ Testing, repair and maintenance of Electrical Machines and Installations
8.	Competencies in general, manual and machining skills for supervising shop floor / work site operations Understanding of safety practices such as earthing, fire and shock prevention measures adopted in industry and service sector	✓ Electrical Workshop Practice

9.	Competency in selection of right kind and quality of materials and preparation of estimates for installation of control panels used in industry	✓ Electrical Engineering Drawing ✓ Estimation and Costing
10.	Ability to prepare tender document as per given drawings	✓ Electrical Estimation and Costing
11.	Understanding the principles of basic and digital electronics, microprocessors and micro-controller based systems and their applications in electrical control circuits	✓ Digital Electronics ✓ Programmable Logic Controllers (PLCs) ✓ Microcontrollers
12.	Ability to use Information Technology and computers for various applications in the field of electrical engineering and Programming skill	✓ C++ Programming ✓ CAD & Simulation ✓ Computer Networks
13.	Knowledge of applied and engineering sciences for better comprehension of technologies used in electrical industry and service sector and to develop scientific temper, analytical skills and to facilitate continuing education	✓ Engineering Physics ✓ Engineering Chemistry ✓ Applied Mathematics ✓ Workshop Practice
14.	Proficiency in oral and written communication, technical report writing, managing relationship with juniors, pears and seniors for effective functioning in the world of work	✓ Communication Skills ✓ Project Work ✓ Exposure to World of Work ✓ Industrial Training
15	Competency in solving simple problems related to various functional areas of electrical engineering may it be prototype development, diagnostic and fault finding or repair and maintenance of plant and equipment	✓ Control and Maintenance of Electrical equipments ✓ Estimation and
.16	Awareness about the environment, use of non- conventional energy sources, external financial and technical support system, adopting energy conservation techniques	✓ Environmental Education ✓ Renewable (Non-Conventional) Sources of Energy

9. CURRICULUM OUTLINE

CREDIT DISTRIBUTION

TERM	No of Courses	Periods	Credits
TERM I	8	640	20
TERM II	9	640	20
TERM III	8	640	21
TERM IV	7	640	20
TERM V	8	640	21
TERM VI	3	665	18
Total	**43**	**3865**	**120**

DURATION: 16 WEEKS | DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING | SCHEME: G

TERM - 43

Sl.No.	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1.	Program Core	Theory	2G233110	Electrical Circuit Theory	4-0-0	60	4	Theory
2.	Program Core	Theory	2G233210	Electrical Machines I	4-0-0	60	4	Theory
3.	Program Core	Practicum	2G233340	Sensors and Measurement	1-0-4	75	3	Practical
4.	Program Core	Practicum	2G233440	Analog and Digital Electronics	1-0-4	75	3	Practical
5.	Engineering Science	Practicum	2G233540	Programming in C	1-0-2	45	2	Practical
6.	Program Core	Practical/Lab	2G233620	Electrical Machines I Practical	0-0-4	60	2	Practical
7.	Open Elective	Advanced Skill Certification	2G233760	Advanced Skills Certification – 3	0-0-4	60	2	NA
8.	Humanities & Social Science	Integrated Learning Experience	2G233880	Growth Lab	-	30	-	-
9.	Audit Course	Integrated Learning Experience	2G233881	Induction Program II	-	16	0	-
10.	Audit Course	Integrated Learning Experience	2G233882	I&E/ Club Activity/ Community Initiatives	-	16	0	-
11.	Audit Course	Integrated Learning Experience	2G233883	Shop floor Immersion	-	8	0	-
12.	Audit Course	Integrated Learning Experience	2G233884	Student-Led Initiative	-	22	0	-
13.	Audit Course	Integrated Learning Experience	2G233885	Emerging TechnologySeminars	-	8	0	-
14.	Audit Course	Integrated Learning Experience	2G233886	Health & Wellness	0-0-2	30	1	NA
Test & Revisions (60) + Library (15)					-	75	-	-
Total					-	**640**	**21**	-

SESHASAYEE INSTITUTE OF TECHNOLOGY, TRICHY

DURATION: 16 WEEKS | DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING | SCHEME: G

TERM - 44

Sl.No.	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1.	Program Core	Theory	2G234110	Electrical Machines II	4-0-0	60	4	Theory
2.	Program Core	Theory	2G234210	Generation, Transmission and Distribution	4-0-0	60	4	Theory
3.	Program Core	Practicum	2G234340	Microcontroller and its Applications	1-0-4	75	3	Practical
4.	Program Core	Practicum	2G234440	Electrical CAD Design	1-0-4	75	3	Practical
5.	Program Core	Practicum	2G234540	Servicing of Electrical Appliances	1-0-2	45	2	Practical
6.	Program Core	Practical/Lab	2G234620	Electrical Machines II Practical	0-0-4	60	2	Practical
7.	Open Elective	Advanced Skill Certification	2G234760	Advanced Skills Certification – 4	0-0-4	60	2	NA
8.	Audit Course	Integrated Learning Experience	2G234882	I&E/ Club Activity/ Community Initiatives	-	30	0	-
9.	Audit Course	Integrated Learning Experience	2G234883	Shop floor Immersion	-	8	0	-
10.	Audit Course	Integrated Learning Experience	2G234884	Student-Led Initiative	-	24	0	-
11.	Audit Course	Integrated Learning Experience	2G234885	Emerging Technology Seminars	-	8	0	-
12.	Audit Course	Integrated Learning Experience	2G234886	Health & Wellness	-	30	0	-
13.	Audit Course	Integrated Learning Experience	2G234887	Special Interest Groups (Placement Training)	-	30	0	-
Test & Revisions (60) + Library (15)					-	75	-	-
Total					-	**640**	**20**	-

DURATION: 16 WEEKS DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING SCHEME: G

TERM - V

** Internship shall be offered in the summer break between 4th and 5th semester followed by a review and award of credits in the 5th semester*

Sl.No.	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1.	Program Core	Theory	2G235110	Power System Protection and Utilization	3-0-0	45	3	Theory
2.	Program Core	Theory	2G235210	Electric Vehicle Technology	3-0-0	45	3	Theory
3.	Program Core	Practicum	2G235340	Power Electronics	1-0-4	75	3	Practical
4.	Program Core	Practicum	2G235440	PLC and Automation	1-0-4	75	3	Practical
5.	Program Elective	Practicum	2G235541 2G235543	**Elective -1** IoT And Application Control of Electrical Machines	1-0-4	75	3	Practical
6.	Humanities & Social Science	Practicum	2G235652	Innovation and Start-ups	1-0-2	45	2	Project
7.	Project / Internship	Project/Internship	2G235740	Industrial Training* [Summer Vacation - 90 Hours]	-	-	2	Project
8.	Open Elective	Advanced Skill Certification	2G235860	Advanced Skills Certification – 5	0-0-4	60	2	NA
9.	Audit Course	Integrated Learning Experience	2G235881	Induction program III	-	40	0	-
10.	Audit Course	Integrated Learning Experience	2G235884	Student-Led Initiative	-	30	0	-
11.	Audit Course	Integrated Learning Experience	2G235886	Health & Wellness	-	30	0	-
12.	Audit Course	Integrated Learning Experience	2G235887	Special Interest Groups (Placement Training)	-	40	0	-
Test & Revisions (60) + Library (15)					-	75	0	-
Total					-	635	21	-

ELECTIVE - 1:

Sl.No.	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1.	Program Elective	Practicum	2G235541	IoT And Application	1-0-4	75	3	Practical
2.	Program Elective	Practicum	2G235542	Computer Hardware and Networking	1-0-4	75	3	Practical
3.	Program Elective	Practicum	2G235543	Control of Electrical Machines	1-0-4	75	3	Practical
4.	Program Elective	Practicum	2G235544	Auto Mechatronics	1-0-4	75	3	Practical
5.	Program Elective	Practicum	2G235545	Mechanical Engineering	1-0-4	75	3	Practical
6.	Program Elective	Practicum	2G235546	Estimation, Standards and Regulations	1-0-4	75	3	Practical
7.	Program Elective	Practicum	2G235547	Inter discipline course	1-0-4	75	3	Practical

DURATION: 16 WEEKS | DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING | SCHEME: G

TERM - VI

Sl.No.	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1.	Program Elective	Theory	2G236112 2G236118	**Elective - 2 (Pathway)** Entrepreneurship Online Elective Courses	3-0-0	45	3	Theory
2.	Program Elective	Practicum	2G236235 2G236234 2G236236	**Elective - 3 (Specialization)** Energy Conservation and Auditing Renewable Energy Systems Electrical Drives and Controls	2-0-2	60	3	Theory
3.	Industrial Training / Project	Project / Internship	2G236151/ 2G236153/ 2G236174	Internship / Fellowship / In-house Project	-	540	12	Project
Test & Revisions					-	20	-	-
Total					-	**665**	**18**	-

Note:

1. *For all semesters, the type of End Semester examination for practicum subjects is based on the higher credits towards the theory or practicalcomponent of the respective course.*
2. *Some of the audit courses are non-credited but compulsory courses that are a part of the program initiative and the implementation processhas to be recorded.*
3. *1 Credit for Projects is equivalent to 45 periods for projects/internships/fellowship*
4. *Electives 3 is considered as Open Elective, providing the option for students to take courses from other departments also if suitable withapproval from the Head of the Institution.*

ELECTIVE - 2 (PATHWAY):

Sl.No.	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1.	Elective | Higher Education	Theory	2G236111	Advanced Engineering Mathematics	3-0-0	45	3	Theory
2.	Elective | Entrepreneurship	Theory	2G236112	Entrepreneurship	3-0-0	45	3	Theory
3.	Elective | Technocrats	Theory	2G236113	Project Management	3-0-0	45	3	Theory
4.	Elective | Technocrats	Theory	2G236114	Finance Fundamentals	3-0-0	45	3	Theory
5.	Elective | Technocrats	Theory	2G236115	Industrial Management And Safety	3-0-0	45	3	Theory
6.	Elective | Technocrats	Theory	2G236116	Battery Management System	3-0-0	45	3	Theory
7.	Elective | Technocrats	Theory	2G236117	Industrial Automation	3-0-0	45	3	Theory
8.	Elective | Technocrats	Theory	2G236118	Online Elective Courses $	3-0-0	45	3	Theory

$ Online courses with the same credit available in AICTE, NPTEL and reputed Institutions with the proper evaluation system and certification can be considered after proper approval from DOTE Exam Section

ELECTIVE - 3 (SPECIALIZATION):

SL.No	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1.	Program Elective	Practicum	2G236231	HVAC (R & AC)	2-0-2	60	3	Theory
2.	Program Elective	Practicum	2G236232	PCB Design and Assembly	2-0-2	60	3	Theory
3.	Program Elective	Practicum	2G236233	Electronics Product Design	2-0-2	60	3	Theory
4.	Program Elective	Practicum	2G236234	Renewable Energy Systems	2-0-2	60	3	Theory
5.	Program Elective	Practicum	2G236235	Energy Conservation and Auditing	2-0-2	60	3	Theory
6.	Program Elective	Practicum	2G236236	Electrical Drives and Controls	2-0-2	60	3	Theory

10. SCHEME OF EXAMINATIONS:

The Scheme of examinations for courses is given in Curriculum outline

CRITERIA FOR PASS:

1. No candidate shall be eligible for the award of Diploma unless he/she has undergone the prescribed course of study successfully in an institution approved by AICTE and affiliated to the State Board of Technical Education & Training, Tamil Nadu and pass all the subjects prescribed in the curriculum.

2. A candidate shall be declared to have passed the examination in a course if he/she secures not less than ***40% in theory subjects and 50%in practical subjects*** out of the total prescribed maximum marks including both the Internal Assessment and the Autonomous Examinations marks put together, course to the condition that he/she secures at least a ***minimum of 40 marks out of 100 marks in the Autonomous Theory Examinations and a minimum of 50 marks out of 100 marks in the Autonomous Practical Examinations***.

CLASSIFICATION OF SUCCESSFUL CANDIDATES:

Classification of candidates who will pass out the final examinations from April 2023 onwards (Joined first year in 2020 -2021) will be done as specified below.

FIRST CLASS WITH SUPERLATIVE DISTINCTION:

A candidate will be declared to have passed in ***First Class with Superlative Distinction*** if he/she secures not less than 75% of the marks in all the courses and passes all the terms in the first appearance itself and passes all courses within the stipulated period of study 2 / 3 / 3½ years [Full time (lateral entry)/Full Time/Sandwich] without any break in study.

FIRST CLASS WITH DISTINCTION:

A candidate will be declared to have passed in ***First Class with Distinction*** if he/she secures not less than 75% of the aggregate marks in all the terms put together and passes all the terms except the I and II term in the first appearance itself and passes all courses within the stipulated period of study 2 / 3 / 3½ years [Full time(lateral entry)/Full Time/Sandwich] without any break in study.

FIRST CLASS:

A candidate will be declared to have passed in ***First Class*** if he/she secures not less than 60% of the aggregate marks in all the terms put together and passes all the courses within the stipulated period of study 2 / 3 / 3½ years [Full time (lateral entry)/Full Time/Sandwich] without any break in study.

SECOND CLASS:

All other successful candidates will be declared to have passed in ***Second Class***.

The above classifications are also applicable for the Sandwich students who passout Final Examination from October 2023 /April 2024 onwards (both joined First Year in 2020 -2021).

DURATION OF A PERIOD IN THE CLASS TIME TABLE:

The duration of each period of instruction is 1 hour and the total period of instruction hours excluding interval and lunch break in a day should be uniformly maintained as 8 hours corresponding to 8 periods of instruction (Theory & Practical).

11. COMPARISON OF F-SCHEME SYLLABUS WITH G - SCHEME SYLLABUS

III TERM

Sl.No.	Course Code in F Scheme	Courses in F Scheme	Course Code in G Scheme	Alternate Courses in G Scheme	Comments
1	2F3201	Electrical Circuit Theory	2G233110	Electrical Circuit Theory	Same as Board 2023 Regulation
2	2F3202	Electrical Machines- I	2G233210	Electrical Machines I	Same as Board 2023 Regulation
3	2F3203	Electronic Devices And Circuits	2G233440	Analog and Digital Electronics	Practicum - Electronic Devices and Circuits subject contents included in Analog and Digital Electronics
4	2F3204	Measurements And Instrumentation	2G233340	Sensors and Measurement	Practicum
5	2F3205	Electrical Circuits And Machines Lab	2G233620	Electrical Machine- I Practical	Same as Board 2023 Regulation
6	2F3206	Electronic Devices And Circuits Lab	2G233540	Analog and Digital Electronics	Practicum
7	2F3207	Electrical Workshop	2G234540	Servicing of Electrical Appliances	Moved to 4^{th} term

IV TERM

Sl.No.	Course Code in F Scheme	Courses in F Scheme	Course Code in G Scheme	Courses in G Scheme	Comments
1	2F4301	Electrical Machines – II	2G234110	Electrical Machines II	Same as Board 2023 Regulation
2	2F4302	Analog & Digital Electronics	2G233440	Analog and Digital Electronics	Practicum
3	2F4303	Energy Conservation And Audit	2G236235	Energy Conservation andAuditing	Introduced as Elective in VI Term
4	2F4401	E – Vehicle Technology & Policy	2G235210	Electric Vehicle Technology	In 5th Term
5	2F4304	Electrical Machines and Instrumentation Lab	2G234620	Electrical Machines II Practical	Regulation of Alternator by MMF method included. Circle diagram removed.
6	2F4305	Analog & Digital Electronics Lab	2G233440	Analog and Digital Electronics	Practicum
7	2F4306	CAD & Simulation Lab	2G234440	Electrical CAD Design	Same as Board 2023 Regulation

V TERM

Sl.No.	Course Code in F Scheme	Courses in F Scheme	Course Code in G Scheme	Courses in G Scheme	Comments
1	2F5307	Power System – I	2G234210	Generation, Transmission and Distribution	Same as Board 2023 Regulation
2	2F5308	Control & Maintenance of Electrical Machines	2G235543	Control of Electrical Machines	Practicum, 2 more experiments added
3	2F5402.1	Elective Theory - I Microcontroller	2G234340	Microcontroller and its Applications	Practicum
4	2F5309	Wiring, Esimation & Winding Lab	--	No Alternate Subject	Introduced as an Advanced Skill Certification Course
5	2F5310	Control & Maintenance of Electrical Machines Lab	2G235543	Control of Electrical Machines	Practicum
6	2F5403.1	Elective Practical – I Microcontroller Lab	2G234340	Microcontroller and its Applications	Practicum
7	2F5404	Entrepreneurship and start up	2G235652	Innovation and Start-ups	Practicum

VI TERM

Sl.No.	Course Code in F Scheme	Courses in F Scheme	Course Code in G Scheme	Courses in G Scheme	Comments
1	2F6311	Power System – II	2G235110	Power System Protection and Utilization	Same as Board 2023 Regulation
2	2F6312	Power Electronics	2G235340	Power Electronics	Practicum
3	2F6405.1	**Elective Theory** Programmable Logic Controller	2G235440	PLC and Automation	Practicum
4	2F6406.1	**Elective Lab** Programmable Logic Controller	2G235440	PLC and Automation	Practicum
5	2F6313	Power Electronics Lab	--	--	Advanced to V Term
6	2F6407	Project Work	2G236151/ 2G236153/ 2G236174	Internship / Fellowship / In-house Project	Same as Board 2023 Regulation

12. HORIZONTAL AND VERTICAL ORGANISATION OF THE COURSES

SN.	Subject	Distribution of credits in various Terms					
		I	II	III	IV	V	VI
1.	Electrical Circuit Theory	-	-	4	-	-	-
2.	Electrical Machines I	-	-	4	-	-	-
3.	Sensors and Measurement	-	-	3	-	-	-
4.	Analog and Digital Electronics	-	-	3	-	-	-
5.	Programming in C	-	-	2	-	-	-
6.	Electrical Machines I Practical	-	-	2	-	-	-
7.	Advanced Skills Certification - 3	-	-	2	-	-	-
8	Health & Wellness	-	-	1	-	-	-
9	Electrical Machines II	-	-	-	4	-	-
10	Generation, Transmission and Distribution	-	-	-	4	-	-
11	Microcontroller and its Applications	-	-	-	3	-	-
12	Electrical CAD Design	-	-	-	3	-	-
13	Servicing of Electrical Appliances	-	-	-	2	-	-
14	Electrical Machines II Practical	-	-	-	2	-	-
15	Advanced Skills Certification - 4	-	-	-	2	-	-

16	Power System Protection and Utilization			-	-	3	
17.	Electric Vehicle Technology	-	-	-	-	3	-
18	Power Electronics	-	-	-	-	3	-
19	PLC and Automation	-	-	-	-	3	-
20	**Elective -1** IoT And Application Control of Electrical Machines	-	-	-	-	3	-
21	Innovation and Start-ups	-	-	-	-	2	-
22	Industrial Training* [Summer Vacation - 90 Hours]	-	-	-	-	2	-
23	Advanced Skills Certification - 5	-	-	-	-	2	-
24	**Elective - 2 (Pathway)** Entrepreneurship Online Elective Courses	-	-	-	-	-	3
25	**Elective - 3 (Specialization)** Energy Conservation andAuditing Renewable Energy Systems Electrical Drives and Controls	-	-	-	-	-	3
26	Internship / Fellowship / In-house Project	-	-	-	-	-	12
	Total			21	20	21	18
TOTAL CREDITS = FIRST YEAR 40 CREDITS + PROGRAMME 80 CREDITS = 120 CREDITS							

13. DETAILED CONTENTS OF VARIOUS SUBJECTS

G SCHEME

Diploma in Electrical and Electronics Engineering

III TERM SYLLABUS

2G233110	ELECTRICAL CIRCUIT THEORY	L	T	P	C	END EXAM
THEORY		4	0	0	4	THEORY

Introduction:

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 everysituation. 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 ofelectrical 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

CO1 :Apply principles of circuit analysis to solve electric circuits.

CO 2 :Apply network theorems to solve electric circuits.

CO 3 :Solve the problems related to single phase A.C Series circuits.

CO 4 :Solve the problems related to single phase A.C Parallel circuits and Resonance circuits.

CO 5 :Solve the problems related to three phase circuits.

Pre-requisites: Knowledge of Mathematics.

2G233110	ELECTRICAL CIRCUIT THEORY	L	T	P	C	END EXAM
THEORY		4	0	0	4	THEORY

CO/PO Mapping:

CO / PO	P O1	PO2	PO 3	PO4	P O5	P O6	P O7
CO1	3	2	1	-	-	-	3
CO2	3	2	3	-	-	-	3
CO3	3	3	3	-	-	-	3
CO4	3	3	2	-	-	-	3
CO5	2	2	2	-	-	-	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.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

2G233110	ELECTRICAL CIRCUIT THEORY	L	T	P	C	END EXAM
THEORY		4	0	0	4	THEORY

Theory Portion :		
UNIT I	**BASIC CIRCUITS ANALYSIS**	Period
Resistive elements - Ohm's Law - Kirchhoff's laws - Resistors in series parallel circuits - Source transformation - Star/delta and delta/star transformation - Mesh Analysis - Node Analysis - Problems on all the above topics.		12
UNIT II	**NETWORK THEOREMS**	Period
Superposition Theorem - Thevenin's Theorem - Norton's Theorem - Maximum Power Transfer Theorem - Problems on all the above topics.		12
UNIT III	**SINGLE PHASE A.C SERIES CIRCUITS**	Period
Sinusoidal voltage and current – Instantaneous, peak, average and effective values – Form Factor - Peak factor - Pure resistive, inductive and capacitive circuits – RL, RC, and 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.		12
UNIT IV	**SINGLE PHASE A.C PARALLEL CIRCUITS & RESONANCE**	Period
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 – Band width – problems on all the above topics.		12
UNIT V	**THREE PHASE CIRCUITS**	Period
Significance of 3 phase circuits – 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 – Measurement of 3 phase power using two wattmeter method (Derivation and Problems) - Star and Delta connected unbalanced loads (No problems) – Symmetrical components (No problems).		12

2G233110	ELECTRICAL CIRCUIT THEORY	L	T	P	C	END EXAM
THEORY		4	0	0	4	THEORY

TOTAL PERIODS	60

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

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's 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.

2G233110	ELECTRICAL CIRCUIT THEORY	L	T	P	C	END EXAM
THEORY		4	0	0	4	THEORY

Text and Reference Books:

1. Dr. M. Arumugam & N. Premakumaran, Electric Circuit Theory, Fifth Edition, Khanna Publishers, 2017
2. B.L. Theraja, A.K. Theraja, A Text Book of Electrical Technology Volume - I , S Chand & Co.,2014.
3. R.K. Mehta & A.K. Mal, Problems and Solutions of Electrical Circuit Analysis, CBS Publishers, 2015.
4. Rajendra Prasad, Fundamentals of Electrical Engineering, Third Edition, PHI Learning Private Limited, 2014.

Web-based/Online Resources:

- 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.
- https://ekumbh.aicte-india.org/userdiplomabook.php
- https://www.khanacademy.org/science/electrical-engineering/ee-circuit-analysis- topic/circuit-elements/v/ee-ideal-sources
- https://onlinecourses.nptel.ac.in/noc20_ee64/preview

2G233111	ELECTRICAL MACHINES I	L	T	P	C	END EXAM
THEORY		4	0	0	4	THEORY

Introduction:

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

CO1 :Understand the significance and operation of DC Generator.

CO 2 :Understand the significance and operation of DC Motor.

CO 3 :Describe Principles and applications of single-phase transformer

CO 4 :Describe the construction of three-phase transformer and its accessories.

CO 5 :Apply maintenance strategies for electrical equipment.

Pre-requisites:

- Basics of Science and Basic algebra.
- Basic Electrical Engineering.

2G233111	ELECTRICAL MACHINES I	L	T	P	C	END EXAM
THEORY		4	0	0	4	THEORY

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	-	1	-	-	2
CO 2	3	2	1	1	-	-	2
CO 3	3	2	1	1	-	-	2
CO 4	3	2	-	1	-	-	2
CO 5	2	2	-	2	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.

2G233111	ELECTRICAL MACHINES I	L	T	P	C	END EXAM
THEORY		4	0	0	4	THEORY

THEORY PORTION:		
UNIT I	**DC GENERATORS**	Period
Basics of Electromagnetism - Overview of DC Generator - Importance of DC generators in power generation and various industries - Types of DC generators - EMF equation - Simple Problems - Internal and External characteristics – Applications - Process of building up of EMF - Critical field resistance - Causes of failure to build up voltage and remedies - Analysis of armature reaction effects - Commutation process – methods of improving commutation.		12
UNIT II	**DC MOTORS**	Period
Overview of DC Motors - Significance of DC Motors in various industries and automation - Types of DC Motors – Torque equation – Simple problems - Load characteristics – Torque - Speed characteristics – Applications - Necessity of starters - 3 point and 4-point starters - Speed Control of DC Motors – Losses, Efficiency and regulation of DC Motors - simple problems – Special DC Machines: BLDC Motor, Servomotor, PMDC Motor, Stepper motor.		12
UNIT III	**SINGLE PHASE TRANSFORMERS**	Period
Introduction to Transformers - Transformer Ratings - Applications – EMF Equation – Problems – Ideal Transformer - No-load and Load Phasor Diagrams at Varying Power Factors - Determination of equivalent circuit constants - Voltage Regulation, Losses and Efficiency - simple problems –Condition for maximum efficiency – All day efficiency - problems- Parallel operation of single-phase Transformer – Auto Transformer – Comparison between two winding transformer and Auto transformer.		12

2G233111	ELECTRICAL MACHINES I	L	T	P	C	END EXAM
THEORY		4	0	0	4	THEORY

UNIT IV	THREE PHASE TRANSFORMER	Period
Three Phase Transformer – Construction and Types of connections of transformer - Parallel operation and grouping of three phase transformers- Cooling of transformers – Various cooling arrangements – Transformer accessories: Conservator, Breather, Explosion vent, Buchholz relay –ON load and OFF load tap changer.		12
UNIT V	**MAINTENANCE OF DC MACHINES AND TRANSFORMERS**	Period
Importance of Maintenance - Preventive and Breakdown Maintenance – Causes of Sparking in Commutator – Defects in Commutator and Remedies – Resurfacing of Commutator and Brushes - Defects in DC Armature winding – Maintenance of Transformer Oil – Transformer oil tester – Acidity test, BDV test – Earthing – Measurement of earth resistance.		12
TOTAL PERIODS		**60**

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

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 and Reference Books:

1. B. L. Theraja and A. K. Theraja, A Textbook of Electrical Technology Volume - II (AC and DC Machines), Multi colour Edition, S. Chand & Co., 2005
2. V.K. Mehta & Rohit Mehta, Principles of Electrical Machines, Second Edition, S. Chand &Co.,2019
3. S. K. Bhattacharya, Electrical Machines, Third Edition, McGraw Hill Education, 2008.
4. Ashfaq Husain, Haroon Ashfaq, Electric Machines, Third Edition, Dhanpat Rai & Co. (P)Ltd., 2016.

Web-based/Online Resources:

- 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.
- MIT Open Course Ware (OCW) Electrical Engineering and Computer Science - Provides free course materials for electrical engineering topics, including electrical machines.
- Khan Academy - Offers tutorials on basic electrical engineering concepts that can reinforce understanding of electromagnetism and circuit analysis.
- IEEE Xplore Digital Library - For advanced research articles and materials on specific electrical machines and their applications.

***

2G233340	SENSORS AND MEASUREMENT	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Introduction:

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:

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

CO 1 : Understand the Terms and characteristics of measuring instruments.
CO 2 : Perform Calibration of Ammeter, Voltmeter and Energy Meter.
CO 3 : Handle Earth tester, Wheatstone, Anderson and Schering bridges.
CO 4 : Experiment with Temperature sensor, Inductive and Capacitive Sensors.
CO 5 : Demonstrate the applications of Arduino compatible sensors.

Pre-requisites:

- Basic Physics
- Basics of Electrical Engineering.

2G233340	SENSORS AND MEASUREMENT	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	3	2	-	1	1
CO 2	3	2	3	2	-	1	1
CO 3	3	2	3	2	-	1	1
CO 4	3	2	3	2	-	1	2
CO 5	3	2	3	2	-	1	2

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.

2G233340	SENSORS AND MEASUREMENT	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

THEORY PORTION		
UNIT I	**CLASSIFICATION AND CHARACTERISTICS OF INSTRUMENTS**	**PERIOD**
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).		2
UNIT 2	**MEASUREMENT OF CURRENT, VOLTAGE AND RESISTANCE**	**PERIOD**
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.		3
UNIT 3	**MEASUREMENT OF POWER,POWERFACTOR AND FREQUENCY**	**PERIOD**
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.		3
Practical Exercises:		
Ex.No	Name of the Experiment	Period
1	VOLTAGE, CURRENT AND POWER MEASUREMENT IN SINGLE PHASE AC CIRCUIT. Activities to Perform: 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. Repeat the same experiment by replacing above meters with single Digital Power Monitor. Compare and Discuss the observations.	4

2	CALIBRATION OF AMMETER AND VOLTMETER Activities to Perform: I) Conduct an Experiment to calibrate the given Ammeter and Voltmeter with corresponding standard meters. ii) Plot the Error Curve.	4
3.	MEASUREMENT OF CURRENT IN THREE PHASE CIRCUIT BY USING SINGLE AMMETER Activities to Perform: • Connect single Ammeter in three phase circuit through Ammeter Selector Switch (ASS) and Current Transformers. • Measure current in R, Y and B phases by using single Ammeter for balanced and unbalanced load.	4
4.	CALIBRATION OF ENERGY METER Activities to Perform: • Conduct an Experiment to calibrate the given Three Phase Energy Meter using Wattmeter and Stop Clock. • Plot the Error Curve.	4
5	MEASUREMENT OF RESISTANCE USING WHEATSTONE BRIDGE Activities to Perform: • Discuss the theory of Wheatstone Bridge. • Conduct an Experiment to measure the value of armature winding resistance using Whetstone Bridge. • Compare the observed value of resistance with theoretical / calculated value.	4
6	MEASUREMENT OF EARTH RESISTANCE BY USING EARTH TESTER. Activities to Perform: • Discuss the Necessity of maintaining Earth Resistance as Low Value. • Discuss the Permissible Earth Resistance Value as per Indian Standard. • Conduct an Experiment to measure the Earth Resistance by using Earth Tester.	4

2G233340	SENSORS AND MEASUREMENT	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

THEORY PORTION		
UNIT IV	**SENSORS AND PASSIVE TRANSDUCERS**	Period
Resistance and Inductance Sensors: Definition of Transducer –Classification of Transducers - Resistive Transducer (Linear and Rotary POTs) – Strain Gauge LoadCell – Construction and Operation of LVDT and RVDT. Proximity Sensors: Inductive Proximity Sensor – Capacitive Proximity Sensor. Light Sensor:		3
UNIT V	**SENSORS AND ACTIVE TRANSDUCERS**	Period
Photodiode – Phototransistor – Photoconductive Cell – Photovoltaic Cells - Bar Code Reader - Optical Shaft Encoder. Temperature Sensors: Thermocouple – Resistance Temperature Detector – Thermostat. Overview of Arduino compatible sensors: Ultrasonic Sensor - Moisture Sensor – Current Sensor.		4
Practical Exercises:		
Ex.No	Name of the Experiment	Period
7	MEASUREMENT OF INDUCTANCE USING ANDERSON BRIDGE Activities to Perform: Discuss the theory of Anderson Bridge. Conduct an Experiment to measure the value of unknown Inductance using Anderson Bridge. Compare the measured value of inductance with theoretical/ calculated value.	4
8	MEASUREMENT OF CAPACITANCE USING SCHERING BRIDGE Activities to Perform: Discuss the theory of Schering Bridge. Conduct an Experiment to measure the value of unknown Capacitance using Schering Bridge. Compare the measured value of Capacitance with theoretical/ calculated value.	4

9	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
10	BEHAVIOUR OF PROXIMITY SENSORS Activities to Perform: i) Observe the behaviour of Inductive proximity sensor and Capacitive Proximity sensor for different material samples. ii) Interface relay and buzzer with sensors to test the output.	4
11	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
12	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
Required Practical Instructions for all the Experiments		12
TOTAL PERIODS		**75**

2G233340	SENSORS AND MEASUREMENT	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

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

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:

1. A.K. Sawhney Puneet Sawhney, A Course in Electrical and Electronics measurements and instrumentation, Dhanpat Rai & Co.,(Pvt) Ltd., 2012.
2. D. Patranabis, Sensors and Transducers, Multi colour Edition, Second Edition, PHI Learning Private Limited., 2013
3. D.V.S. Murty , Transducers and Instrumentation, Second Edition, PHI Learning Pvt Ltd., 2012.

Web-based/Online Resources:

- https://archive.nptel.ac.in/courses/108/108/108108147/
- https://archive.nptel.ac.in/courses/108/105/108105153/

2G233340	SENSORS AND MEASUREMENT	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

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

S.No	Name of the Equipments	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

2G233340	SENSORS AND MEASUREMENT	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

End TERM Practical ExamModel Question Paper

Duration: 3 Hours Max. Marks: 100

List of Questions

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.
2. Conduct an Experiment to calibrate the given Ammeter and Voltmeter with corresponding standard meters.
3. Conduct an Experiment to measure current in three phase circuit by using single ammeter.
4. Conduct an Experiment to calibrate the given Three Phase Energy Meter using Wattmeter and Stop Clock.
5. Conduct an Experiment to measure the value of armature winding resistance using Whetstone Bridge.
6. Conduct an Experiment to measure the Earth Resistance by using Earth Tester.
7. Conduct an Experiment to measure the value of unknown Inductance using Anderson Bridge.
8. Conduct an Experiment to measure the value of unknown Capacitance using Schering Bridge.
9. Construct a circuit to measure Temperature of Liquid using Thermostat, Thermocouple and RTD. (Any 2 transducer).
10. Construct a circuit and Observe the behaviour of Inductive proximity sensor and Capacitive Proximity sensor for different material samples.
11. Construct a circuit for Measurement of Linear Displacement using LVDT.
12. Develop and Execute Arduino Program to obtain the performance of Ultrasonic sensor and Moisture Sensors.

***

2G233440	ANALOG AND DIGITAL ELECTRONICS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Introduction:

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

CO1 :Construct DC Power Supply Unit using Rectifier, Filter and Voltage Regulator.

CO 2 :Construct Astable Multivibrator circuit using IC 555.

CO 3 :Develop Amplifier, Summer and Zero crossing detector using Op-Amp IC 741.

CO 4 :Interpret various Number Systems and Logic Gates used in Digital Circuits.

CO 5 :Demonstrate Combinational circuit and Sequential circuits.

Pre-requisites:

- Basic Electrical and Electronics Engineering.

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	2	-	1	1
CO 2	3	2	2	2	-	1	1
CO 3	3	2	2	2	-	1	1
CO 4	3	2	3	2	-	1	1
CO 5	3	2	2	2	-	1	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 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.

2G233440	ANALOG AND DIGITAL ELECTRONICS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Theory Portion :		
UNIT I	**SEMICONDUCTOR DEVICES**	Period
Construction and V-I characteristics of : Diode, Zener Diode,– Applications - Half Wave Rectifier With & Without filter - Full Wave Rectifier With & Without filter – Zener Diode as Voltage Regulator		2
UNIT 2	CONFIGURATIONS AND POWER ELECTRONICS COMPONENTS	Period
SCR, TRIAC, DIAC, BJT, FET, UJT, Common Emitter, Common Base and Common Collector Configuration of BJT.		2
PRACTICAL EXERCISES:		
Ex.No	Name of the Experiment	Period
1.	Construct the circuit and Obtain the VI Characteristics of PN Junction Diode and Zener Diode.	4
2.	Construct the circuit and Obtain the Input and Output Characteristics of BJT in CE Configuration.	4
3.	Construct the circuit and Obtain the VI Characteristics of FET & UJT.	4
4.	Construct the circuit and Obtain the Input and output Wave forms of Half Wave Rectifier with and without filter.	4
5.	Construct the circuit and Obtain the Input and output Wave forms of Bridge Rectifier with and without filter.	4
THEORY PORTION:		
UNIT III	OP-AMP IC 741 and TIMER IC 555	Period
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.		4
PRACTICAL EXERCISES		
Ex.No	Name of the Experiment	Period
6.	Construct Inverting Amplifier and Non-Inverting amplifier using Op-amp IC 741 and Test its performance.	4

7.	Construct Summing Amplifier and Difference amplifier using Op-amp IC 741 and Test its performance.	4
8.	Construct Zero Crossing Detector and Voltage Comparator using Op-amp IC 741 and Test its performance.	4
9.	Construct Astable Multivibrator circuit using IC 555 and Test its performance.	4
10.	Test the performance of IC Voltage Regulator Power Supplies using IC 7805, IC 7912.	4
THEORY PORTION		
UNIT IV	LOGIC GATES AND COMBINATIONAL CIRCUITS	Period
Number Systems: Decimal – Binary – Octal – Hexadecimal – BCD – Conversion from one number system to other. Boolean Algebra – Basic laws and De Morgan’s Theorems. Logic Gates: Symbol and Truth table of OR Gate, AND Gate, NOT Gate, NAND Gate, NOR Gate and Ex-OR Gate.		4
UNIT V	SEQUENTIAL CIRCUITS	Period
SR, D, JK, T Flip Flops: Symbolic Representations, Truth tables and List of Applications.		3
Practical Exercises:		
Ex.No	Name of the Experiment	Period
11.	Realization of basic gates using NAND & NOR Gates.	4
12.	Construct Half Adder and Full Adder circuit using Discrete IC’s and Test its performance.	4
Required Practical Instructions for all the Experiments		12
TOTAL PERIODS		75

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

Suggested List of Students Activity:

1. Presentation/Seminars by students on any recent technological developments based on the course.
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 and Reference Books:

1. V K Mehta, Rohit Mehta, Principles of Electronics, 12th Edition, S. Chand & Co., 2020
2. R.S. Sedha, Applied Electronics, Multi color Edition, S Chand & Co., 2019
3. Ramakant A. Gayakwad , Op-amps and Linear Integrated Circuits, Revised Fourth Edition, Pearson Education, 2021.
4. Donald Donald P. Leach, Albert Paul Malvino, Goutam Saha, Digital Principles and Applications, Eight Edition, Mc Graw-Hill Education, 2014.

Web-based/Online Resources:

- NPTEL/SWAYAM: Analog: https://nptel.ac.in/courses/117/103/117103063
- https://nptel.ac.in/courses/108/105/108105158
- https://nptel.ac.in/courses/108/102/108102112
- https://nptel.ac.in/courses/108/105/108105113
- NPTEL/SWAYAM: Digital circuits https://nptel.ac.in/courses/108/105/108105132
- https://nptel.ac.in/courses/117/106/117106086

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

S.No	Name of the Equipment	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

2G233440	ANALOG AND DIGITAL ELECTRONICS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

End TERM Practical ExamModel Question Paper

Duration: 3 Hours   Max. Marks: 100

List of Questions

1. Construct the circuit and Obtain the VI Characteristics of PN Junction Diode and Zener Diode.
2. Construct the circuit and Obtain the Input and Output Characteristics of BJT in CE Configuration.
3. Construct the circuit and Obtain the VI Characteristics of FET & UJT.
4. Construct the circuit and Obtain the Input and output Wave forms of Half Wave Rectifier with and without filter.
5. Construct the circuit and Obtain the Input and output Wave forms of Full Wave Rectifier with and without filter.
6. Construct Inverting Amplifier and Non-Inverting amplifier using Op-amp IC 741 and Test its performance.
7. Construct Summing Amplifier and Difference amplifier using Op-amp IC 741 and Test its performance.
8. Construct Zero Crossing Detector and Voltage Comparator using Op-amp IC 741 and Test its performance.
9. Construct Astable Multivibrator circuit using IC 555 and Test its performance.
10. Construct a circuit to test the performance of IC Voltage Regulator Power Supplies using IC 7805, IC 7912.
11. Construct a circuit for Realization of basic gates using NAND & NOR Gates.
12. Construct Half Adder and Full Adder circuit using Discrete IC's and Test its performance.

***

2G233540	PROGRAMMING IN C	L	T	P	C	END EXAM
PRACTICUM		1	0	2	2	PRACTICAL

Introduction:

This course is designed to provide students with a comprehensive understanding of the fundamentals of programming. Through a structured curriculum, students will delve into thehistory 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 typesand control 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 usingfunctions and structures.

Course Outcomes:

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

CO1 :Understand about the Programming concepts.

CO 2 :Store different data types and variables.

CO 3 :Control the program order and repeating sequences of the program.

CO 4 :Implement Arrays and Strings in your C program.

CO 5 :Apply code reusability with functions and storing different Data types using Structures.

Pre-requisites:

- Digital Skills
- Knowledge on Handling Computer

2G233540	PROGRAMMING IN C	L	T	P	C	END EXAM
PRACTICUM		1	0	2	2	PRACTICAL

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	3	2	1	-	-	3
CO 2	3	1	2	1	-	-	3
CO 3	3	3	3	3	-	-	3
CO 4	3	3	3	3	-	-	3
CO 5	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.

2G233540	**PROGRAMMING IN C**	L	T	P	C	END EXAM
PRACTICUM		1	0	2	2	PRACTICAL

Theory Portion :		
UNIT I	**INTRODUCTION TO C PROGRAMMING**	Period
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.		3
Practical Exercises:		
Ex.No	Name of the Experiment	Period
1	Write and Execute a C program to implement Ohm's Law.	3
2	Write and Execute a C program to calculate total resistance of 3 resistors connected in series and in parallel.	3
Theory Portion :		
UNIT II	C LANGUAGE BASICS	Period
DATA TYPES IN C - C Operators - Operators and Associativity - Arithmetic Expression - Evaluation of Expressions - Type Cast Operators - I/O Statements - scanf and printf.		3
Practical Exercises:		
3	Write and Execute a C program to calculate Power using Voltage and Current, Voltage and Resistance, Current and Resistance.	3
4	Write and Execute a C Program to calculate sum and average of 5 numbers.	3
Theory Portion :		
UNIT III	STATEMENTS	
Branching: Introduction - Simple if statement - if–else statement - Switch statement - goto statement - Simple programs.		3
Practical Exercises:		
5	Write and Execute a C program to Check Largest of Three Numbers.	3
6	Write and Execute a C Program to calculate total capacitance of 3 capacitors connected in series and in parallel using switch case.	3
Theory Portion :		
UNIT IV	ARRAYS and STRINGS	Period

2G233540	PROGRAMMING IN C	L	T	P	C	END EXAM
PRACTICUM		1	0	2	2	PRACTICAL

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

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

Suggested List of Students Activity:

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

Text and Reference Books:

1. Herbert Schildt, C: The Complete Reference, Fourth Edition, McGraw Hill Education, 2017.
2. E. Balagurusamy , Programming In ANSI C, Eight Edition, McGraw Hill, 2019.
3. Vinod Sir, Modern C Programming Language Advance, Publisher: Vinod Yadav, 2021.

Web-based/Online Resources:

- https://archive.nptel.ac.in/courses/106/104/106104128/

2G233540	PROGRAMMING IN C	L	T	P	C	END EXAM
PRACTICUM		1	0	2	2	PRACTICAL

Equipment / Facilities required conducting the Practical Course Requirement:
(For a Batch of 30 Students)

LIST OF EQUIPMENTS

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

End TERM Practical ExamModel Question Paper

Duration: 3 Hours **List of Questions** Max. Marks: 100

1. Write and Execute a C program to implement Ohm's Law.
2. Write and Execute a C program to calculate total resistance of 3 resistors connected in series and in parallel.
3. Write and Execute a C program to calculate Power using Voltage and Current, Voltageand Resistance, Current and Resistance.
4. Write and Execute a C Program to calculate sum and average of 5 numbers.
5. Write and Execute a C program to Check Largest of Three Numbers.
6. Write and Execute a C Program to calculate total capacitance of 3 capacitorsconnected in series and in parallel using switch case.
7. Write and Execute a C program to accept 10 numbers and print them.
8. Write and Execute a C Program to perform string functions strlen, strcmp and strrev.
9. Write and Execute a C program to find power and square root using Math Functions.
10. Write and Execute a C Program to calculate Electrostatic Force (Coulomb's Law) using function.

***

2G233620	ELECTRICAL MACHINES I PRACTICAL	L	T	P	C	END EXAM
PRACTICAL		0	0	4	2	PRACTICAL

Introduction:

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.

Course Objectives:

The objective of this course is to enable the student to

1. Comprehend the behaviour and characteristics of DC Shunt Generator and DC Series Generator.
2. Perform load tests on DC Shunt motor and DC Series Motor and interpret data.
3. Evaluate the regulation, efficiency, and losses in single-phase and three-phase transformer at various 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

After successful completion of this course, the students will be able to

CO1 :Perform Load tests on DC Shunt Generator and DC Series Generator and interpret characteristic curves.

CO 2 :Perform load tests on DC Shunt Motor and DC Series Motor and explore armature and field control methods for speed modulation.

CO 3 :Conduct OC Test, SC Test and Load tests on single-phase transformers to evaluate their performance characteristics.

CO 4 :Perform breakdown test and acidity tests on Transformer oil.

CO 5 :Test the performance of stepper motor and servo motor drive.

Pre-requisites:

- Electrical Machines – I Theory

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	1	1	3	-	-	2
CO 2	3	2	1	3	-	-	2
CO 3	3	2	2	3	-	-	3
CO 4	3	2	2	3	-	-	2
CO 5	3	2	-	3	1	-	-

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

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.

2G233620	ELECTRICAL MACHINES I PRACTICAL	L	T	P	C	END EXAM
PRACTICAL		0	0	4	2	PRACTICAL

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	Load Test on DC Shunt Motor and Draw the Performance Curve. 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	Speed Control of DC Shunt Motor by Armature Control Method Field Control Method	5
6	Load Test on Single Phase Transformer.	5
7	Load Test on Three Phase Transformer.	5
8	Predetermination of Efficiency and Regulation of Single-Phase Transformer by conducting O.C and S.C Tests. Finding the Equivalent Circuit Constants of Single-Phase Transformer by conducting O.C and S.C Tests.	5
9	Parallel Operation of two Single Phase Transformers.	5
10	Breakdown Test to determine the Dielectric Strength of Transformer Oil and Also conduct Acidity Test on Transformer Oil.	5
11	Testing of Stepper motor drive.	5
12	Testing of Servo motor drive.	5
TOTAL PERIOD		**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 question.

Suggested List of Students Activity:

- Engaging in group discussions to delve 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 expertsand 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:

1. B. L. Theraja and A. K. Theraja, A Textbook of Electrical Technology Volume - II (AC and DC Machines), Multi colour Edition, S. Chand & Co., 2005
2. V.K. Mehta & Rohit Mehta, Principles of Electrical Machines, Second Edition, S. Chand& Co., 2019
3. S. K. Bhattacharya, Electrical Machines, Third Edition, McGraw Hill Education, 2008.
4. Ashfaq Husain, Haroon Ashfaq, Electric Machines, Third Edition, Dhanpat Rai & Co. (P)Ltd., 2016.

Web-based/Online Resources:

- All About Circuits (https://www.allaboutcircuits.com/)
- Electronics Hub (https://www.electronicshub.org/)
- Circuit Digest (https://circuitdigest.com/)
- MIT Open Course Ware - Electrical Engineering and Computer Science(https://o
- NPTEL - Electrical Engineering (https://nptel.ac.in/course.html)
- IEEE Xplore Digital Library (https://ieeexplore.ieee.org/Xplore/home.jsp)
- Online simulation tools like Circuit Lab (https://www.circuitlab.com/) and

MultisimLive (https://www.multisim.com/).

Equipment / Facilities required conducting the Practical Course Requirement:

(For a Batch of 30 Students)

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.	1 Phase Transformer 1KVA (or more) 220V/110V	3 Nos
6.	3 Phase Transformer 1KVA (or more) 440V/220V	1 No
7.	1 Phase Variac 10 amps	3 Nos
8.	3 Phase Variac 15 amps	2 Nos
9.	Single Phase Resistive Load 1.5KW/3/5 KW, 220V	2 Nos
10.	Three Phase Resistive Load 3KW,415V	2 Nos
11.	Tachometer Digital type	3 Nos
12.	Rheostat – Various ranges 50Ω/5A,100 Ω/5A, 300 Ω/2A, 600 Ω/2A(or equivalent)	4 Nos
13.	AC Ammeter – Various ranges 0-500mA, 0-1/2A, 0-5/10A,0- 10/20A (or equivalent)	8 Nos
14.	DC Ammeter – Various ranges 0-500mA, 0-2A, 0-5A, 0-10A,0- 15/30A (or equivalent)	8 Nos
15.	DC Voltmeter – 0 - 5/10V, 0 - 30V, 0 - 300V	8 Nos
16.	AC Voltmeter – 0 - 75V, 0 - 150V, 0 - 300V, 0 - 600V	8 Nos
17.	Wattmeter – Various ranges LPF 150/300/600V 2.5A/5A,1/2.5A	6 Nos
18.	Wattmeter – Various ranges UPF 75/150/300,5/10A	6 Nos
19.	Wattmeter – Various ranges UPF 150/300/600V 10/20A	6 Nos
20.	Transformer oil BDV Test kit and Acidity Test kit	Each 1 No
21.	DC Stepper Motor drive	1 No
22.	DC Servo Motor drive	1 No

End TERM Practical Exam Model Question Paper

Duration: 3 Hours Max. Marks: 100

List of Questions

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

G Scheme

Diploma in Electrical and Electronics Engineering

IV TERM SYLLABUS

2G2324110	ELECTRICAL MACHINES – II	L	T	P	C	END EXAM
THEORY		4	0	0	4	THEORY

Introduction:

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.

Course Objectives:

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

- Grasp alternator principles, types, construction, windings, cooling, excitation, and EMFequation'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.

Course Outcomes:

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

CO1 :Understand alternator principles, construction, types, EMF equation, and applications.

CO 2 :Achieve expertise in voltage regulation, testing, load analysis, and synchronization of alternator.

2G2324110	ELECTRICAL MACHINES – II	L	T	P	C	END EXAM
THEORY		4	0	0	4	THEORY

CO 3 :Investigate rotating magnetic fields, induction motor principles, construction, characteristics, starting and speed control methods.

CO 4 :Examine single-phase motor types, maintenance practices, and BIS guidelines.

CO 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 Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	1	-	-	1	-	3
CO 2	3	3	-	2	-	-	3
CO 3	3	3	-	3	2	-	3
CO 4	3	2	-	2	2	-	3
CO 5	3	2	-	2	2	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.

Theory Portion:		
UNIT I	**ALTERNATOR PRINCIPLE AND CONSTRUCTION**	Period
Basic Principle of Alternators – Stationary Armature Rotating Field – Advantages of Rotating Field – Construction details of Alternator – Types of Alternators – Salient Pole Rotor – Cylindrical Type Rotor – Comparison of Salient pole and Cylindrical pole Alternator – Single layer and Double layer Windings – Full Pitched and Short Pitched Windings – Effect of Distribution Factor and Pitch Factor (No derivation) – EMF Equation – Relation between Frequency, Speed and Number of Poles – Problems – Cooling of Alternators (Methods only) – Excitation and Exciters.		13
UNIT II	ALTERNATOR PERFORMANCE AND TESTING	Period
Load Characteristics of Alternators – Reason for Change in Terminal Voltage – Armature Reaction for various Power Factor Loads – Effective Resistance – Leakage Reactance – Synchronous Reactance - Synchronous Impedance – Voltage Regulation – Determination of Voltage Regulation of Alternator by Direct Load Test method – Predetermination of Regulation of Alternator by Indirect Method (EMF, MMF, and ZPF) (short notes only) – Necessity and conditions for Parallel Operation of Alternators – Synchronizing of Alternators by Dark Lamp Method, Bright Lamp Method, Dark – Bright Lamp Method and Synchroscope Method – Synchronizing Current - Synchronizing Power and Synchronizing Torque – Load Sharing of Alternators – Infinite Bus Bar.		14
UNIT III	**THREE PHASE INDUCTION MOTOR**	Period

2G2324110	ELECTRICAL MACHINES – II	L	T	P	C	END EXAM
THEORY		4	0	0	4	THEORY

Concept of Rotating Magnetic Field (Short notes only) – Principle of Operation of Three Phase Induction Motors – Slip and Slip Frequency – Construction of Squirrel cage and Slip Ring Induction motor – Comparison between Cage and Slip Ring Induction Motors – Expression for Torque in Synchronous Watts – Slip-Torque Characteristics – Stable and Unstable Region – Power Stages – Determination of Maximum Torque – Speed Control of Induction Motors – Starters of Induction Motors – Direct Online Starter and its merits for Cage Motors – Star Delta Starter – Auto Transformer Starter – Rotor Resistance Starter – Cogging – Crawling in Induction Motor – Double cage Induction Motor - Induction Generator.		13
UNIT IV	**SINGLE PHASE MOTORS AND MAINTENANCE OF INDUCTION MOTORS**	Period
SINGLE PHASE MOTORS: Types of Single Phase Motors – Single Phase Induction Motors – Methods of starting – Construction, Working Principle and Slip Torque Characteristics of Split Phase Motor, Capacitor Motors, Shaded Pole Motor, Repulsion Motor, Universal Motor and Reluctance Motor - Operation of Three Phase Motor with Single Phase Supply. MAINTENANCE OF INDUCTION MOTORS: BIS Publication dealing with the code of Practice of Induction Motors and starters – Classification of Cage motors – Continuous rating and intermittent rating – Various types of enclosures – Selection of Starters for Induction Motor – Common Induction Motor Troubles and their Remedies – Static Balancing – Degreasing – Vacuum Impregnation.		11
UNIT V	SYNCHRONOUS MOTOR AND SPECIAL AC MACHINES	Period

SYNCHRONOUS MOTOR: Principle of Operation – Methods of Starting – Effects of Excitation on Armature Current and Power Factor – V Curve and Inverted V Curve of Synchronous Motor – The Phenomenon of Hunting and Prevention of Hunting by Damper Winding – Comparison between Synchronous Motor and Three Phase Induction Motor – Applications. **SPECIAL AC MACHINES**: Permanent Magnet Synchronous Motor – Switched Reluctance Motor – Variable Reluctance Motor – AC Servo Motor – Linear Induction Motor.	9
TOTAL PERIODS	**60**

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

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.
- Case Studies: Analyze real-world cases of synchronous motor failures and troubleshooting solutions.
- Industry Interaction: Invite industry experts to share insights on alternator performance testing, induction motor maintenance best practices.
- Regularly revise the core concepts of electromagnetism as they are fundamental to understanding electrical machines.

- Focus on understanding the practical applications and operational principles rather than memorizing equations.
- Engage with practical lab sessions or virtual lab simulations to gain hands-on experience with these machines

Text and Reference Books:

1. B. L. Theraja and A. K. Theraja, A Textbook of Electrical Technology Volume - II (AC and DC Machines), Multi colour Edition, S. Chand & Co., 2005
2. V.K. Mehta & Rohit Mehta, Principles of Electrical Machines, Second Edition, S. Chand& Co.,2019
3. S. K. Bhattacharya, Electrical Machines, Third Edition, McGraw Hill Education, 2008.
4. Ashfaq Husain, Haroon Ashfaq, Electric Machines, Third Edition, Dhanpat Rai & Co. (P) Ltd., 2016.

Web-based/Online Resources:

- **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.
- **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.
- 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.*
- **MIT Open Courseware**: MIT offers free access to course materials for "Electric Machines" which covers topics such as induction motors, synchronous motors, and special AC machines. Lecture notes, assignments, and exams are available.
- **IEEE Xplore** Digital Library: IEEE provides access to numerous research papers, articles, and conference proceedings related to electrical machines. It's a valuable resource for

in-depth study and research.

- Khan Academy: Khan Academy offers introductory-level videos and tutorials on electrical engineering topics, including principles of alternators, induction motors, and synchronous motors.

***

2G234210	GENERATION, TRANSMISSION AND DISTRIBUTION	L	T	P	C	END EXAM
THEORY		4	0	0	4	THEORY

Introduction

This course, Generation, Transmission and Distribution, explores into the core components of electrical power systems. Various methods of generating electricity, from traditional hydro power 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.

Course Objectives:

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.

2G234210	GENERATION, TRANSMISSION AND DISTRIBUTION	L	T	P	C	END EXAM
THEORY		4	0	0	4	THEORY

Course Outcomes:

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

CO1 :Describe various generation methods, grid integration and smart grid technologies.

CO 2 :Design and analyse overhead transmission lines, line support selection and transmission efficiency for optimal power delivery.

CO 3 :Propose solutions for HVDC transmission and FACTS controllers for enhanced power transmission and grid stability.

CO 4 :Assess effective insulation systems for power transmission, as well as the construction and classification of underground cables.

CO 5 :Analyse electrical distribution systems, including substations, bus bar 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 Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	3	2	2	-	-	-
CO 2	3	2	2	1	-	-	-
CO 3	3	2	2	1	-	-	-
CO 4	3	2	1	1	-	-	-
CO 5	3	3	2	2	-	-	-

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

2G234210	GENERATION, TRANSMISSION AND DISTRIBUTION	L	T	P	C	END EXAM
THEORY		4	0	0	4	THEORY

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 key concepts 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.

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.

Theory Portion :		
UNIT I	**GENERATION OF ELECTRICAL POWER**	Period
Methods of Generation: Schematic arrangement and choice of site for Hydel, Thermal, Nuclear power plants - Block Diagram of Diesel, Solar Thermal, Solar Photovoltaic – Solar Cell Technologies – Wind & Pumped storage schemes. Load Management: Grid or Inter connected system – Smart Grid - Load curve - Demand factor - Load factor - Plant Use Factor - Diversity factor – Plant capacity factor – Load Dispatching Centre.		12
UNIT II	**A.C TRANSMISSION**	Period
pical Layout of A.C. Power supply scheme - Elements of a Transmission Line - Over Head Line - Conductor materials and their properties - Line supports and their properties - Types of supports and their applications - Sag in overhead lines - Calculation of Sag - When the supports are at equal and unequal levels - Simple Problems - Constants of a Transmission line - Transposition of Transmission lines - Skin Effect - Ferranti Effect - Corona Formation - Factors affecting Corona - Classification of O.H. Transmission lines - Voltage regulation and Transmission Efficiency (No Problems).		12
UNIT III	**HVDC TRANSMISSION & FACTS**	Period

H.V.D.C Transmission: Layout Scheme - D.C Link configurations (Mono polar, Bipolar and Homo polar) - HVDC Convertor Station (Schematic diagram only) – Integration of HVDC & Renewable energy into existing AC grids - HVDC Locations in India. FACTS: Definition - Need for FACTS controllers - Types of FACTS controllers - SVS – STATCOM - UPFC (Block diagram explanation only).		12
UNIT IV	**LINE INSULATORS AND UNDERGROUND CABLES**	Period
Line Insulators: Properties of Insulators - Materials - Types - Causes of failure of Insulators - Testing of Insulators - 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 - Cables for three phase service - Construction of Belted cable, Screened cable, Pressure cables - Laying of underground cables.		12
UNIT V	**DISTRIBUTION**	Period
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 Distributionsystem. 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.		12
	TOTAL PERIODS	**60**

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

Suggested List of Students Activity:

- **Unit I: Generation of Electrical Power**
- Activity 1: Power Plant Visit & Report: Organize a visit to a Thermal/ Hydro/ Solar/Wind power plant. Students can then write a report detailing the types of equipment they observed, Powerplant layout, and its role in the power generation system.
- Activity 2: Load Management Challenge: Present students with a real-world load curve data set (available online) and ask them to analyze it. They can calculate factors like

demand factor, load factor, and plant capacity factor. Challenge them to propose strategies for load management using concepts like smart grids.

Unit II: A.C. Transmission

- Activity 3: Transmission Line Design Project: Simulate the design of a simple overhead transmission line. Students can use online tools or basic calculations to determine factors like sag and conductor selection based on specific power transmission requirements.
- Activity 4: Transmission Line Case Studies: Present students with case studies of real-world challenges faced in AC transmission, such as Corona effect or Ferranti effect. Ask them to search and propose solutions to mitigate these challenges.

Unit III: HVDC Transmission & FACTS

- Activity 5: HVDC System Modelling: Using simulation software or online tools, allow students to model a simple HVDC transmission system. They can explore the differences between AC and DC transmission and analyze the benefits of HVDC integration with renewable energy sources.
- Activity 6: FACTS Controller Debate: Divide the class into groups and assign each group a different type of FACTS controller (SVC, STATCOM, UPFC). Each group searches and presents the advantages and applications of their assigned controller. Hold a class debate to discuss the most effective FACTS controller for specific scenarios.

Unit IV: Line Insulators and Underground Cables

- Activity 7: Insulator Design Challenge: Challenge students to design an insulator string for a specific voltage level. They should consider factors like material selection, string efficiency, and methods for improvement.
- Activity 8: Underground Cable Exploration: Organize a field trip to a local company involved in underground cable installation. Alternatively, students can search and present on the different types of underground cables, their construction, and laying methods.

Unit V: Distribution

- Activity 9: Distribution System Design Project: Divide students into groups and assign them the task of designing a simple distribution system for a specific area (residential, commercial).

They should consider factors like system type (AC/DC, overhead/underground), connection schemes, and substation equipment selection.

- Activity 10: Substation Visit and Report: Organize a visit to a local substation (with safety precautions). Students can then write a report detailing the types of equipment they observed, substation layout, and its role in the power distribution system.

Text and Reference Books:

1. VK. Mehta, Rohit Mehta, Principles of Power Systems, Revised Edition, S. Chand & Co, 2022.
2. M.L. Sony, P.V. Gupta and U.S. Bhatnagar, A Course in Electrical Power, Dhanpath Rai & Co (P) Ltd., 2013.
3. C.L. Wadhwa, Electrical Power Systems, Eighth Multi Colour Edition, New Age International Publishers.
4. K.R. Padiyar, HVDC Power Transmission Systems Technology and System Interactions, Reprint, New Age International, 2005.

Web-based/Online Resources:

- https://www.tangedco.org/en/tangedco/about-us/generation/
- https://nptel.ac.in/courses/108102047
- https://pvwatts.nrel.gov/
- https://nptel.ac.in/courses/108105104
- https://onlinecourses.nptel.ac.in/noc20_ee39/preview
- https://www.tangedco.org/en/tangedco/about-us/

***

2G234340	MICROCONTROLLER AND ITS APPLICATIONS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Introduction:

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

CO1 :Remember Microcontroller and embedded systems and it's evolution.

CO 2 :Understand dsPIC33CH architecture, memory and Interfacing techniques.

CO 3 :Demonstrate dsPIC33CH with simple program.

CO 4 :Examine dsPIC33CH with simple experiments.

CO 5 :Develop their own power controls using dsPIC33CH.

Pre-requisites:

- Electrical Circuit Theory
- Analog and Digital Electronics
- C-Programming

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	-	-	2	3	2	3
CO 2	3	2	3	2	3	3	3
CO 3	3	-	3	3	3	3	3
CO 4	3	3	3	3	3	3	3
CO 5	3	2	3	2	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.

2G234340	MICROCONTROLLER AND ITS APPLICATIONS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Theory Portion :		
UNIT I	**ARCHITECTURE OF 8051**	PERIOD
Introduction to Microcontrollers Definitions and comparisons - Features, advantages, and applications of microcontrollers **Architecture of 8051** Block diagram and functions of each block-Pin configuration and details -Clock cycles, state machine cycles, and reset mechanisms **Memory Organization** Overview of ROM and RAM in the 8051-Interfacing external memory		5
UNIT II	**OVERVIEW OF 8051 INSTRUCTIONSET**	PERIOD
2.1 Assembler and Addressing Modes : Instruction Format, Different addressing modes of 8051, Assembling and running an 8051 program -Structure of Assembly Language - Assembler directives. **2.2 Instruction Sets :** Classification of 8051 Instructions(based on Length) - Classification of 8051 Instructions(based on Function) .Data Handling instructions - Data transfer instructions - Arithmetic Instructions - Format of these instructions and examples		2
UNIT III	**I/O AND PROGRAMMING EXAMPLES**	PERIOD
3.1 I/O: BIT addresses for i/o and RAM – I/O programming – i/o bit manipulation programming – Bit Manupulation Instructions. **3.2 Programs** : Multibyte Addition – 8 bit Multiplication and Division-Biggest Number/Smallest number-Ascending order/Desecding order-Conversion programs-HEX to BCD,BCD to HEX,Time delay routines.		3

Practical Exercises:

Ex.No	Name of the Experiment	Period
1.	Addition, Subtraction , Multi-byte addition	20
2.	Arranging the given data in Ascending order	
3	Multiplication and Division of two numbers	
4	Finding the maximum number in an array	
5	Parity bit generation	
6	Square Root of an given number	

2G234340	MICROCONTROLLER AND ITS APPLICATIONS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Theory Portion:		
UNIT IV	**INTERRUPTS,TIMER/COUNTER**	
4.1 INTERRUPTS- Interrupts available in 8051,their vector adresses,Interrupt priority in 8051-interrupt enable register(IE) Interrupt priority register (IP),Interrupt handling-programming Timer Interrupts-programming external hardware interrupts) **4.2 Special Function Registers:** SFRs used for Timer/counter-Timer 0 and Timer 1 registers-TCON registers-TMOD registers-SFRs used for serial communication-SCON register-SBUF register-PCON register.		5
UNIT V	**INTERFACING TECHNIQUES**	Period
5.1 Programmable Interface IC: IC 8255 -Block Diagram -Modes of 8255 -CWR format - 8051 interfacing with the 8255. **5.2 Interfacing circuits** : Relays and opto isolators –Sensor interfacing -ADC interfacing -DAC interfacing -Keyboard interfacing - Seven segment LED Display Interfacing - LCD display interfacing . **5.3 Microcontroller based Application** : Stepper Motor interfacing -DC motor interfacing PWM Introduction to IoT-Block diagram of home automation using IoT.		5
PRACTICAL EXERCISES		
Name of the Experiment		Period
7	Digital I/O	20
8	Seven segment LED displays	
9	Time delay program (with DAC)	
10	Traffic light	
11	DC motor control	
12	8 bit ADC	
Required Practical Instruction for all the Experiments		15
TOTAL PERIODS		**75**

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

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 Books:

1. The 8051 microcontroller Embedded Systems, 2nd Edition
2. 8051 microcontroller Architecture, Programming & Applications 2nd Edition 1996

Reference Books:

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:

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

2G234340	MICROCONTROLLER AND ITS APPLICATIONS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

End TERM Practical Exam Model Question Paper

Duration: 3 Hours Max. Marks: 100

List of Questions

1. Write an 8051 assembly level program to arrange an array of ‘N’ bytes of data in ascending order.
2. Write an assembly language program to perform the addition of two 8-bit numbers.
3. Write an assembly language program to perform the subtraction of two 8-bit numbers.
4. Write an assembly language program to find the square of a given number N.
5. Write an assembly language program to perform the multiplication of two numbers.
6. Write an assembly language program to perform the division of two numbers.
7. Write an assembly language program to perform the parity bit generation.
8. Write an assembly language program to perform the seven segment LED displays.
9. Write an assembly language program to perform the DC motor interfacing control.
10. Write an assembly language program to create the time delay with DAC.
11. Write an assembly language program for Digital Output using Buzzer.
12. Write an assembly language interfacing program for traffic light control .

2G234440	ELECTRICAL CAD DESIGN	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Introduction:

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 willenable 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 FireAlarm arrangements.

Course Outcomes:

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

CO1 :Explain the features and various tool bars of AutoCAD Software.

CO 2 :Draw the Electrical Symbols used in Wirings, Machines and Electronic Circuits.

CO 3 :Prepare Electrical Estimation for Residential and Industrial wirings.

CO 4 :Draw the Single Line Diagrams of various Panels and Distribution Board.

CO 5 :Draw the Motor Winding Diagram, Substation Layout and Fire Alarm arrangements.

Pre-requisites:

- Knowledge in Drafting Practices
- Basics of Electrical Engineering

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	1	1	3	-	1	1
CO 2	3	1	1	3	-	1	1
CO 3	3	1	1	3	-	1	1
CO 4	3	1	1	3	-	1	1
CO 5	3	1	1	3	-	1	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 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.

2G234440	ELECTRICAL CAD DESIGN	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Theory Portion :		
UNIT I	**ELECTRICAL SYMBOLS**	Period
Need of Electrical symbols – List of Symbols – Brief study of Indian Electricity Rules1956 (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.		4
Practical Exercises:		
Ex.No.	Name of the Experiment	Period
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.	5
2.	Draw the single line diagram of Three phase MCB Distribution Board.	5
3.	Draw the panel wiring diagram of Horizontal bus bar arrangement with Incoming and Outgoing Switches using AutoCAD.	5
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.	5
UNIT II	**PROTECTION AND SWITCHGEAR**	**PERIOD**
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		4
UNIT III	**RESIDENTIAL AND INDUSTRIAL WIRING**	
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 befollowed in preparing electrical estimate - Building Plan - Wiring Pipe Layout - Wiring Diagram – Load Calculation		4
Practical Exercises:		
Ex.No	**Name of the Experiment**	**Period**
5.	Estimate the quantity of Materials and Cost required for a single Bedroom residential building (1 BHK).	5
6.	Estimate the quantity of Materials and Cost required for street light service having 12 Lamps light fittings.	5

7.	Estimate the quantity of Materials and Cost required for Irrigation Pump wiring with 5 hp Induction Motor.	5
8.	Estimate the quantity of Materials and Cost required for Industrial power wiring having four machines.	5
Theory Portion :		
UNIT IV	**WINDING DIAGRAM**	**PERIOD**
Overview of AC Motor Winding Diagram and DC Motor Winding Diagram		1
UNIT V	**SUBSTATION LAYOUT**	
Various components of Electrical Substation – Importance of Fire Alarm Arrangements in Multi Storey Building - Symbols used in Fire Alarm Arrangement.		2
Practical Exercises:		
Ex.No	Name of the Experiment	Period
9.	Draw the Mush Winding Diagram of a Three Phase Induction Motor using AutoCAD.	5
10.	Draw the Winding Diagram of Lap Connected DC Armature with Commutator Connections and Brush Positions using AutoCAD.	5
11.	Draw the single line diagram of 110 KV / 11 KV Receiving Substation using AutoCAD.	5
12.	Draw the Single Line Diagram of Fire Alarm Riser Arrangement in typical Multi-Storey Building using AutoCAD.	5
TOTAL PERIODS		**75**

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

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:

1. K.B. Raina & S.K. Battacharya, Electrical Design Estimating and Costing, New Age International (p) limited, 2017.

2. M. Yokes, B. S. Nagaraja, N. Nandan, Computer Aided Electrical Drawing, PHI Learning Pvt. Ltd, 2014.
3. Sham Tickoo, Anurag, AutoCAD 2013 for Engineers and Designers, Wiley, 2012.

Web-based/Online Resources:

- http://students.autodesk.com/ (register and get free student version of LATEST AutoCAD software for approximately 3 year)
- https://www.autodesk.in/campaigns/autocad-tutorials

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

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

2G234440	ELECTRICAL CAD DESIGN	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

End TERM Practical ExamModel Question Paper

Duration: 3 Hours Max. Marks: 100

List of Questions

1. Draw the following 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 and OR Gate.
2. Draw the single line diagram of Three phase MCB Distribution Board using AutoCAD.
3. Draw the panel wiring diagram of Horizontal busbar with Incoming and Outgoing Switch boards using AutoCAD.
4. Draw the single line diagram of typical Medium Voltage with following feeders using AutoCAD.
   Incoming: One from EB and Another from DG with Interlock.
   Outgoing: 12 Outgoing feeders with various loads.
5. Estimate the quantity of Materials and Cost required for a single Bedroom residential building (1 BHK).
6. Estimate the quantity of Materials and Cost required for Irrigation Pump wiring 5 hp Induction Motor.
7. Estimate the quantity of Materials and Cost required for Industrial power wiring having four machines.
8. Estimate the quantity of Materials and Cost required for street light service having 12 Lamps light fittings.
9. Draw the Mush Winding Diagram of a Three Phase Induction Motor using AutoCAD.
10. Draw the Winding Diagram of Lap Connected DC Armature with Commutator Connections and Brush Positions using AutoCAD.
11. Draw the single line diagram of 110 KV / 11 KV Receiving Substation using AutoCAD.
12. Draw the Single Line Diagram of Fire Alarm Riser Arrangement in typical Multi-Storey Building using AutoCAD.

***

2G234540	SERVICING OF ELECTRICAL APPLIANCES	L	T	P	C	END EXAM
PRACTICUM		1	0	2	2	PRACTICAL

Introduction:

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 centres, 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 inbecoming 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, the student will be able to

CO1 :Identify various parts of Heating and Motorized domestic appliances.

CO 2 :Interpret connection diagrams of Heating and Motorized domestic appliances.

CO 3 :Execute Servicing of Iron Box, Water Heater, Induction Stove and Washing Machine.

CO 4 :Execute Servicing of Fans, Mixer Grinder and Wet Grinders.

CO 5 :Install OFF Grid Solar PV system and test its working.

Pre-requisites:

- Basics of Electrical and Electronics Engineering.

2G234540	SERVICING OF ELECTRICAL APPLIANCES	L	T	P	C	END EXAM
PRACTICUM		1	0	2	2	PRACTICAL

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	3	2	-	1	1
CO 2	3	1	3	2	-	1	1
CO 3	3	1	3	2	-	1	1
CO 4	3	1	3	2	-	1	1
CO 5	3	1	3	2	1	1	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 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 usedto ensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices may be followed in the real environment as faras possible.

2G234540	SERVICING OF ELECTRICAL APPLIANCES	L	T	P	C	END EXAM
PRACTICUM		1	0	2	2	PRACTICAL

Theory Portion :		
UNIT I	**DOMESTIC APPLIANCES I**	Period
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.		3
UNIT II	**DOMESTIC APPLIANCES II**	Period
ELECTRIC FAN: 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.		3
Practical Exercises: Perform the experiments by using actual electrical appliances and Trainer Kits are not allowed.		
Ex.No	Name of the Experiment	Period
1	SERVICING 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 thefault if any.Re-assemble and Test its working with supply.	4
2	SERVICING OF WATER HEATER <u>Activities to Perform:</u> Dismantle and identify the parts of water heater. 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.	4

3	SERVICING OF CEILING FAN Activities to Perform: Dismantle and identify the parts of ceiling 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
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.	4

2G234540	SERVICING OF ELECTRICAL APPLIANCES	L	T	P	C	END EXAM
PRACTICUM		1	0	2	2	PRACTICAL

Theory Portion :		
UNIT III	**DOMESTIC APPLIANCES II**	Period
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.		3
UNIT IV	**DOMESTIC APPLIANCES II**	Period
WASHING MACHINE: Identification of various Parts – Connection Diagram - w Common defects - causes.		3
UNIT V	**DOMESTIC APPLIANCES II**	Period
OFF GRID SOLAR PV SYSTEM: Connection diagram of Solar Panel with Inverter/Charge Controller and Battery.		3
Practical Exercises:		Period
5	SERVICING OF WET GRINDER <u>Activities to Perform:</u> 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 ifany. Re-Assemble and Test its working with supply.	4
6	SERVICING OF PORTABLE INDUCTION STOVE <u>Activities to Perform:</u> Dismantle and identify the parts of Portable Induction Stove. Do technical check by referring the Error Codes and rectify the fault ifany. Re-Assemble and Test its working with supply.	3

7	SERVICING OF WASHING MACHINE Activities to Perform: Dismantle and identify the parts of washing machine. Do technical test as per the service manual Check Capacitor, Motor and Control Panel and rectify the fault if any. Re-Assemble and Test its working with supply.	3
8	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.	4
TOTAL PERIODS		**45**

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

Suggested List of Students Activity:

1. Activity 1: Four students can be grouped as a batch to prepare and submit the activityreport 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.

2G234540	SERVICING OF ELECTRICAL APPLIANCES	L	T	P	C	END EXAM
PRACTICUM		1	0	2	2	PRACTICAL

Text and Reference Books:

1. L. Palaniappan, Hand Book on Home Appliances, First Edition, S.P. Publications, 2019.
2. K.B. Bhatia, Study of Electrical Appliances & Devices, Seventh Edition, Khanna publishers, 2024.
3. K.P.Anwar, Domestic Appliances Servicing, Fifth Edition, Scholar Institute Publications, 2018.
4. Service Manual of Corresponding Brand of Domestic Appliances.

Web-based/Online Resources:

- Swayam Online Course Portal: https://youtu.be/FZU5VrfFA70

Equipment / Facilities required to conduct the Practical Course Requirement: (For a Batch of 30 Students)

LIST OF EQUIPMENT

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	2 Nos
4.	Mixer Grinder	2 Nos
5.	Wet Grinder	2 Nos
6.	Portable Induction Stove	2 Nos
7.	Washing Machine	2 Nos
8.	100W Solar Panel, Inverter/Charge Controller and Battery	2 Set
9.	Tools Set	6 Nos
10.	Digital Multimeter	6 Nos
11.	Digital Power Monitor	2 Nos
12.	Bench Vice	1 No
13.	Series Test Board	As required
14.	Display Charts for Parts of above Appliances	Each 1 No
15.	Service Manual of Each Appliances	Each 1 No

2G234540	SERVICING OF ELECTRICAL APPLIANCES	L	T	P	C	END EXAM
PRACTICUM		1	0	2	2	PRACTICAL

END TERM PRACTICAL EXAM MODEL QUESTION PAPER

Duration: 3 Hours Max. Marks: 100

<u>List of Questions</u>

1. Perform Dismantling, Identification of parts, Technical Checking, Re-assembling and Testing of Automatic Iron box.
2. Perform Dismantling, Identification of parts, Technical Checking, Re-assembling and Testing of Water Heater.
3. Perform Dismantling, Identification of parts, Technical Checking, Re-assembling and Testing of Ceiling Fan.
4. Perform Dismantling, Identification of parts, Technical Checking, Re-assembling and Testing of Mixer Grinder.
5. Perform Dismantling, Identification of parts, Technical Checking, Re-assembling and Testing of Wet Grinder.
6. Perform Dismantling, Identification of parts, Technical Checking, Re-assembling and Testing of Portable Induction Stove.
7. Perform Dismantling, Identification of parts, Technical Checking, Re-assembling and Testing of Washing Machine.
8. Perform Installation of OFF Grid Solar PV System and Test its Performance.

***

2G234620	ELECTRICAL MACHINES II PRACTICAL	L	T	P	C	END EXAM
PRACTICAL		0	0	4	2	PRACTICAL

Introduction:

1. 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

2. Assess the performance of a three-phase alternator under varying loads, ensuring voltage and frequency stability.
3. Determine voltage regulation using the EMF method, measuring no-load voltage and analyzing regulation across different loads.
4. Sync alternators with the grid or another alternator, ensuring precise phase and frequency alignment.
5. Analyze the performance of three phase induction motors, including torque-speed characteristics and efficiency, under diverse loads.
6. Establish resistance, reactance, and leakage coefficients for precise modeling of three-phase induction motor.
7. Demonstrate techniques such as capacitor banks to enhance power factor, reducing reactive power consumption and enhancing system efficiency.
8. Conduct load analysis to single phase induction motor and understand torque-speed characteristics and efficiency.
9. Perform Transformer windings and End connection in three phase squirrel cage induction motor.

2G234620	ELECTRICAL MACHINES II PRACTICAL	L	T	P	C	END EXAM
PRACTICAL		0	0	4	2	PRACTICAL

Course Outcomes:

After successful completion of this course, the students will be able to

CO 1 : Alternator operation, performance, and voltage regulation using EMF method.

CO 2 :Synchronize proficiently 3-phase alternators using lamp and synchroscope Method.

CO 3 :Compare slip ring and squirrel cage motor performance via load testing.

CO 4 :Develop skills in determining induction motor constants and Demonstrate power Factor improvement using capacitors.

CO 5 :Access single-phase induction motor performance through load testing for Efficiency insight.

Pre- requisites:

- Electrical Circuit Theory
- Electrical Machines II Theory.

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	3	-	3	-	-	2
CO 2	3	1	-	3	1	1	2
CO 3	3	1	1	3	1	-	2
CO 4	3	3	-	3	-	-	2
CO 5	3	2	1	3	-	2	2

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

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.

2G234620	ELECTRICAL MACHINES II PRACTICAL	L	T	P	C	END EXAM
PRACTICAL		0	0	4	2	PRACTICAL

Practical Exercises:		
Ex. No	Name of the Experiment	Period
1	Conduct Load test on 3 Phase Alternator.	6
2	Predetermine the Regulation of Three Phase Alternator by EMF method.	6
3	Predetermine the Regulation of Three Phase Alternator by MMF method	6
4	Synchronization of 3 Phase Alternators by a) Lamp method. b) Synchroscope method	6
5	Conduct Load Test on a three phase squirrel cage induction motor and plot the performance curve.	6
6	Conduct Load Test on a three phase slip-ring induction motor and plot the performance curve.	6
7	Find the equivalent circuit constants of a three phase induction motor by conducting No-Load and Blocked Rotor tests.	6
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.	6
10	Determination the 'V' curve and inverted 'V' curve of synchronous motor.	6
	TOTAL PERIODS	**60**

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

Suggested List of Students Activity:

- Case Studies: Present case studies on power factor improvement techniques, synchronization methods for three-phase alternators, and performance prediction ofinduction motors. Analyze real-world examples to deepen understanding and stimulate critical thinking.

2G234620	ELECTRICAL MACHINES II PRACTICAL	L	T	P	C	END EXAM
PRACTICAL		0	0	4	2	PRACTICAL

- 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:

1. B. L. Theraja and A. K. Theraja, A Textbook of Electrical Technology Volume - II (AC and DC Machines), Multi colour Edition, S. Chand & Co., 2005
2. V.K. Mehta & Rohit Mehta, Principles of Electrical Machines, SecondEdition, S. Chand& Co.,2019
3. S. K. Bhattacharya, Electrical Machines, Third Edition, McGraw HillEducation, 2008.
4. Ashfaq Husain, Haroon Ashfaq, Electric Machines, Third Edition, Dhanpat Rai& Co. (P)Ltd., 2016.

Web-based/Online Resources:

- IEEE Xplore Digital Library**:** https://ieeexplore.ieee.org/
- All About Circuits**:** https://www.allaboutcircuits.com/
- Electrical4U**:** https://www.electrical4u.com/
- Engineering360 from IEEE: https://www.engineering360.com/
- Khan Academy: https://www.khanacademy.org/
- Learn Engineering: https://www.learnengineering.org/
- Electrical Engineering Portal: https://electrical-engineering-portal.com/

Equipment / Facilities required to conduct the Practical Course Requirement: (For a Batch of 30 Students.

S. No	LIST OF EQUIPMENT	QUANTITY
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

END TERM PRACTICAL EXAM MODEL QUESTION PAPER

Duration: 3 Hours Max. Marks: 100

List of Questions

1. Conduct Load test on 3 Phase Alternator and plot the load characteristics curve.
2. Predetermine the Regulation of Three Phase Alternator by EMF method.
3. Predetermine the Regulation of Three Phase Alternator by MMF method.
4. Perform Synchronization of 3 Phase Alternators by
   a) Lamp method b) Synchroscope method
5. Conduct Load Test on a three phase squirrel cage induction motor and plot the performance curve.
6. Conduct Load Test on a three phase slip-ring induction motor and plot the performancecurve.
7. Find the equivalent circuit constants of a three phase induction motor by conductingNo-Load and Blocked Rotor tests.
8. Demonstrate that power factor of an induction motor load is improved by connecting capacitor bank.
9. Conduct Load Test on a single phase induction motor and plot the performance curve.
10. Conduct and Experiment to obtain the ‘V’ curve and inverted ‘v’ curve of synchronous

G Scheme

Diploma in Electrical and Electronics Engineering

V TERM SYLLABUS

2G235110	POWER SYSTEM PROTECTION AND UTILIZATION	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Introduction:

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 protectionmechanisms safe guard 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 relay sand circuit breakers.
- Understand the principle of electric traction system sand the technology to optimize modern electric traction systems.
- Explore the orison 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

CO 1	:	Understand and select proper protective scheme for different major electric equipment.
CO 2	:	Understand the fundamentals of relays and circuit breaker.
CO 3	:	Describe the principles of electric traction systems.

CO 4 : Understand the fundamentals of illumination systems and to design for few applications.

CO 5 : Demonstrate the utilization of electrical energy for heating and welding purposes.

Pre-requisites:

- Basic Electrical Engineering
- Electrical Machines I
- Electrical Machines II
- Generation, transmission and distribution..

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	2	1	-	-	-
CO 2	3	1	2	1	-	-	-
CO 3	3	2	3	1	-	-	-
CO 4	3	2	3	1	-	-	-
CO 5	3	1	2	1	-	-	-

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

Instructional Strategy:

- Begin by introducing foundational concepts such as electrical networks, powergeneration, 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 out comes and identify areas for improvement.

2G235110	POWER SYSTEM PROTECTION AND UTILIZATION	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

THEORY PORTION:		
UNIT I	**PROTECTION SCHEMES**	Period
Protection Schemes: Significance and need for protective schemes– Nature and causes of faults – Types of faults – Effects of faults – Zones of protection.Equipment Protection: Applications of Current Transformers (CT) and Potential Transformers (PT) in protection schemes – Protection of Transformer. Over Voltage Protection: Voltage surge–Causes of Over Voltage–Lightning–Direct stroke, Indirect stroke – Protection against lightning – Earthing screen, Overhead Ground Wires, Lightning Arresters – Expulsion Type, Gapless Arrester. Fuses: Construction and Working of HRC Fuse–H.V. Fuses.		9
UNIT II	**RELAYS AND CIRCUIT BREAKERS**	Period
Relays: Basic principle –– Relay characteristics –Relay timing –Instantaneous relay–Inverse time relay and Definite time lag relay–Inverse definite minimum time relay - Primary and back up Protection - Classification of relays – Induction type over current relay (Directional and Non directional), Differential relay–Over Current relay – Distance relay. Static Relays: Basic elements of static relay. Circuit Breakers: Arcing phenomenon and Arc interruption – Re–Striking Voltage and Recovery Voltage –Rate of rise of recovery voltage –Types of circuit breakers – Air Blast, Oil, SF6and Vacuum Circuit Breakers – HVDC Breaker.		9
UNIT III	**ELECTRIC TRACTION**	Period
Fundamentals of electric drive–Factors governing the selection of Electric Motor – Different types of electrical drives – Application of Motors for Particular Services – Characteristic Features of Traction Motor – Advantages and Disadvantages of Electric Traction – Over Head Equipment – Contact Wire, Centenary and Droppers and Collection Gear – Bow and Pantograph Collector – Different Systems of Track Electrification. Traction Mechanics: Units and Notations used in Traction Mechanics – Speed Time Curve for Different Services – Simplified Speed Time Curve – Energy Saving with Series Parallel Starting –Shunt Transition –Bridge Transition –Multiple Unit Control – Regenerative Braking – Magnetic Levitation (MAGLEV).		9

2G235110	POWER SYSTEM PROTECTION AND UTILIZATION	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

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

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

Suggested List of Students Activity:

- Power point presentation on “Technology in recent super-fast 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.

Text and Reference Books:

1. Sunil S.Rao, Switch gear and Protection, Fourth Edition, Khanna Publishers,2010.
2. L.Wadhwa, Generation ,Distribution and Utilisation of Electrical Energy, New Academic Science, New Delhi, 2011
3. S.L.Uppal, S.Rao, Electrical Power Systems, Fifteenth Edition, Khanna Publishers, 2009.
4. B.Rabindaranath, M.Chander, Protective System Protection and Switch gear, New age International, 2012.

Web-based/Online Resources:

- NPTEL Videos Lecture 01: Faults in Power System IIT Kharagpur https://youtu.be/WPmOB31UTkI?si=3uqr7o_C4nC9whoo
- NPTEL:I nterior Lighting https://youtu.be/gWv4lx6y2Qw?si=XKnI181-P-ahu1xi.

2G235210	ELECTRIC VEHICLE TECHNOLOGY	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Introduction:

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 Out comes:

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

CO 1	:	Describe about working principle of electric vehicles.
CO 2	:	Explain the construction and working principle of various motors used in electric vehicles.
CO 3	:	Understand working principle of electronic sand sensor less control in electric vehicles.
CO 4	:	Understand working principle of hybrid vehicles.
CO 5	:	Illustrate the various types and working principle of fuel cells

Pre-requisites:

- Basics of Science and Engineering.

2G235210	ELECTRIC VEHICLE TECHNOLOGY	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	1	1	-	1	1	2
CO 2	3	1	2	2	1	1	2
CO 3	3	1	2	2	1	1	2
CO 4	3	1	2	2	1	1	2
CO 5	3	1	2	2	1	1	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.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

2G235210	ELECTRIC VEHICLE TECHNOLOGY	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

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

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

Assessment.

Suggested List of Students Activity:

- Presentation / Seminars by students onany 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 and Reference Books:

1. Jack Erjavec and Jeff Arias, Hybrid, Electric and Fuel Cell Vehicles, Cengage Learning, 2012 .
2. Jack Erjavec and Jeff Arias, Alternative Fuel Technology – Electric, Hybrid and Fuel Cell Vehicles, Cengage Learning Pvt. Ltd., New Delhi, 2007.
3. MehrdadEhsani,YiminGao,sebastienE.GayandAliEmadi,“ModernElectric,Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2009.

Web-based/OnlineResources:

- NPTEL Electrical Vehicle Technology.
- https://afdc.energy.gov/vehicles/how-do-all-electric-cars-work
- https://e-amrit.niti.gov.in/types-of-electric-vehicles
- https://www.niti.gov.in/sites/default/files/2021-08/HandbookforEVChargingInfrastructureImplementation081221.pdf

2G235340	POWER ELECTRONICS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Introduction:

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

CO 1 : Understand and construct the trigger and commutation circuits of SCR.

CO 2 : Understand the Line commutated power control circuits.

CO 3 : Understand the working of different types of choppers and inverters.

CO 4 : Understand the basics of DC Drives

CO 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.

2G235340	POWER ELECTRONICS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	1	2	2	-	1	2
CO 2	3	1	2	2	-	1	2
CO 3	3	1	2	2	-	1	2
CO 4	3	1	2	2	-	1	2
CO 5	3	1	2	2	-	1	2

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

Instructional Strategy:

- It is advised that teachers take step stop iquepupils'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 maybe used toensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices may be followed in the real environment as far as possible.

2G235340	POWER ELECTRONICS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Theory Portion		
UNIT I	**COMMUTATION CIRCUITS AND PHASE CONTROLLED RECTIFIERS**	Period
Power Electronics: Definition – Scope and Applications – Power Electronic Switch Specifications – Types of Power Electronic Circuits. SCR – rating and their importance, Symbol, Circuit, Working, Characteristics and 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.		4
UNIT II	**LINE COMMUTATED POWER CONTROL CIRCUITS**	Period
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.		3
Practical Exercises:		
Ex.No	Name of the Experiment	Period
1.	Construct a Lamp dimmer circuit using TRIAC.	6
2.	Construct the Line synchronized Ramp trigger circuit using UJT with AC Load to measure firing angles.	6
3.	Construct and test the SCR commutation circuits.	6
4.	IGBT Characteristics.	6
5.	Construct and test a single-phase Half-controlled bridge with RL Load.	6
Theory Portion:		
UNIT III	**CONVERTERS**	Period
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.		3
UNIT IV	**INVERTERS**	Period
Inverters: Introduction, Classification of Inverter. Circuit Diagram, Working and Waveform - Full Bridge Inverter - Three Phase Bridge Inverter Under 180° Mode &		3

120° Mode Operations - Pulse Width Modulated Inverters, (Single Pulse, Multiple Pulse, Sinusoidal Pulse).		
UNIT V	**MOTOR DRIVE APPLICATIONS**	Period
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.		2
Practical Exercises:		
Ex.No	**Name of the Experiment**	**Period**
6.	Construct and test the Single phase to single-phase Cyclo converter.	6
7.	Design the PWM based step down DC Chopper using MOSFET/IGBT.	6
8.	Construct and test the Single-phase Single pulse/Sinusoidal PWM inverter using MOSFET/IGBT.	6
9.	Three phase Half bridge / Full bridge Converter.	6
10.	Construct and test the Speed Control of AC Motor using VFD drive.	6
TOTAL PERIODS		**75**

Note: *Common Test and Revision periods can be used for conducting ContinuousAssessment.*

Suggested List of Students Activity:

- Presentation / Seminars by student so many recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly / for tightly based on the course
- Viva Voce will be conducted before conducting an experiment

Text and Reference Books:

1. MD Singh, K.B . Khanchandani , Powe r Electronics, Seventh reprint, Tata Mc Graw Hill Publishing Company Ltd, 2005.
2. Mohammed H.Rashid ,Power Electronics, Third Edition, New age publication ,2004.
3. Will I am P .Robbins ,Ned Mohan ,Tore M .Undeland ,Powe Electronics: Converters, Applications and Design, Third Edition, Wiley, 2002.

Web – based / Online Resources:

- https://www.electronicsfou.com/ technology-trends/learn-electronics/understanding-power-electronics
- https :/ /www .geeks for geeks .org / power- electronics
- https :// www .youtube .com / watch ? v = 1Auay 7ja2 oY – NPTEL Lecture Series on Power Electronics by Prof .B.G .Fernandes ,Department of Electrical Engineering , IIT Bombay.

2G235340	POWER ELECTRONICS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Equipment / Facilities required to conduct the Practical Course.

(Batch Strength: 30 Students)

S.No	Name of the Equipment's	Quantity Required
1.	Line synchronized Ram p trigger circuit using UJT	3Nos.
2.	SCR commutation circuit kit	1 No.
3	IGBT kit	
4.	Single phase Half 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.	Three phase Half bridge/Full bridge converter with RL - Load	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 – BT 136, DIAC – DB 32, Resistor - 2K Ω, 26 Ω ,Capacitor-0.01µf, Potentiometer- 1MΩ	Each1No
13.	CRO	5 Nos.

2G235340	POWER ELECTRONICS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

End Semester Practical Exam Model Question Paper

Duration:3Hours Max.Marks:100

List of Questions

1. Construct a Lamp dimmer circuit using TRIAC.
2. Construct the Line synchronized Ramp trigger circuit using UJT with AC Load to measure firing angles.
3. Construct and test the SCR commutation circuits.
4. IGBT Characteristics.
5. Construct and test a single-phase Half-controlled bridge with RL Load.
6. Construct and test the Single phase to single-phase Cyclo converter.
7. Design the PWM based step down DC Chopper using MOSFET/IGBT.
8. Construct and test the Single phase Single pulse/Sinusoidal PWM inverter using MOSFET/IGBT.
9. Three phase Half bridge / Full bridge Converter.
10. Construct and test the Speed Control of AC Motor using VFD drive.

***

2G235440	PLC AND AUTOMATION	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Introduction:

Nearly all the industrial equipment that you find in a modern manufacturing facility share sone thing in common – computer control. The most commonly used controller isthe 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.

Course Objectives:

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 Instruction sin 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 network sand SCADA.

Course Outcomes:

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

CO 1	:	Describe the importance of typical components of a PLC.
CO 2	:	Develop and Execute PLC Program using Relay type and Timer Instructions.
CO 3	:	Develop and Execute PLC Program using Counter and Compare Instructions.
CO 4	:	Develop and Execute PLC Program using Analog Input Instruction.
CO 5	:	Describe the importance of I/O bus networks and SCADA in automation.

Pre-requisites:

- Basics of Electrical and Electronics Engineering.

2G235440	PLC AND AUTOMATION	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

CO/POMapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	1	3	2	-	1	2
CO 2	3	2	3	2	-	1	2
CO 3	3	2	3	2	-	1	2
CO 4	3	2	3	2	-	1	2
CO 5	3	2	3	2	1	1	2

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

Instructional Strategy:

- It is advised that teachers take step stop equippers' 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.

2G235440	**PLC AND AUTOMATION**	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Theory Portion:		
UNIT I	**INTRODUCTION TO PLC**	Period
Automation – Components of Automation - Factory Automation and Process Automation – Advantages of Automation - Block diagram of PLC – Principle of operation – PLC Scan – Advantages of PLC.		3
UNIT II	**I/O MODULES, PROGRAMMING OF PLC**	Period
Typical DiscreteI/Ofield Devices–Sinking and SourcingI/Omodules–Relay outputmodule – Isolated output module - Criteria for selection of suitable PLC – List of PLCs available in the market – Develop ladder logic program using Relay type instructions		2
UNIT III	**TIMERS (APPLICABLE FOR PLC)**	Period
Introduction about Timer Instructions–ON Delay and OFF Delay Timer – Retentive Timer Instruction.		2
Practical Exercises:		
Ex.No	Name of the Experiment	Period
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.	5
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 wire Proximity Sensor (D) and Buzzer (Y) with PLC and check the output.	5
3	PLC BASED STAR DELTA STARTER Sequence of Operation: Develop and Execute Ladder Logic in PLC for Automatic Star- Delta Starter	5

	Operation. Check the output by interfacing PLC with three phase cage induction motor.	
4	PLC BASED FORWARD AND REVERSE CONTROL OF INDUCTION MOTOR* Sequence of Operation: 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.	5
5	PLC BASED CONVEYOR SYSTEM WITH PRE WARNING SIREN Sequence of Operation: Develop and Execute Ladder Logic in PLC using an ON delay timer to delay the star to fan 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.	5
6	PLC BASED WATER LEVEL CONTROL SYSTEM Sequence of Operation: 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.	5
Theory Portion:		
UNIT IV	**COUNTERS, MATH & DATA COMPARE INSTRUCTIONS.**	Period
Introduction about Counter Instructions – UP Counter – DOWN Counter – Applications of Counter Instructions – Math Instructions - Data Compare Instructions – Simple programs using above instructions.		3
Practical Exercises:		
Ex.No	Name of the Experiment	Period

7	PLC BASED COUNTING OF MOVING OBJECTS ON A CONVEYOR Sequence of Operation: 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.	5
8	PLC BASED COUNTING OF MOVING OBJECTS ON TWO CONVEYORS Sequence of Operation: 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 conveyor sin to the Plant. When the count of total object has reached pre-set count value, turn ON buzzer to give beep sound for 1second and turn OFF the conveyors.	5
9	PLC BASED CAR PARKING CONTROL SYSTEM* Sequence of Operation: 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 Executeladder 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.	5
10	PLC BASED FAN CONTROL FOR ENERGY CONSERVATION Develop and Execute a ladder logic in PLC to operate Fan in the Meeting Hall based on counting the number of persons entering into the Hall. Interface suitable types of sensor with PLC to senser the per son 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.	5
11	PLC BASED THREE FLOOR LIFT CONTROL SYSTEM Develop and Execute a ladder logic in PLC to control Lift/Elevator in 3 floor system. Interface Call buttons, suitable sensors for detecting floors and Motorwith PLC to check the sequence of operation.	5
	Theory Portion:	
UNIT V	**ANALOG I/O MODULE & INDUSTRIAL NETWORK**	Peri od

Analog Input Modules-Typical Analog Input field devices –Analog Output Modules -Typical analog output field devices. Block diagram of I/O bus networks-Serial communications–Field bus Networks- Typical PROFI BUS architecture-Typical MOD BUS architecture –Typical Foundation field bus architecture – Importance of HMI and SCADA in Automation - Typical SCADA system architecture.	5

Practical Exercises:

Ex.No	Name of the Experiment	Period
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.	5
	TOTAL PERIODS	**75**

Note: Common Test and Revision period scan be used for conducting ContinuousAssessment.

*Exercises No.4 & 9 is for Demonstration only and Not to be given for Examination. But it must be included in the Practical Document.

Cycle I Exercises: 1,2,3,5 & 6 and Cycle II Exercises: 7,8,10,11 & 12.

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 of activity.
- 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.

2G235440	PLC AND AUTOMATION	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Text and Reference Books:

1. Frank D. Petruzella, Programmable Logic Controllers, 6th Edition, Indian Edition, Mc Graw Hill, 2023
2. Richard A.Cox, Technician's Guide to Programmable Logic Controllers, Fourth Edition,Delmer Cengage Learning, 2013.
3. Gary Dunning, Introduction to Programmable Logic Controllers, Third Edition, Cengage Learning India Pvt Ltd, 2021.
4. Hugh Jack, Automating Manufacturing Systems with PLCs, Free Software Foundation, 2007.
5. L.A. Bryan and E.A.Bryan, "Programmable Controllers Theory and Implementation,"2nd Edition, Industrial Text Company Publication, 1997.

Web-based/ Online Resources:

- https://www.sanfoundry.com/100-plc-programming-examples/
- https://archive.nptel.ac.in/courses/108/105/108105062/
- https://www.youtube.com/watch?v=MS3qJq2jvu0
- https://www.youtube.com/watch?v=rqxoREpOjTU

Equipment/Facilities required to conduct the Practical Course.

(Batch Strength: 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	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

2G235440	PLC AND AUTOMATION	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

End Semester Practical Exam Model Question Paper

Duration:3Hours Max.Marks:100

List of Questions

1. Develop and Execute Ladder Logic in PLC for DOL Starter Operation with Single Phasing Prevention.
2. Develop Ladder Logic in PLC to execute the following logical relation between the input and output field devices: a) Y =A + B + C + Db) Y =A . B .C . Dc) Y = (A+B) . (C+D)d) Y = (A.B) + (C.D).
3. Develop and Execute Ladder Logic in PLC for Automatic Star-Delta Starter Operation.
4. Develop and Execute Ladder Logic in PLC to delay the start of a conveyor with pre-warning siren.
5. Develop and Execute Ladder Logic in PLC for automatic Water Level Control System using pump motor and solenoid valve.
6. Develop and Execute ladder logic in PLC for counting the object moving in the conveyor.
7. Develop and Execute Ladder Logic in PLC to get the total number of objects transferred by two conveyors into the Plant.
8. Develop and Execute a ladder logic in PLC to operate Fan sin the Meeting Hall base don counting the number of persons entering into the Hall.
9. Develop and Execute a ladder logic in PLC to control Lift / Elevator in three floor system.
10. Develop and Execute a ladder logic program for multi level Illumination control system.

***

2G235541	IoT AND APPLICATION	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Introduction:

Internet of Things has emerged as a 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 over view and programming of the popular IoT platformRaspberry 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

CO 1 : Demonstrate the architecture and functioning of IoT systems.

CO 2 : Understand the Python Scripting Language which is used in IoT devices.

CO 3 : Understand the working and features of Raspberry Pi.

CO 4 : Build a proto type using Raspberry pi.

CO 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.

2G235541	**IoT AND APPLICATION**	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	1	3	3	2	1	3
CO 2	3	1	3	3	2	1	3
CO 3	3	1	3	3	2	1	3
CO 4	3	1	3	3	2	1	3
CO 5	3	1	3	3	2	1	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 multi media, 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

2G235541	IoT AND APPLICATION	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

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

2G235541	IoT AND APPLICATION	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Note: *Common Test and Revision period scan be used for conducting ContinuousAssessment.*

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 and Reference Books:

1. Simon Monk, Programming the Raspberry Pi: Getting Started with Python, Mc GrawHill Professional, January 2012.
2. Vijay Madisetti and Arshdeep Bahga, Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2016.
3. Jain, Prof. Satish, Singh, Shashi, Internet of Things and its Applications, 1st Edition, BPB, 2020.
4. Eben Up ton and Gareth Halfacree, "Raspberry Pi User Guide" ,4th edition, John Wiley & Sons., August 2016.
5. Alex Bradbury and Ben Everard, "Learning Python with Raspberry Pi", John Wiley & Sons., Feb 2014.

Web-based/Online Resources:

- https://archive.nptel.ac.in/courses/106/105/106105166/
- https://www.raspberrypi.com/documentation/computers/getting-started.html
- https://projects.raspberrypi.org/en/collections/python
- https://projects.raspberrypi.org/en/projects/raspberry-pi-getting-started
- 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

2G235541	IoT AND APPLICATION	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

End Semester Practical Exam

Model Question Paper

Duration:3Hours Max.Marks:100

List of Questions

1. Write and Execute a simple Python program to display message on screen.
2. Write and Execute a simple Python program using Logical operators.
3. Write and Execute a simple Python program to demonstrate the use of if else statement.
4. Write and Execute a Python program to demonstrate the use of ‘while’ loop.
5. Write and Execute a Python program to demonstrate the use of ‘for’ loop.
6. Perform Installation of an OS in Raspberry pi.
7. Write and Execute a program to blink a LED using raspberry pi.
8. Write and Execute a program for turning a LED ON, when the switch is pressed using raspberry pi.
9. Write and Execute a program to control street light automatically using LDR and raspberry pi.
10. Construct an IoT based Air pollution monitoring system.

***

2G235542	COMPUTER HARDWARE AND NETWORKING	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Introduction:

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

CO 1	:	Install various secondary storage devices with memory partition and formatting.
CO 2	:	Install optical storage devices like DVD & Blue Ray disc and perform different Cable crimping in a network.
CO 3	:	Install the printers and configure TCP / IP for network connectivity.
CO 4	:	Assemble and disassemble laptop to identify the parts and install dual OS in a system.
CO 5	:	Install and configure networking devices.

Pre-requisites: Basic knowledge of Computers.

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	3	-	2	-	-	-
CO 2	3	3	-	2	-	-	-
CO 3	3	3	-	2	-	-	-
CO 4	3	3	-	2	-	-	3
CO 5	3	3		2	-		3

2G235542	COMPUTER HARDWARE AND NETWORKING	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

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 through out 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.

Theory Portion:		
UNIT I	**PC HARD WARE COMPONENTS**	Period
Introduction:Parts-Mother board,sockets,expansion slots,memory,powersupply, 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–CableTester. Printers: Introduction – Types of printers – Dot Matrix – Laser – Multi Function Printer- Operation – Features.		8
Practical Exercises:		
Ex.No	Name of the Experiment	Period
1.	Identification of system layout (Study Exercise) Front panel indicators & switches and front side & rear side connectors. Familiarize the computer system Layout: Marking positions of SMPS, Mother board, HDD, DVD and add on cards. Configure bios setup program and trouble shoot the typical problems Using BIOS utility.	5

2.	Hard Disk Install Hard Disk. Configure CMOS-Setup. Partition and Format Hard Disk. Identify Master/Slave/IDE Devices. Practice with scan disk, disk clean up, disk De-fragmentation, Virus Detecting and Rectifying Software.	5
3.	Install and Configure a DVD Writer & Blu-ray Disc Writer. Recording a Blank DVD & Blu-ray Disc	5
4.	Do the following cabling works in a network Cable Crimpling Standard Cabling Cross Cabling I/O Connector Crimping Testing the Crimped cable using a Cable tester.	5
5.	Printer Installation: Install and configure Dotmatrix printer Install and configure Laser printer.	5
Theory Portion:		
UNIT II	**NETWORKING**	
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.		7
Practical Exercises:		
Ex. No	Name of the Experiment	Period
6.	Configure Host IP, Subnet Mask and Default Gateway in a system in LAN (TCP/IP Configuration). Configure Internet connection and use IP CONFIG, PING / Tracert And Netstat utilities to debug the Network issues.	5
7.	Assemble a system with add on cards and check the working condition Of the system and install Dual OS.	5
8.	Transfer files between systems in LAN using FTP Configuration. Install A printer in LAN and share it in the network.	5

9.	Install and configure Network Devices: HUB, Switch and Routers.	5
10.	Install and Configure Wired and Wireless NIC and transfer files between systems.	5
Required Practical Instructions for CycleI & II Experiments		10
TOTAL PERIODS		**75**

Note: *Common Test and Revision periods can be used for conducting ContinuousAssessment.*

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 References Books:

1. BehrouzA.Forouzan,Data communication and Networking, Fourth Edition ,Mc.Graw Hill Higher Education, 2007.
2. William Stallings, Network Security Essentials:Applications and Standards, Fourth Edition, Pearson Publications (Prentice Hall), 2011.
3. William Stallings, Cryptography and Network Security:Principles and Practice, Pearson Publications, 2016
4. BehrouzA. Forouzan, Cyptography and Network Security, Special Indian Edition, TataMcGraw-Hill,2007.
5. Andrew S.Tanenbaum, DavidJ. Wether all, Computer Networks, Fifth Edition, PearsonPublications, 2013

Web-based/Online Resources

- http://nptel.ac.in/.
- Vlabs:http://cse29-iiith.vlabs.ac.in/
- https://dgt.gov.in/sites/default/files/CHNM_CTS2.0_NSQF-3.pdf

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

S.No	Name of the Equipment's	Quantity Required
1.	Desktop Systems	30Nos
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.	RJ45 Jack	1 Box
9.	Dot matrix Printer and Laser Printer	Each1No
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	-

End Semester Practical Exam

Model Question Paper

Duration:3Hours Max.Marks:100

List of Questions

1. Perform following activity on Hard Disk
   Install Hard Disk.
   Configure CMOS-Setup.
   Partition and Format Hard Disk.
   Identify Master/ Slave/ IDE Devices.
   Practice with scandisk, disk clean up, disk De-fragmentation, Virus Detecting and Rectifying Software
2. Install and Configure a DVD Writer & Blu-ray Disc Writer.
   Recording a Blank DVD & Blu-ray Disc.
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.
4. Install and configure Dot matrix printer and Laser printer.
5. Configure Host IP, Subnet Mask and Default Gate way in a system in LAN (TCP/IP Configuration).
   Configure Internet connection and use IPCONFIG,PING/ Tracert and Netstat Utilities to debug the Network issues.
6. Assemblea system with add on cards and check the working condition of the system And install Dual OS.
7. Transfer files between systems in LAN using FTP Configuration. Install a printer in LAN

and share it in the network.

8. Install and configure Network Devices: HUB, Switch and Routers.
9. Install and Configure Wired and Wireless NIC and transfer files between systems.

***

2G235543	CONTROL OF ELECTRICAL MACHINES	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Introduction:

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. Itis 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

CO 1 :	Familiarize control circuit elements such as industrial switches, relays, timers, contactors, and interlocking arrangements.
CO 2 :	Develop and Execute control and main circuit of DOL starter and star deltastarter For cage induction motor.
CO 3 :	Understand the control and main circuit of Rotor Resistance Starter.
CO 4 :	Develop and execute the control and power circuit for Two Speed Control, Forward-Reverse Control, Jogging and Dynamic Braking of ac motor.
CO 5 :	Design the industrial control circuits based on the schematic diagram.

Pre-requisites:

- Electrical Machines-I
- Electrical Machines-II.

2G235543	CONTROL OF ELECTRICAL MACHINES	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	1	3	3	1	1	2	2
CO 2	1	3	3	1	1	3	2
CO 3	1	3	3	1	1	3	2
CO 4	1	3	3	1	1	3	2
CO 5	1	3	3	1	1	3	2

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

Instructional Strategy:

- It is advised that teachers take step stop equippers' 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.

2G235543	CONTROL OF ELECTRICAL MACHINES	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Theory Portion:		
UNIT I	**SWITCHES**	Period
Switches–Push button, selector switch, limit switch, float switch, zero speed switch, and proximity switch		2
UNIT II	**RELAYS**	Period
Relays – Frequency response relay and Phase failure relay (single phasing preventer) - Over current relay –Bimetallic thermal over load relay and Magnetic dash pot oil filled relay		2
UNIT III	**TIMERS**	Period
Timer – Pneumatic and Electronic timer – Solenoid type contactor (Airbreak contactor) - Solid state relay – Simple ON – OFF motor control circuit - Remote control Operation- inter locking of drives		3
Practical Exercises:		
Ex.No	Name of the Experiment	Period
1.	Wire and test the control circuit for two speed pole changing motor.	6
2.	Wire and test the working of single phasing preventer with control and Main circuit.	6
3.	Test the timing characteristics of thermal overload relay	6
4	Remote control operation of 3ϕ squirrel cage induction motor.	6
5.	Wire and test the control and main circuit for semi automatic star–delta Starter.	6
6.	Wire and test the control and main circuit for automatic star–delta Starter using Pneumatic timer.	6
Theory Portion:		
UNIT IV	**AC MOTOR CONTROL CIRCUITS**	Period
Concept and operation of DOL starter and Semi-Automatic and Automatic Star-delta starters. Concept and working/operation of forward and reverse, Jogging, Dynamic braking of cage induction motor and Automatic Rotor Resistance Starting of Slip Ring Induction Motor.		4
UNIT V	**INDUSTRIAL CONTROL CIRCUITS**	Period
Design of control circuit: Planner Machine – Skip hoist control – Conveyor system – Automatic water level control.		4

2G235543	CONTROL OF ELECTRICAL MACHINES	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Practical Exercises:		
Ex. No	Name of the Experiment	Period
7.	Wire and test the control and main circuit for forward and reverse operation.	6
8.	Wire and test the control and main circuit for jogging in cage induction motor.	6
9.	Wire and test the control and main circuit for dynamic braking of cage motor.	6
10.	Wire and test the control and main circuit for dynamic braking of DC shunt motor.	6
11.	Wire and test the control and main circuit for automatic rotor resistance starter.	6
12.	Conduct test on speed control DC motor using SCR.	6
TOTAL PERIODS		**75**

Note: Symbols in the circuit should be used as per Text Book No.01

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

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the 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-worldapplication.

Text and Reference Books:

1. S.K.Bhattacharya, Brijinder Singh, Control of Electrical Machines, Revised Second Edition,New Age International Publishers, 2003.
2. Steve Senty, Motor Control Fundamentals, First Edition, Delmar Cengage Learning, 2013.
3. Stephen L. Herman, Electric Motor Control 10th Edition, Delmar Cengage Learning, 2014.

Web-based/Online Resources:

- https://www.youtube.com/watchdiplomadotee-lectures.

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

S.No	Name of the Equipments	Quantity Required
1.	AC Contactor230V/440V,16A	20Nos
2.	Push Button With NO/NC Elements	24Nos

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

2G235543	CONTROL OF ELECTRICAL MACHINES	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

End Semester Practical Exam Model Question Paper

Duration: 3 Hours Max.Marks:100

List of Questions

1. Wire and test the control circuit for two speed pole changing motor.
2. Wire and test the working of single phasing preventer with control and Main circuit.
3. Test the timing characteristics of thermal overload relay
4. Remote control operation of 3ϕ squirrel cage induction motor.
5. Wire and test the control and main circuit for semi automatic star–delta Starter.
6. Wire and test the control and main circuit for automatic star–delta Starter using Pneumatic timer.
7. Wire and test the control and main circuit for forward and reverse operation.
8. Wire and test the control and main circuit for jogging in cage induction motor.
9. Wire and test the control and main circuit for dynamic braking of cage motor.
10. Wire and test the control and main circuit for dynamic braking of DC shunt motor.
11. Wire and test the control and main circuit for automatic rotor resistance starter.
12. Conduct test on speed control DC motor using SCR.

***

2G235544	AUTO MECHATRONICS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Introduction:

The Auto mechatronics is referred to as modern automotive technology and also commonly known as Automotive Mechatronics. Autotropic 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 proto type 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

CO 1	:	Understand the operation of sensors and electrical systems in vehicle.
CO 2	:	Understand automated driving technology.
CO 3	:	Prepare prototype of solar and wind powered vehicles.
CO 4	:	Describe advanced charging and electronic fuel ignition in Automobile.
CO 5	:	Understand the vehicle safety and automatic climate control in automobiles Through technology.

Pre-requisites:

- Basics of Electrical and Electronics
- Sensors
- Digital Skills

2G235544	AUTO MECHATRONICS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	-	2	3	-	-
CO 2	3	-	3	-	2	1	3
CO 3	-	3	2	-	-	3	-
CO 4	3	2	2	1	3	3	3
CO 5	3	-	2	1	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.

2G235544	AUTO MECHATRONICS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Theory Portion:		
UNIT I	**INTRODUCTION TO AUTOMATED DRIVING TECHNOLOGIES**	Period
The road to autonomy–Sensor Positioning-Automated Driving System–Mapping.		3
Practical Exercises:		
Ex.No	Name of the Experiment	Period
1.	Online Case studies from Nvidia – Bosch - Google (Waymo) - Tesla Autopilot – Audi - Jaguar Land Rover - Toyota Guardian – FLIR - First sensor AG.	8
Theory Portion:		
UNIT II	**ALTERNATE ENERGY SOURCES**	Period
Overview of Alternate Energy sources in India-Energy and Environment Overview-Importance of Alternate Energy sources.		3
Practical Exercises:		
Ex.No	Name of the Experiment	Period
2.	Create a proto type of Solar powered vehicle.	14
3.	Create a proto type of Wind powered vehicle.	
Theory Portion:		
UNIT III	**ADVANCED CHARGING AND STARTING, IGNITION AND FUEL INJECTION**	Period
Charging system principles-Smart charging - Advanced Chargingsystem technology—Electronic starter motor control and stop-start system-Electronic ignition-Electronic control of diesel injection.		4
Practical Exercises:		
Ex.No	Name of the Experiment	Period
4.	Demonstrate fast charging in an electric vehicle.	16
5.	Dismantling, troubleshooting & 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**	Period
Anti-lock brakes-Automatic transmission-Central locking and child locking.		2
Practical Exercises:		
Ex.No	Name of the Experiment	Period

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

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

Cycle 1 Exercises for Examination:2,3,4,5&6

Cycle 2 Exercises for Examination:7,8,9&12

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 Books:

1. Konrad Reif, Automotive Mechatronics Automotive Networking·Driving Stability Systems, springer
2. B.T. Fijalkowski, Automotive Mechatronics: Operational and Practical Issues volume 1, Springer
3. Tom Denton,Automated Driving and Driver Assistance Systems,1st Edition, Routledge, Taylor & Francis Group, UK, 2020.
4. Richard Folkson,Alternative Fuels and Advanced Vehicle Technologies for Improved Environmental Performance, Woodhead Publishing Ltd, 2014.

Web-based/Online Resources:

- https://www.tesla.com/support/autopilot

2G235544	AUTO MECHATRONICS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

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

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

2G235544	AUTO MECHATRONICS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

End Semester Practical Exam Model Question Paper

Duration:3Hours Max.Marks:100

List of Questions

1. Create a proto type of Solar powered vehicle.
2. Create a proto type of Wind powered vehicle.
3. Demonstrate fast charging in an electric vehicle.
4. Dismantling,troubleshooting and assembling of electronic starter motor.
5. Trace the automobile electrical system with respect to electronic ignition System.
6. Removing, servicing and replacing electronic control of diesel injection.
7. Demonstrate the working of Anti lock braking system.
8. Online Study of the Automatic transmission's shifting behavior under Various driving conditions.
9. Verify the functionality of individual door lock actuators
10. Dismantle existing AC unit and replace climate control unit in a car and note down the changes in performance.

***

2G235545	MECHANICAL ENGINEERING	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Introduction:

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. Beinging rained in many challenges and innovations a cross 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 Out comes:

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

CO 1 Understand the fundamental concept of Thermodynamics.

CO 2 Understand the Law of Thermodynamics.

CO 3 Describe the working of Thermal Machines and Power Plants.

CO 4 Understand the principle of Power Transmitting Elements.

CO 5 Understand various Manufacturing Processes and Engineering Materials.

Pre-requisites:

- Knowledge of science and Engineering

2G235545	MECHANICAL ENGINEERING	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	1	1	1	-	1	1
CO 2	2	1	1	1	-	1	1
CO 3	2	1	1	1	-	1	1
CO 4	2	1	1	1	-	1	1
CO 5	2	1	1	1	-	1	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 foran 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 activitiesin 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.

2G235545	MECHANICAL ENGINEERING	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Theory Portion:		
UNIT I	**FUNDAMENTALS OF THERMODYNAMICS**	Period
Fundamentals of Thermodynamics, Pressure and Pressure Measurement, Temperature, Zeroth law of Thermodynamics, Thermometric scale, Forms of Energy,Work Transfer, P-d V work, Heat Transfer, Concept of Specific Heat, Sensible Heat, Latent Heat.		3
UNIT II	**FIRST LAW OF THERMODYNAMICS**	Period
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 onp-VandT-s diagrams, Engineering applications of various processes.		3
UNIT III	**INTRODUCTION TO THERMALMACHINES**	Period
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).		3
UNIT IV	**POWER TRANSMITTING ELEMENTS**	Period
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.		3
UNIT V	**MANUFACTURING PROCESSES AND ENGINEERING MATERIALS**	Period
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.		3

2G235545	**MECHANICAL ENGINEERING**	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Practical Exercises:

Ex.No	Name of the Experiment	Period
1.	Study and identification of IC engine components.	60
2.	Study and identification of components of Refrigerator.	
3.	Teston OLP, current coil relay and PTC relay of a refrigeration system.	
4.	Study and Demonstration of working of Brakes, Clutch and Couplings.	
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		**75**

2G235545	MECHANICAL ENGINEERING	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

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

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 and References Books:

1. Prof.B.L.Ballaney,Thermal Engineering (Engineering Thermodynamics & Energy Conversion Techniques), 25th Edition, Khanna Publishers.
2. R.K.Rajput,A Text book of Engineering Thermodynamics, Second Edition, Laxmi Publications Pvt Ltd,. Reprint 2003.
3. S.K.Hajra Choudhary, A.K.Hajra Choudhary,Nirjhar Roy,Elements of WorkShop Technology –Volume I and II, Media Promoters & publishers Pvt.Ltd.
4. V.B.Bhandari,Design of Machine Elements, Fourth Edition, Tata-Mc Graw Hill Publications, 2017.

Web-based/Online Resources:

- https://phys.libretexts.org/Courses/University_of_California_Davis/UCD%3A_Physics_9BWaves_Sound_Optics_Thermodynamics_and_Fluids/05%3A_Fundamentals_of_Thermodynamics.
- https://www.energy.gov/energy-sources#:~:text=Primary%20energy%20sources%20take%20many,%2C%20solar%2C%20geothermal%20and%20hydropower.

2G235545	MECHANICAL ENGINEERING	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

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	Each3Nos
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	Each1No

2G235545	MECHANICAL ENGINEERING	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

End Semester Practical Exam Model Question Paper

Duration:3Hours Max.Marks:100

List of Questions

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.
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.
3. Perform tests on the Overload Protector (OLP), Current Coil Relay, and Positive Temperature Co efficient (PTC) Relay as per the provided instructions and Interpretthe test results.
4. Demonstrate the working principles of brakes,clutch,and coupling susing the provided setups and Explain the operation of each component and discuss its role in power transmission or control in mechanical systems.
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.
6. Perform plain turning on a work piece using a lathe machine. And Ensure precision in the turning process and achieve the specified dimensions of the workpiece.
7. Drillholes of specified diameters in the workpiece using the lathe machine.
   Perform thread cutting operations on the workpiece as per the provided specifications.
8. Operate the CNC machine to perform plain turning on a workpiece.
   Program the CNC machine to achieve the desired dimensions and surface finish of the workpiece.
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.
10. Perform arcwelding to create butt joints with specified welding parameters and Inspect the welded joints for defects and ensure weld integrity.

2G235546	ESTIMATION, STANDARDS AND REGULATIONS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Introduction:

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 TERMstudents.

Course Objectives:

The objective of this course is to enable the student to

- Understand regulations in volved in Indian Electricity ACT.
- Familiarize to do the plan layout 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 theelectrical safety measures and guidelines.

Course Out comes:

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

CO 1 : Explain the regulations involved in Indian Electricity ACT.

CO 2 : Prepare the electrical pipe layout for domestic, commercial and industrial building.

CO 3 : Estimate the quantity of Electrical materials required for various types of internal wiring.

CO 4 : Get familiar about the determination of the size and material of conductor and Cable from electrical and mechanical consideration.

CO 5 : Familiarize electrical safety measures and guidelines.

Pre-requisites: Knowledge of Electrical Engineering.

2G235546	ESTIMATION, STANDARDS AND REGULATIONS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	1	2	1	-	1	1
CO 2	3	1	2	1	-	1	1
CO 3	3	1	2	1	-	1	1
CO 4	3	2	3	1	-	1	1
CO 5	3	2	3	1	-	1	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 out come-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

2G235546	ESTIMATION, STANDARDS AND REGULATIONS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

Theory Portion:		
UNIT I	**INDIAN ELECTRICITY RULES**	Period
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-Switch Gear. IERules1956:28,30,31,54,56&87-BEEPATrules2012-Standards and Labelling scheme of BEE.		5
UNIT II	**ELECTRICAL INSTALLATIONS**	Period
Electrical installations, domestics, industrial ,Wiring System, Internal distribution ofElectrical Energy-Methods of wiring-Systems of wiring-conductor materials used incables - 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 beearthed-Determination of size of earth wire and earth plate for domestic and industrial installations - Material required forGI pipe earthing.		5
Practical Exercises:		
Ex.No	Name of the Experiment	Period
1.	Estimate the quantity of material required in Electrical Installation for Small residential building/Flat.(1BHK)	30
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 lightfitting.	
4.	Estimate the quantity of material required in Electrical Installation for Workshop with one number of 3 phase, 15 hp induction motor.	
5.	Estimate the quantity of material required in Electrical Installation for Small Workshop with 3or4 Machines.	
6.	Estimate the quantity of material required for CCTV wiring with 4 channel DVR for commercial building.	

UNIT III	ELECTRICAL SAFETY GUIDELINES	
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.		5
Practical Exercises: Estimation of Materials using Software		
Ex.No	Name of the Experiment	Period
7.	Using any supporting Software, Estimate the quantity of material required in Electrical Installation for Small residential building/ Flat. (1BHK)	30
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		**75**

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

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 References Books:

1. J.B.Gupta,A course in Electrical Installation, Estimating and costing, 9thEdition,S.K. Kataria and Sons, Reprint 2022.
2. S.Rao, R.K.Jain, Prof.H.L.Saluja, Electrical Safety, Fire Safety Engineering and SafetyManagement, Second Edition, Khanna Publishers, 2012
3. K.B.Raina & S.K.Battacharya, Electrical Design Estimating and Costing, New ageinternational(P) Ltd, reprint edition 2011.
4. IS732:Code of Practice for Electrical Wiring Installations

Web-based/Online Resources

- https://cea.nic.in/old/cei_rgn.html
- https://cea.nic.in/cei-regulations/?lang=en
- https://aerc.assam.gov.in/documents-detail/indian-electricity-rule1956
- https://electricity.py.gov.in/indian-electricity-rules
- Bureau of Energy Efficiency:https://beeindia.gov.in

2G235546	ESTIMATION, STANDARDS AND REGULATIONS	L	T	P	C	END EXAM
PRACTICUM		1	0	4	3	PRACTICAL

End Semester Practical Exam Model Question Paper

Duration:3Hours Max.Marks:100

List of Questions

1. Estimate the quantity of material required in Electrical Installation for Small residential building/Flat.(1BHK)
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.
7. Using any supporting Software, Estimate the quantity of material required in Electrical Installation for Small residential building/Flat.(1BHK)
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 Small Workshop with 4 Machines.
11. Using any supporting Software, Estimate the quantity of material required for CCTV Wiring with 4 channel DVR for commercial building.

***

2G235652	INNOVATION AND START-UPS	L	T	P	C	END EXAM
PRACTICUM		1	0	2	2	PROJECT

Introduction:

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 up on 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 Proto type 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.

2G235652	INNOVATION AND START-UPS	L	T	P	C	END EXAM
PRACTICUM		1	0	2	2	PROJECT

Course Out comes:

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

CO 1 : Differentiate between Innovation and Start-ups.

CO 2 : Explain the importance of IPR, Patents and Copyrights.

CO 3 : Describe the methodology to be adopted for preparing the Business Plan.

CO 4 : Gain practical experience by Industrial training and visiting the near by industry.

CO 5 : Explore and identify various funding facilities available from Government and Non-Government Schemes for Start-ups.

2G235652	INNOVATION AND START-UPS	L	T	P	C	END EXAM
PRACTICUM		1	0	2	2	PROJECT

Pre-requisites:

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

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	-	-	1	-	2	3	3
CO2	-	-	1	-	2	3	3
CO3	-	-	1	-	2	3	3
CO4	-	-	1	-	2	3	3
CO5	-	-	1	-	2	3	3

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 engineeringapplications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activitiesfor an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategythroughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activitiesin 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 incase of discrepancies.

2G235652	INNOVATION AND START-UPS	L	T	P	C	END EXAM
PRACTICUM		1	0	2	2	PROJECT

Theory Portion:		
UNIT I	**INTRODUCTION TO INNOVATION**	Period
An Introduction to Innovation and Creativity- Innovation in current Environment – Types of Innovation-Challenges of Innovation-Steps of Innovation Management-Divergent v/s Convergent thinking-Design thinking and Entrepreneurship.		6
UNIT II	**INCUBATIONCLUBS, IPR, PATENTS AND COPYRIGHTS**	Period
Idea Generation - Incubation Clubs - Prototype Development - Marketing of Innovation-Management of Innovation-Creation of IPR-Types of IPR-Patents and Copyrights- Patents in India - Technological and Non-Technological Innovation Process.		6
UNIT III	**GOVERNMENT ANDNON-GOVERNMENT FUNDING SCHEMES FOR START-UPS**	Period
An introduction to Start-up-Start-ups in India-Procedure for registration of Start- ups – Business Model-Business Plan- Case Studies-Opportunities and Challenges -Funding supports from Government Schemes-MUDRA, TANSEED, NEEDS ,PMEGP, UYEGP – Non-Government Schemes - CSR Fund - Angel Investors -Venture Capitalist.		6
UNIT IV	**SEMINAR**	
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 PPTsfor presentation. Idea Generation Innovation Management Product Development Business Model Innovation Organizational Culture and Change Management Leadership and Innovation Barriers to Innovation		9

Innovation Marketing E-Commerce success stories (anyone) Role of Start-ups in Higher Education Professional Networking in Building Brands How to start a start-up in India		
UNIT V	**EXPOSURE TO INDUSTRY**	Period
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.		18
TOTAL PERIODS		**45**

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

Reference Books:

1. In a Goller, John Bessant, Creativity for Innovation Management, First Edition, Routledge, 2017.
2. Walter Brenne and Falk Uebernickel , Design Thinking for Innovation, Research and Practice, Springer, 2016.
3. Henri Charmasson, John Buchaca, Patents, Copyrights & Trademarks for Dummies, Second Edition, Wiley Publishing Inc.

Web-based/Online Resources:

- https://www.startupindia.gov.in/
- https://www.mudra.org.in/
- https://startuptn.in/tanseed/
- https://www.msmetamilnadu.tn.gov.in/needs.php
- https://www.kviconline.gov.in/pmegpeportal/pmegphome/index.jsp
- https://msmeonline.tn.gov.in/uyegp/

***

G Scheme

Diploma in Electrical and Electronics Engineering

VI TERM SYLLABUS

2G236111	**ADVANCED ENGINEERING MATHEMATICS**	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Introduction:

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.
- Learnthenotationofpartialdifferentiationanddeterminetheextremitiesoffunctions 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

CO 1 : Find Eigen values and corresponding Eigen vectors of a square matrix.

CO 2 : Apply the knowledge of partial differentiation to evaluate Jacobian and Extremities of two variable functions.

CO 3 : Evaluate the gradient of a scalar field and the divergence and curl of vector fields.

CO 4 : Solve ordinary differential equations using various techniques.

CO 5 : Use Laplace transforms to solve first-order ordinary differential equations.

Pre-requisites:

- Knowledge of Matrices, Determinants and Differentiation
- Integration and Vector Algebra.

2G236111	ADVANCED ENGINEERING MATHEMATICS	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	3	2	1	1	1	3
CO 2	3	3	2	1	1	1	3
CO 3	3	3	2	1	1	1	3
CO 4	3	3	2	1	1	1	3
CO 5	3	3	2	1	1	1	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.

2G236111	**ADVANCED ENGINEERING MATHEMATICS**	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Theory Portion:		
UNIT I	**EIGEN VALUES AND EIGEN VECTORS**	Period
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.		9
UNIT II	**FUNCTIONS OF SEVERAL VARIABLES**	Period
Partial derivatives of two variable and three variable functions (upto second order) – Homogeneous functions and Euler's theorem (excluding proof)–Jacobian matrix and determinant – Maxima and minima of functions of two variables – Simple problems.		9
UNIT III	**VECTOR CALCULUS**	Period
Scalar filed and Vector field–Vector differential operator–Gradient of a scalar field Directional derivative–Divergence and curl of a vector field (excluding properties) Solenoid and irrational vector fields –Simple problems.		9
UNIT IV	**DIFFERENTIAL EQUATIONS**	Period
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.		9
UNIT V	**LAPLACE TRANSFORMS**	Period
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.		9
TOTAL PERIODS		**45**

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

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.

2G236111	ADVANCED ENGINEERING MATHEMATICS	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

- Demonstrate the applications of differential equations in solving engineering problems.
- Presentation/Seminars by students and conduct Quizzes.

Text and Reference Books:

1. John Bird,Higher Engineering Mathematics, 9th Edition, Routledge, 2021.
2. B.S. Grewal , Higher Engineering Mathematics, 42nd Edition, KhannaPublishers, 2012.
3. S.Arumugam, A.Thangapandi Isaac, & A.Somasundaram, Differential Equations andApplications, Yes Dee Publishing Pvt. Ltd., 2020.
4. P.Duraipandian, & Kayalal Pachaiyappa, Vector Analysis, S.Chand and Company Limited, 2014.
5. S.Narayanan, &T.K.Manicavachagom Pillai, Calculus Volume I and II ,S.ViswanathanPublishers Pvt. Ltd., 2007

Web-based/Online Resources:

- https://www.khanacademy.org/math/
- https://www.mathportal.org/
- https://openstax.org/subjects/math
- https://www.mathhelp.com/
- https://www.geogebra.org/
- https://www.desmos.com/
- https://phet.colorado.edu/

***

2G236112	ENTREPRENEURSHIP	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Introduction:

Development of a diploma curriculum is a dynamic process responsive to the society and reflecting the needs and aspiration 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 promoting concern for excellence. In this context the course on entrepreneurship and startups 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 ensure good means of living for every individual, provides jobs and develop Indian economy.

Course Objectives:

The objective of this course is to enable the student to

- Acquire entrepreneurial spirit and resource fulness.
- 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.

CourseOutcomes:

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

CO 1 : Understand the process of entrepreneurship.

CO 2 : Analyse the importance of generation of ideas and product selection.

CO 3 : Familiarization of various financial and nonfinancial schemes.

CO 4 : Acquire various cost components to arrive pricing of the product.

CO 5 : Learn the preparation of project feasibility report.

Pre-requisites:

- Knowledge of basic Engineering and Industrial engineering.

2G236112	ENTREPRENEURSHIP	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	-	-	-	-	3	1	3
CO 2	-	-	-	-	3	3	3
CO 3	-	-	-	1	-	3	2
CO 4	-	1	3	3	2	3	2
CO 5	-	2	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.

2G236112	ENTREPRENEURSHIP	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Theory Portion:		
UNIT I	**ENTREPRENEURSHIP–INTRODUCTION AND PROCESS**	Period
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, Mind set of an employee and an entrepreneur - Risk Taking –Concepts.		9
UNIT II	**BUSINESS IDEA**	Period
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.		9
UNIT III	**BANKING**	Period
Size and capital based classification of business enterprises –Role of financial institutions, Role of Government policy, Entrepreneurial support systems, Incentive schemes for state government, and Incentive schemes for Central governments.		9
UNIT IV	**PRICING AND COST ANALYSIS**	Period
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 and 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.		9
UNIT V	**BUSINESS PLAN PREPARATION**	Period
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,tagline,Promotionstrategy,BusinessPlanPreparation,-Conceptand Importance ,Execution of Business Plan.		9
	TOTAL PERIODS	**45**

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

2G236112	ENTREPRENEURSHIP	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

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 free lance services. This hands-on experience helps them understand various aspects of entrepreneurship

2G236112	ENTREPRENEURSHIP	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Text and Reference Books:

1. Dr.G.K.Varshney, Fundamentals of Entrepreneurship, Revised Edition, Sahitya Bhawan Publications, 2019.
2. H.Nandan, Fundamentals of Entrepreneurship, Prentice Hall India Learning Private Limited, Third Edition, 2013.
3. R.K.Singal, Entrepreneurship Development & amp; Management, SK Kataria and Sons, 2013.

Web-based/Online Resources:

- https://ocw.mit.edu/courses/15-390-new-enterprises-spring-2013/resources/lecture- 1/
- https://onlinecourses.nptel.ac.in/noc20_ge08/preview

***

2G236113	PROJECT MANAGEMENT	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Introduction:

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, 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.
- Understand the stages in Project Life Cycle.
- Appreciate the need for Project Portfolio Management System.
- Know the considerations in choosing an appropriate project management structure.
- Understand the components of techno-economic feasibility studies.
- Know about the detailed project report
- Learn about project constraints.
- Understand the techniques of evaluation.
- Get insight into the Social Cost Benefit Analysis Method.
- Know how to construct project networks using PERT and CPM.
- Learn how to crash project networks
- Understand the meaning of project appraisal.
- Understand the meaning of project audits.
- Know the qualities of an effective project manager.
- Understand the stages in Team Development model.

2G236113	PROJECT MANAGEMENT	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Course Outcomes:

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

CO 1 : Understand the Project Management Principles.

CO 2 : Learn to create and manage project schedules.

CO 3 : Create structure and manage the project commitments.

CO 4 : Gain enterprise support.

CO 5 : Prepare Detailed Project Report (DPR).

Pre-requisites:

- Knowledge of basic Engineering

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	-	-	-	-	3	1
CO 2	3	-	-	-	1	3	1
CO 3	3	-	-	1	1	3	1
CO 4	3	-	-	-	1	3	1
CO 5	3	-	-	1	1	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 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.

2G236113	PROJECT MANAGEMENT	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Theory Portion:		
UNIT I	**PROJECT MANAGEMENT–AN OVERVIEW, PROJECT PORTFOLIO MANAGEMENT SYSTEM AND STRUCTURE, STEPS IN DEFINING PROJECT AND PROJECT DELAYS**	Period
Project – Classification – Importance of Project Management – An Integrated Approach – Project Portfolio Management System – The Need – Choosing the appropriate Project Management Structure: Organizational considerations and project considerations – steps in defining the project – project Rollup – Process breakdownstructure–ResponsibilityMatrices–Externalcausesofdelayand internal constraints.		9
UNIT II	**VARIOUS STAGES AND COMPONENTS OF PROJECT FEASIBILITY STUDIES, PHASES OF A PROJECT, STAGES IN PROJECT LIFECYCLE ANDPROJECT CONSTRAINTS**	Period
Project feasibility studies - Opportunity studies, General opportunity studies, specific opportunity studies, pre-feasibility studies, functional studies or support studies, feasibility study – components of project feasibility studies – Managing Project resources flow–project planning to project completion: Pre-investment phase, Investment Phase and operational phase– Project Life Cycle– Project constraints.		9
UNIT III	**PROJECT EVALUATION UNDER CERTAINTY AND UNCERTAINTY, PROJECT EVALUATION, COMMERCIAL AND SOCIAL COST BENEFIT ANALYSIS**	Period
Project Evaluation under certainty - Net Present Value (Problems - Case Study), Benefit Cost Ratio ,Internal Rate of Return ,Urgency ,Payback Period ,ARR –Project Evaluation under uncertainty–Methodology for project evaluation–Commercial vs. National Profitability–Social Cost Benefit Analysis, Commercial or National Profitability ,social or national profitability.		9
UNIT IV	**DEVELOPING PROJECT NETWORK USING PERT AND CPM, PROJECT APPRAISAL AND CONTROL PROCESS.**	Period

2G236113	PROJECT MANAGEMENT	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Developing a Project Plan- Developing the Project Network– Constructing a Project Network (Problems)–PERT–CPM–Crashing of Project Network (Problems- Case Study) –Resource Leveling and Resource Allocation –how to avoid cost and time overruns– Steps in Project Appraisal Process–Project Control Process–Control Issues – Project Audits–the Project Audit Process–project closure–team, team Member and project manager evaluations.		9
UNIT V	**PROJECT MANAGING VERSUS LEADING OF PROJECT, QUALITIES OF PROJECT MANAGER AND MANAGING PROJECT TEAMS, TEAM BUILDING AND PERFORMANCE TEAMS AND TEAM PITFALLS.**	Period
Managing versus leading a project - managing project stakeholders - social network building (including management by wandering around) - qualities of an effective project manager - managing project teams - Five-Stage Team Development Model - situational factors affecting team development - project team pitfalls.		9
TOTAL PERIODS		**45**

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

Suggested List of Students Activity:

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, stakeholder).
- 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.

2G236113	PROJECT MANAGEMENT	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

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 and Reference Books:

1. Clifford F. Gray And Erik W. Larson, Project Management – The Managerial Process, Tata Mc graw Hill.
2. Dragan Z. Milosevic, Project Management Toolbox: Tools And Techniques For The Practicing Project Manager,
3. Gopalakrishnan, P/Ramamoorthy,VE, Textbook Of Project Management, Macmillan India. Ltd.
4. Harold Kerzner, Project Management :A Systems Approach To Planning, Scheduling , And Controlling, Eighth Edition, John Wiley & Sons
5. Jason Charvat, Project Management Methodologies: Selecting, Implementing, And Supporting Methodologies and Processes For Projects, John Wiley & Sons
6. Kevin Forsberg, Ph.D , Hal Mooz, Visualizing Project Management: A Model For Business And Technical Success, Second Edition, Pmp And Howard Cotterman, John Wiley & Sons

Web-based/Online Resources:

- https://youtu.be/pc9nvBsXsuM
- NPTEL Courses

  https://youtu.be/PqQqTAu_FiM

0

2G236114	FINANCE FUNDAMENTALS	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Introduction:

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, and 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 the 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:

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

- CO 1: Manage financial resources effectively to achieve personal goals.
- CO 2: Ensure that the business has enough money to meet its obligations and that it can recover in the future.
- CO 3: Exhibit financial literacy through the usage of different terminologies appropriate to the context.
- CO 4: Differentiate different types of budgeting and allocate the resources.
- CO 5: Apply the idea of marginal costing in decision-making.

Pre-requisites: Knowledge of basic industries.

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	1	-	2
CO2	3	-	-	-	1	-	2
CO3	3	-	-	-	1	-	2
CO4	3	-	-	-	1	-	2
CO5	2	-	-	-	1	-	2

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

2G236114	FINANCE FUNDAMENTALS	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

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.

Theory Portion:		
UNIT I	**PERSONAL FINANCE**	Period
Personal Finance– Meaning, Objectives and advantages– Individual Perspective–Family Perspective –Time Value of Money –Personal Savings: Meaning, Different modes of Saving–Bank Deposit, Online Investments, Insurance, Stocks, Gold, Real Estate–Returns Vs Risk–Financial Discipline–Setting Alerts for commitments (With Real time Examples).		9
UNIT II	**BUSINESS FUNDING**	Period
Sources : Personal Savings–Borrowings–Venture Capital–Venture Capital Process – Commercial Banks – Government Grants and Scheme.		9
UNIT III	**FINANCE LANGUAGE**	Period
Capital–Drawing –Income–Expenditure –Revenue Vs Capital Items –Assets–FixedAssets–Current Assets–Fictitious Assets–Liabilities–Long-term Liabilities –Current Liabilities–Internal Liabilities–External Liabilities–Shareholders fund: Equity Share capital - ,Preference Share Capital, Reserve & Surplus – Borrowings: Debentures, Bank Loan, OtherLoan– Depreciation–Reserve Vs Provision.		9
UNIT IV	**BUDGETING**	Period

2G236114	FINANCE FUNDAMENTALS	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Budgetary Control – Meaning – Preparation of various budgets – Purchase budget – Sales budget – Production budget – Cash budget – Flexible budgets.		9
UNIT V	**MARGINAL COSTING**	Period
Marginal Costing – Meaning – Marginal Costing vs Absorption Costing – Concepts of Variable Cost, Fixed Cost, and Contribution – PV Ratio – Break-Even Point – Margin of Safety – Key Factor – Application of Marginal Costing in decision making – Make or Buy – Shutdown or Continue – Exploring New Markets (with problems).		9
TOTAL PERIODS		**45**

Note: *Common Test and Revision periods can be used for conducting ContinuousAssessment.*

Suggested List of Student Activities:

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.s

Reference Books:

1. Dr. L. Natarajan, *Banking Theory, Law & Practice*, First Edition, Margham Publications, 2019.
2. T. S. Reddy and Dr. A. Murthy, *Corporate Accounting*, Margham Publications.
3. T. S. Reddy & Dr. Y. Hariprasad Reddy, *Management Accounting*, Margham Publications.
4. T. S. Reddy and Y. Hariprasad Reddy, *Cost Accounting*, Margham Publications

***

2G236115	INDUSTRIAL MANAGEMENT AND SAFETY	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Introduction:

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, aimed at protecting its employees and assets by minimizing hazards, risks, accidents, and near misses. The relevant laws, compliance, and best practices in the industry address most issues for optimal protection. Employers must ensure strict adherence to these regulations for maximum safety.

Course Objectives:

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

- Ensure protection of workers' rights and address their grievances.
- Prevent major industrial accidents.
- Prevent accidents causing permanent or partial disablement.

Course Outcomes:

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

CO 1	:	Explain the objectives and precautions of electrical safety, the effects of shocks, and their prevention..
CO 2	:	Summarize the safety aspects during the installation of plant and equipment.
CO 3	:	Describe the electrical safety in residential, commercial, and agricultural installations.
CO 4	:	Describe the various electrical safety measures in hazardous areas, equipment earthing, and system neutral earthing.
CO 5	:	State the electrical systems safety management and IE rules.

Pre-requisites:

- Knowledge of basic Industries and Safety systems.

2G236115	INDUSTRIAL MANAGEMENT AND SAFETY	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	-	1	-	-	2
CO 2	3	2	1	1	-	-	2
CO 3	3	2	1	1	-	-	2
CO 4	3	2	-	1	-	-	2
CO 5	2	2	-	2	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..

2G236115	INDUSTRIAL MANAGEMENT AND SAFETY	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Theory Portion:		
UNIT I	**ELECTRICAL SAFETY, SHOCKS AND THEIR PREVENTION**	Period
Terms and definitions - Objectives of safety and security measures - Hazards associated with electric current and voltage - Principles of electrical safety - Approaches to prevent Accidents - Scope of subject electrical safety. Primary and secondary electrical shocks - possibilities of getting electrical shock and its severity – medical analysis of electric shocks and its effects- shocks due to flash/ Spark over's - prevention of shocks - safety precautions against contact shocks, flash shocks, burns, residential buildings and shops.		9
UNIT II	**SAFETY DURING INSTALLATION OF PLANT AND EQUIPMENT**	Period
Introduction- preliminary preparations- preconditions for start of installation work- risks during installation of electrical plant and equipment - safety aspects during installation – field quality and safety during erection – personal protective equipment for erection personnel - installation of a large oil immersed power transformer – installation of outdoor switchyard equipment –safety duringi nstallation of electrical rotating machines - drying out and insulation resistance measurement of rotating machines.		9
UNIT III	**ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL AND AGRICULTURAL**	Period
Wiring and fitting – Domestic appliances – Water tap giving shock – Shock from wet wall – Fan causing shock – Multi-storied building – Temporary installations – Agricultural pump installation – Do's and Don'ts for safety in the use of domestic electrical appliances.		9
UNIT IV	**EQUIPMENT EARTHING AND SYSTEM NEUTRAL EARTHING**	Period

2G236115	INDUSTRIAL MANAGEMENT AND SAFETY	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Introduction - Distinction between system grounding and Equipment Grounding – Equipment Earthing – Functional Requirement of earthing system- description of a earthing system. Neutral grounding (System Grounding)- Types of Grounding, Methods of Earthing Generators Neutrals.		9
UNIT V	**SAFETY MANAGEMENT OF ELECTRICAL SYSTEMS & IE RULES AND ACTS**	Period
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)		9
TOTAL PERIODS		**45**

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

Suggested List of Student Activities:

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

Text and Reference Books:

1. Prof. S. Rao, H. L. Saluja, *Electrical Safety, Fire Safety Engineering and Safety Management*, Khanna Publishers, 1997.
2. Pradeep Chaturvedi, *Energy Management: Policy, Planning and Utilization*, Concept Publishing Company, 1997.

***

2G236116	BATTERY MANAGEMENT SYSTEM	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Introduction:

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 a 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 systems.
- Study about battery characteristics and parameters.
- Model the types of batteries.
- Know the concepts of battery management system and design the battery.
- Study about battery testing, disposal, and recycling.

Course Outcomes:

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

CO 1 : Discuss about the different types of energy storages ystem.
CO 2 : Describe about the battery characteristics & parameters.
CO 3 : Model different types of batteries.
CO 4 : Apply the concepts of battery management system and design the battery pack.
CO 5 : Explain about the battery testing, disposal and recycling.

Pre-requisites:

- Basics of Science
- Basics of Batteries

2G236116	**BATTERY MANAGEMENT SYSTEM**	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	-	1	-	-	2
CO2	3	2	1	1	-	-	2
CO3	3	2	1	1	-	-	2
CO4	3	2	-	1	-	-	2
CO5	2	2	-	2	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.

2G236116	BATTERY MANAGEMENT SYSTEM	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Theory Portion:		
UNIT I	**INTRODUCTION TO BATTERY MANAGEMENT SYSTEM**	Period
Definition of Battery Management System – Block Diagram of Battery Management System – Battery Management System parts – Why a BMS is required in any Energy Storage System – PLC-based BMS – Safety Management: Overcurrent protection – Overcharge and over-discharge protection – Overtemperature protection – Topological relationship between a Battery Monitoring Circuit (BMC) and a cell – Topological relationship between a Battery Monitoring Circuit (BMC) and a Battery Control Unit (BCU) – The benefits of battery management systems.		9
UNIT II	**ENERGY STORAGE SYSTEM**	Period
Batteries: Lead Acid Battery, Nickel-based batteries, Sodium-based batteries, Lithium-based batteries – Li-ion & Li-poly, Metal Air Battery, Zinc Chloride Battery – Ultra capacitors – Flywheel Energy Storage System – Hydraulic Energy Storage System – Comparison of different Energy Storage Systems.		9
UNIT III	**BATTERY PARAMETERS & CHARGING**	Period
General Definitions: Cell and Battery – Energy Density – Power Density – Rated Capacity – Specific Energy – Specific Power – Efficiency of batteries – State of Charge (SOC) – C-rate – State of Health (SOH) – Cycle Life – Cut-off Voltage – Self-Discharge – Nominal Voltage. Charging Modes: Low-rate charging – Quick charging – Fast charging – Top-off or equalization charging – Trickle or maintenance charging – Reflex or 'burp' charging. End-of-Charge Triggers: Timed end-of-charge trigger – Maximum temperature end-of-charge trigger – Maximum voltage end-of-charge trigger.		9
UNIT IV	**EV BATTERY EFFICIENCY**	Period
Factors affecting battery efficiency – Regenerative Braking – Variation of battery cell voltage during early formation cycles – Battery failure modes due to operating conditions – Failure modes associated with excessive battery charging – Failure modes associated with inadequate battery charging – Failure modes associated with battery storage conditions – Self-discharge of NiMH battery stored at 100% SOC – Traction Battery Pack Design – General approach of Battery modelling		9

2G236116	BATTERY MANAGEMENT SYSTEM	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

UNIT V	BATTERY TESTING, DISPOSAL & RECYCLING	Period
Battery Testing: Constant current discharge test – Peak Power Test – Constant PowerTest – Variable Power Discharge Test – Partial Discharge Test – Stand loss Test – Thermal Performance Test – Battery Vibration Test – Fast Charge Test. **Limitations forTransport and Storage of Cells and Batteries:** Battery Leakage: Gas generation in batteries, leakage path, leakage rates – Explosions: Causes of battery explosions, explosive process – Thermal Runaway: Highdischarge rates, short circuits, charging and discharging – Environment and Human Health impact assessments of batteries – General recycling issues and drivers – Methods of recycling of EV batteries.		9
TOTAL PERIODS		**45**

Note:*CommonTestandRevisionperiodscanbeusedforconductingContinuous Assessment.*

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodicclassquizzesconductedonaweekly/fortnightlybasedonthecourse.
- Miniprojectthatshallbeanextensionofanypracticallabexercisetoreal-world application

Text and Reference Books:

1. Ibrahim Dinçer,HalilS .Hamutand NaderJavani,ThermalManagementofElectricVehicle Battery Systems, First Edition, John Wiley& Sons Ltd., 2016.
2. H.J. Bergveld, Wanda S. Kruijt and Peter P.H.L. Notten,Battery Management Systems Design by Modelling, Springer Science Business Media, 2001.
3. SandeepDhameja,ElectricVehiclebatterysystems, Newnes,2001.
4. JamesLarminie,JohnLowry,“ElectricVehicleTechnologyExplained”,JohnWiley&Sons Ltd, 2003.

Web-based/ Online Resources:

- https://mnre.gov.in/energy-storage-systemsess-overview/

***

2G236117	INDUSTRIAL AUTOMATION	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Introduction:

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 cancollect 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 flowl ines 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

CO 1	:	Understand the basics of automation and analyze the cost-effective of automated system.
CO 2	:	Identify the suitable flow lines and understand the computer simulation for the automation of given application..
CO 3	:	Describe material handling and relevant technologies for the automation.
CO 4	:	Differentiate various control aspects of automation.
CO 5	:	Demonstrate the automation for assembly line and testing of manufacturing industry.

Pre-requisites: Basic Electrical and Electronics Engineering.

2G236117	INDUSTRIAL AUTOMATION	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

CO/POMapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	2	2	-	1	1
CO 2	3	2	2	2	-	1	1
CO 3	3	2	2	2	-	1	1
CO 4	3	2	2	2	-	1	1
CO 5	3	2	2	2	-	1	1

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

Instructional Strategy:

- Engage and Motivate: Instructors should actively engage students to boost their learningconfidence.

  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 out

2G236117	INDUSTRIAL AUTOMATION	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

comes and analyze potential sources of error in case of discrepancies.

Theory Portion:		
UNIT I	**INTRODUCTION TO AUTOMATION**	Period
Automation in Production System - Principles and Strategies of Automation - Basic Elements of an Automated System - Advanced Automation Functions - Levels of Automations - Production Economics: Methods of Evaluating Investment Alternatives - Costs in Manufacturing - Break Even Analysis - Unit cost of production - Cost of Manufacturing Lead time and Work-in-process.		7
UNIT II	**DETROIT-TYPE AUTOMATION**	
Automated Flow lines - Methods of Work part Transport - Transfer Mechanism - Buffer Storage - Control Functions and Automation for Machining Operations - Design and Fabrication Considerations - Analysis of Automated Flow Lines: General Terminology and Analysis - Analysis of Transfer Lines Without Storage - Partial Automation - Computer Simulation of Automated Flow Lines.		12
UNIT III	**MATERIAL HANDLING AND IDENTIFICATION TECHNOLOGIES**	
Thematerialhandlingfunction-TypesofMaterialHandlingEquipment-Analysisfor MaterialHandlingSystems-DesignoftheSystem-ConveyorSystems-Automated Guided Vehicle Systems - Automated Storage Systems: Storage System Performance-Automated Storage /Retrieval Systems-Work-in-process Storage-InterfacingHandlingandStoragewithManufacturing-Productidentification system: Barcode, RFID.		12
UNIT IV	**CONTROL TECHNOLOGIES IN AUTOMATION**	
The material handling function - Types of Material Handling Equipment - Analysis for Material Handling Systems - Design of the System - Conveyor Systems - Automated Guided Vehicle Systems - Automated Storage Systems: Storage System Performance - Automated Storage/Retrieval Systems - Work-in-process Storage - Interfacing Handling and Storage with Manufacturing - Product identification system: Barcode, RFID.		7
UNIT V	**AUTOMATED ASSEMBLY AND TESTING**	

2G236117	INDUSTRIAL AUTOMATION	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Design for Automated Assembly - Types of Automated Assembly Systems - Part Feeding Devices - Analysis of Multi-station Assembly Machines - Analysis of a Single Station Assembly Machine. Inspection and testing - Statistical Quality Control - Automated Inspection Principles and Methods - Sensor Technologies for Automated Inspection - Coordinate Measuring Machines - Other Contact Inspection Methods - Machine Vision – Other optical Inspection Methods.	7
TOTAL PERIODS	**45**

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

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 basis on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

Text and Reference Books:

1. Krishna Kant, *Computer Based Industrial Control*, Second Edition, PHI Learning Pvt Ltd., 2010.
2. Tiess Chiu Chang & Richard A. Wysk, *An Introduction to Automated Process Planning Systems*, Prentice-Hall, 2008.
3. Viswanandham N & Narahari Y, *Performance Modeling of Automated Manufacturing Systems*, First Edition, PHI Learning Pvt Ltd., 2009.

Web-based/Online Resources:

- NPTEL Resource

2G236231	HVAC (R & AC)	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Introduction:

To impart knowledge about HVAC systems, 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 compressors and capacity calculation of cooling coils 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 a sealed compressor.
- Determine the heat transfer of an air-cooled condenser.
- Determine the capacity of a cooling tower.
- Determine the capacity of a sealed system by capillary tube and thermostatic expansion device.
- Determine the heat transfer of an evaporator.
- Set and adjust the low-pressure cutout in a VCR system.
- Draw the wiring diagram of RSIR and CSIR starting circuits.

Course Outcomes:

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

CO 1	:	Check the CSR terminals and test the pumping capacity of sealed compressor.
CO 2	:	Determine the heat transfer of air-cooled condenser for window and split air conditioner.
CO 3	:	Determine the capacity of cooling tower and capacity of sealed system by expansion devices.
CO 4	:	Determine the heat transfer of evaporator for window and split air conditioner.
CO 5	:	Set and Adjust the low-pressure cutout in VCR system and draw the wiring diagram of RSIR and CSIR starting circuit.

Pre-requisites: Basics of Science and Engineering.

2G236231	HVAC (R & AC)	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

CO/POMapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	1	2	1	3	1	1	2
CO 2	3	2	2	2	1	1	2
CO 3	1	2	1	3	1	1	2
CO 4	3	2	2	3	1	1	2
CO 5	3	2	2	3	1	1	2

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

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/Hands-on practices are under a simulated environment (maybe followed by a real environment as far as possible).

2G236231	HVAC (R & AC)	L	T	P	C	END EXAM
THEORY		3	0	0	3	THEORY

Theory Portion:		
UNIT I	**COMPRESSOR**	Period
Compressor – Introduction - functions of a compressor – Classification - open type reciprocating compressor – Compression ratio, Clearance volume, Volumetric Efficiency - Definition only. Construction & working of single-acting and single-stage reciprocating compressor. Hermetically sealed compressors – construction and working - Differences between open type and hermetically sealed type compressor - variable frequency driven motor.		6
UNIT II	**CONDENSER**	Period
Condenser - Introduction – Functions – Classification of condensers – Air-cooled condenser, Water-cooled condenser - Working of air-cooled condensers - Types of air-cooled condenser – Natural convection air-cooled condenser - forced convection air-cooled condenser – Base-mounted air-cooled condenser and Remote air-cooled.		6
UNIT III	**EXPANSION DEVICE AND COOLING TOWER**	Period
Expansion devices- Introduction – Functions – Types of expansion devices – Capillary tube, Automatic expansion valve, Thermostatic expansion valve – Construction and working only. Cooling tower - Functions of a cooling tower – Types of cooling towers – Natural draft cooling towers – Construction and working of Atmospheric natural draft (spray type) cooling tower - Mechanical draft cooling tower – Construction and working of forced draft cooling tower - Definition of cooling tower range, approach, and efficiency.		6
UNIT IV	**EVAPORATOR**	Period
Evaporator - Introduction – Functions - Types of evaporators – Bare tube coil evaporators - Finned evaporators - Plate evaporators - Shell and tube evaporators - Shell and coil evaporators - Natural convection evaporators - forced convection evaporators – Construction and working only.		6
UNIT V	**HVAC CONTROLS AND WIRING CIRCUIT**	Period
Motor Operating Components: Selector switch – OLP – Relay – Capacitor – Starting, Running. System Controls: LP, HP cutout – Humidity control – Thermostat switch – Solenoid valve – CSIR and RSIR wiring circuit.		6

Practical Exercises:		
Ex.No	Name of the Experiment	Period
1.	Determination of CSR terminal of a refrigeration compressor.	3

2.	Testing the pumping capacity of sealed compressor.	3
3.	Determination of heat transfer of air cooled condenser for window air conditioner.	3
4.	Determination of heat transfer of air cooled condenser for split air conditioner.	3
5.	Determination of range, approach and efficiency of cooling tower.	3
6.	Determination of COP for sealed system by using capillary and Thermostatic expansion device.	3
7.	Determination of heat transfer of evaporator for window air conditioner.	3
8.	Determination of heat transfer of evaporator for split air conditioner.	3
9.	Setting and Adjusting of low pressure cutout in VCR system.	3
10.	Wiring, Starting and Running of air conditioner with RSIR starting circuit And CSIR circuit.	3
TOTAL PERIODS		**60**

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

Suggested List of Students Activity:

- Prepare/Download a specification of the following: Various tools, Equipment and controls used in HVAC systems.
- Presentation/Seminars by students on any recent technological developments based on the course.

Text and Reference Books:

1. Arora and Domkundwar, *A Course in Refrigeration and Air-conditioning*, Dhanpat Rai & Sons Publication, 2018.
2. R. S. Khurmi and J. K. Gupta, *Textbook of Refrigeration and Air-conditioning*, Fifth Edition, S. Chand & Co., 2020.
3. C. P. Arora, *Refrigeration and Air-conditioning*, Third Edition, McGraw Hill, 2017.

Equipment/Facilities required to conduct the Practical Course.

(Batch Strength: 30 Students)

S.No	Name of the Equipment’s	Quantity Required
1.	VCR experimental setup with LP Cutout, Capillary tube and TEV	1No
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

***

2G236232	PCB DESIGN AND ASSEMBLY	L	T	P	C	END EXAM
PRACTICUM		2	0	2	3	THEORY

Introduction:

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:

CO 1	:	Identify different types of Printed Circuit Boards (PCB) and Explain the differences between.
CO 2	:	Select the right components for a given analog circuit, draw the schematic and Generate netlist.
CO 3	:	Draw the PCB layout for an analog circuit and verify using design rule check. Generate gerber file,BOM.
CO 4	:	List out the steps involved in PCB assembly process.
CO 5	:	Fabricate a simple analog circuit manually.

2G236232	PCB DESIGN AND ASSEMBLY	L	T	P	C	END EXAM
PRACTICUM		2	0	2	3	THEORY

Pre-requisites: Knowledge of working of electronic components and devices.

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	1	1	3	1	1	1
CO 2	3	3	3	3	1	1	1
CO 3	3	1	1	3	1	1	1
CO 4	3	2	2	3	1	1	1
CO 5	3	2	2	1	1	1	1

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.

2G236232	PCB DESIGN AND ASSEMBLY	L	T	P	C	END EXAM
PRACTICUM		2	0	2	3	THEORY

Theory Portion:		
UNIT I	**INTRODUCTION TO PCB DESIGN**	Period
Basics of electronic components and circuits - Introduction to PCB design - Types - Single layer - Double layer – Multilayer – Applications - Overview of PCB design process - Electronic Components and Footprints - Understanding component data sheets - Introduction to PCB design software (e.g., KiCAD or any open-source EDA Software).		6
UNIT II	**INTRODUCTION TO SCHEMATIC DESIGN**	Period
Introduction to schematic design - Drawing circuit schematics using EDA (Electronic Design Automation) tools - Net-list generation and connectivity verification - Understanding PCB layer stack-up - Board materials - Materials used for multilayer PCBs - PCB thickness - Units - Aspect ratio - Importance of grounding in PCBs - Impedance matching - Reflection - Ground Bounce - SSN.		6
UNIT III	**PCB DESIGN**	Period
PCB layout and routing using software tools – Vias - Solder Mask - Silk Screen Jumper -Design rule check - Troubleshooting and debugging common issues – Creation of accurate and comprehensive design documentation- Gerber file- Bill of Materials.		6
UNIT IV	**PCB ASSEMBLY**	Period
Flowchart for PCB assembly process - Steps involved in fabrication of single-sided PCB, double-sided PCB & multilayer PCB - Testing of PCB - Importance of RoHS (Restriction of use of Hazardous Substances) - Waste management of hazardous materials in PCB - Environment Management Standards (EMS) - RF PCB.		6
UNIT V	**MANUAL PCB FABRICATION**	Period
Schematic Diagram- PCB Layout –Transfer to copper clad board–Etching–Drilling -Component placement–Testing–Finishing.		6

Practical Exercises:		
Ex.No	Name of the Experiment	Period
1.	Familiarization of any Electronic design automation(EDA) software and Solder an analog circuit (Halfwave rectifier)in a PCB with plated hole.	4
2.	Create a schematic, generate netlist and simulate an RC coupled amplifier.	4
3.	Create a schematic, generate netlist and simulate a High pass filter.	4

4.	Place the components of RC coupled amplifier and route the connections between the components manually and verify using design rule check.	4
5.	Place the components of RC coupled amplifier and route the connections between the components using autorouting option.	4
6.	Design a PCB layout for Astable Multivibrator circuit and verify using design rule check.	4
7.	Design a PCB layout for regulated power supply, verify using design rule check and generate Gerber file, BOM.	3
8.	Create symbols and footprint for 1N4007 diode and IC741.	3
	Required Practical Instructions for Cycle I & II Experiments	.
	TOTAL PERIODS	**60**

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

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 basis on the course.
- Viva Voce will be conducted before conducting an experiment.

Text and Reference Books:

1. R S Khandpur, *Printed Circuit Boards: Design – Fabrication*, Hardcover, McGraw Hill Education, 2017.
2. Clyde F. Coombs, Happy T. Holden, *Printed Circuits Handbook*, Seventh Edition, McGraw Hill, 2016.
3. Er. S.D. Mehta, *Electronic Product Design Volume-I: Basics of PCB Design*, S Chand & Company, 2011.

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

S.No	Name of the Equipments	Quantity Required
1.	Desktop Computer	15Nos
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

***

2G236233	ELECTRONICS PRODUCT DESIGN	L	T	P	C	END EXAM
PRACTICUM		2	0	2	3	THEORY

Introduction:

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 deign 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 generators.
- Study about electronic automation design.
- Study semiconductor packaging and electronic board design.

Course Outcomes:

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

CO 1 : Explain the overview of electronic system design.

CO 2 : Design principle of power sources.

CO 3 : Design of amplifiers and function generators.

CO 4 : Describe the function of electronic automation design.

CO 5 : Analyze the semiconductor package and electronic board design.

2G236233	ELECTRONICS PRODUCT DESIGN	L	T	P	C	END EXAM
PRACTICUM		2	0	2	3	THEORY

Pre-requisites:

- Fundamental knowledge on electronic devices and circuits.

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	3	3	2	1	1	1
CO 2	3	3	3	2	1	1	1
CO 3	3	3	3	2	1	1	1
CO 4	3	3	3	2	1	1	1
CO 5	3	3	3	2	1		1

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/Hands-on practices may be followed in the real environment as far as possible.

2G236233	ELECTRONICS PRODUCT DESIGN	L	T	P	C	END EXAM
PRACTICUM		2	0	2	3	THEORY

Theory Portion:		
UNIT I	**OVERVIEW OF ELECTRONIC PRODUCT DESIGN**	Period
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.		6
UNIT II	**DESIGN OF POWER SOURCES**	Period
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 (230 VAC/Battery) - Design of power scheduler.		6
UNIT III	**AMPLIFIERS AND FUNCTION GENERATORS**	Period
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		6
UNIT IV	**ELECTRONICAUTOMATIONDESIGN**	Period
Circuit for Relay and motor control applications – SCADA architecture and applications – DCS architecture and applications – Block Diagram of Analog Data Acquisition System – Introduction to Transducer and types - Design of Electronic voltmeter, ammeter – and Multimeter.		6
UNITV	**SEMICONDUCTORPACKAGESANDELECTRONICBOARDDESIGN**	Period
Semiconductor Packages: Single chip packages or modules - SCMCommon 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.		6
Practical Exercises:		
Ex.No	Name of the Experiment	Period
1.	Design of Voltage to Current converter system.	
2.	Design of DC Power Supply Unit for 230V/12V, 1 Amps.	
3.	Design of Amplifier Circuit.	

2G236233	ELECTRONICS PRODUCT DESIGN	L	T	P	C	END EXAM
PRACTICUM		2	0	2	3	THEORY

4.	Design of AM Modulator and De-modulator.	
5.	Design of Electronic Ammeter.	
6.	Design of Electronic Voltmeter.	
7.	Design of Instrumentation Amplifier.	
8.	Design PCB for simple streetlight control circuit using LDR.	
TOTAL PERIODS		**60**

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

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 basis 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.

Text and Reference Books:

1. John F. Wakerly, *Digital Design: Principles & Practices*, Third Edition, Prentice Hall International, 1999.
2. Walter C. Bosshart, *Printed Circuit Boards - Design & Technology*, First Edition; Tata McGraw Hill.
3. Kim R. Fowler, *Electronic Instrument Design: Architecting for the Life Cycle*, Latest Edition; Oxford University Press.
4. A.E. Ward and J.A.S. Angus, *Electronic Product Design*, Stanley Thornes (Publishers) Ltd., 1999.

Web-based/Online Resources:

- Electronic Product Design and Development
- What is Electronic Product Design?
- How to Develop and Prototype a New Product

Equipment/Facilities required conducting the Practical Course (Batch Strength: 30 Students)

2G236233	ELECTRONICS PRODUCT DESIGN	L	T	P	C	END EXAM
PRACTICUM		2	0	2	3	THEORY

S.No	**Name of the Equipment**	**Quantity Required**
1.	Desktop Computer	15Nos
2.	Printer	1 No
3.	Soldering Iron, Multimeter& OtherTools	6 Nos
4.	PCB & PCB Drilling Machine	6 Nos
5.	Discrete Electronic Components	As Required

***

2G236234	RENEWABLE ENERGY SYSTEMS	L	T	P	C	END EXAM
PRACTICUM		2	0	2	3	THEORY

Introduction:

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. Renewables 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 photovoltaics 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:

CO 1	:	Illustrate the Indian and global energy scenario.
CO 2	:	Compare various solar energy technologies and identify their applications.
CO 3	:	Infer wind data and compare various wind energy systems.
CO 4	:	Examine various bio-energy technologies and identify their applications.
CO 5	:	Interpret ocean and geothermal energy conversion technologies.

Pre-requisites:

- Basics of Science and Engineering.

<table>
<tr><td>2G236234</td><td rowspan="2">RENEWABLE ENERGY SYSTEMS</td><td>L</td><td>T</td><td>P</td><td>C</td><td>END EXAM</td></tr>
<tr><td>PRACTICUM</td><td>2</td><td>0</td><td>2</td><td>3</td><td>THEORY</td></tr>
</table>

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	1	-	1	1	3	2	2
CO 2	3	-	2	3	3	2	2
CO 3	3	-	2	2	3	2	2
CO 4	3	-	2	2	3	2	3
CO 5	2	-	2	1	3	2	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.

2G236234	RENEWABLE ENERGY SYSTEMS	L	T	P	C	END EXAM
PRACTICUM		2	0	2	3	THEORY

Theory Portion:		
UNIT I	**ENERGY SCENARIO**	Period
Indian energy scenario in various sectors – domestic, industrial, commercial, agriculture, transportation and others – Present conventional energy status – Present renewable energy status – Potential of various renewable energy sources – Global energy status – Per capita energy consumption – Future energy plans.		6
UNIT II	**SOLAR ENERGY**	Period
Solar radiation – Measurements of solar radiation and sunshine – Solar spectrum – Solar thermal collectors – Flat plate and concentrating collectors – Solar thermal applications – Solar thermal energy storage – Fundamentals of solar photovoltaic conversion – Solar cells – Solar PV Systems – Solar PV applications.		6
UNIT III	**WIND ENERGY**	Period
Wind data and energy estimation – Betz limit – Site selection for wind farms – characteristics – Wind resource assessment – Horizontal axis wind turbine – components–Vertical axis wind turbine –Wind turbine generators and its performance–Hybrid systems–Environmental issues-Applications.		6
UNIT IV	**BIO-ENERGY**	Period
Bio resources – Biomass direct combustion – thermochemical conversion – biochemical conversion-mechanical conversion – Biomass gasifier – Types of biomass gasifiers–Cogeneration–Carbonization–Pyrolysis–Biogas plants–Digesters–Biodiesel production–Ethanol production–Applications.		6
UNIT V	**OCEAN AND GEOTHERMAL ENERGY**	Period
Small hydro–Tidal energy–Wave energy–Open and closed OTEC Cycles–Limitations–Geothermal energy–Geothermal energy sources–Types of geothermal power plants – Applications - Environmental impact.		6
Practical Exercises:		
Ex.No	Name of the Experiment	Period

2G236234	RENEWABLE ENERGY SYSTEMS	L	T	P	C	END EXAM
PRACTICUM		2	0	2	3	THEORY

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

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 basis on the course.

Text and Reference Books:

1. Godfrey Boyle, *Renewable Energy, Power for a Sustainable Future*, Oxford University Press, U.K., 2012.
2. M. Buchla David, *Renewable Energy Systems*, Pearson Education Publication, 2017.
3. S. P. Sukhatme, *Solar Energy: Principles of Thermal Collection and Storage*, Tata McGraw Hill Publishing Company Ltd., 2009.
4. G. N. Tiwari, *Solar Energy – Fundamentals, Design, Modelling and Applications*, Alpha Science Intl Ltd, 2015.

Web-based/Online Resources:

- Energy.gov: Renewable Energy
- EDF Energy: Renewable Energy Sources
- NRDC: Renewable Energy Facts

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

S.No	Name of the Equipment	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	1NoEach
8.	Rechargeable Battery	2 Nos
9.	Digital Multimeter	6 Nos
10.	Lamp Load	1 No

2G236235	ENERGY CONSERVATION AND AUDITING	L	T	P	C	END EXAM
PRACTICUM		2	0	2	3	THEORY

Introduction:

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 bench marking 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

CO 1	:	Explain the basic principle of Energy Management and Conservation.
CO 2	:	Select Energy Efficient gadgets for domestic, commercial and industrial Applications.
CO 3	:	Estimate the energy performance of Electrical Equipment.
CO 4	:	Get familiar about the energy conservation practice.
CO 5	:	Practice simple experiment using Soft Starter.

Pre-requisites:

- Basics of Electrical and Electronics Engineering,

2G236235	ENERGY CONSERVATION AND AUDITING	L	T	P	C	END EXAM
PRACTICUM		2	0	2	3	THEORY

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	2	1	1	1	1
CO 2	3	1	2	1	1	1	1
CO 3	3	2	3	1	1	1	1
CO 4	3	2	3	1	1	1	1
CO 5	3	1	2	1	1	1	1

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 rein force learning.
- Encourage group discussions to promote peer learning, idea sharing, and problem-solving.

Theory Portion:		
UNIT I	**ENERGY MANAGEMENT AND AUDIT**	Period
Need of Energy Audit-Types of energy audit, Energy audit approach-understanding energy costs-Bench marking,Energy performance –Matching energy use to requirement - Maximizing system efficiencies - optimizing the input energy requirements-Fuel and energy substitution - Energy Audit instruments.		6
UNI T II	**ELECTRICAL SYSTEM**	Period

2G236235	ENERGY CONSERVATION AND AUDITING	L	T	P	C	END EXAM
PRACTICUM		2	0	2	3	THEORY

Electricity billing – Electrical load management and maximum demand control- Power factor improvement and its benefits -Selection and location of capacitors – Performance assessment of PF capacitors - Distribution and transformer losses.		6
UNIT III	**ELECTRIC MOTORS**	Period
Losses in induction motors-Motor efficiency -Factors affecting motor performance - Rewinding and motor replacement issues - Energy saving opportunities with energy efficient motors.		6
UNIT IV	**LIGHTING**	Period
Lighting–Light Source, Choice of lighting, Luminance requirements and energy conservation avenues. DGSet System–Factors affecting election, Energy performance assessment of Diesel conservation avenues.		6
UNIT V	**ENERGY EFFICIENT TECHNOLOGIES IN ELECTRICAL SYSTEMS**	Period
Maximum demand controllers-Automatic power factor controllers-Energy efficient motors - Soft starters with energy saver - Variable speed drives - Energy efficient transformers-Electronic Ballast-Occupancy sensors-Energy efficient lighting controls.		6

Practical Exercises:		
Ex.No	Name of the Experiment	Period
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 over flow of Over head tank.	

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 rating tube light.	
5.	Construct lighting circuit for a room with Occupancy sensor.	
6.	Measure the Current, Power and Energy consumption of Modern BLDC Ceiling Fan.	
7.	Connect Soft starter with suitable rating Induction Motor and Observe its operation during starting and running. Also measure the current and Power consumption.	30
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.	
	TOTAL PERIODS	**60**

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

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.
- Practical case studies of energy conservation and Illumination system.
- Power requirement for different domestic appliances.

Text and Reference Books:

1. Book I-General aspect of energy management and energy audit, Second Edition2005, ByBureau of Energy Efficiency, Ministry of Power, India.
2. Book III - Energy efficiency in electrical utilities, Second Edition 2005, By Bureau of Energy Efficiency, Ministry of Power, India.
3. Mehmet Kanoglu, Yunus A Cengel, Energy Efficiency and Management for Engineers,First Edition, McGraw-Hill Education, 2020.
4. Moncef Krati, Energy Audit of Building Systems:An Engineering Approach, ThirdEdition, CRC Press, Dec.2020
5. Sonal Desai,Hand book of Energy Audit ,Mc Graw Hill Education (India) Private Limited,

2017.

Web-based/Online Resources:

- Energy Conservation Act-2001 https://youtu.be/QRT5mYp7B_g?si=yfV2VCccL8Ku5O- N
- Basics of Energy Conservation https://youtu.be/RPjcgmR4USg?si=ln5wolfr4eclRaDY

Equipment/Facilities required to conduct the Practical Course.

(Batch Strength: 30 Students)

S.No	Name of the Equipment's	Quantity Required
1.	LED Lamp, Incandescent Lamp, Digital Power Monitor	Each2Nos
2.	Pump Motor with Sensor arrangement	1 No
3.	Arduino Shield, LDR, Relay and Lamp	Each1No
4.	Copper Choke and Electronic Choke	Each3Nos
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

***

2G236236	ELECTRICAL DRIVES AND CONTROLS	L	T	P	C	END EXAM
PRACTICUM		2	0	2	3	THEORY

Introduction:

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

CO 1	:	Explain motor load dynamics and multiquadrant operation of drives.
CO 2	:	Analyze operation of converter fed and chopper fed DC drives.
CO 3	:	Apply different braking methods of D.C. and induction motor drive.
CO 4	:	Elaborate vector control for induction motor and BLDC drives.
CO 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.

2G236236	ELECTRICAL DRIVES AND CONTROLS	L	T	P	C	END EXAM
PRACTICUM		2	0	2	3	THEORY

CO/PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	1	2	2	-	1	1
CO 2	2	1	2	2	-	1	1
CO 3	2	1	2	2	-	1	1
CO 4	2	1	2	2	-	1	1
CO 5	2	1	2	2	-	1	1

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

Instructional Strategy:

- Engage and Motivate: Instructors should actively engage studentstoboost 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 strategythroughout 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.

2G236236	ELECTRICAL DRIVES AND CONTROLS	L	T	P	C	END EXAM
PRACTICUM		2	0	2	3	THEORY

THEORY PORTION:		
UNIT I	**ELECTRICAL DRIVES**	Period
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 andmulti-quadrant operation – equivalent values of drive parameters-load torque components-nature and Classification of load-constant power operation of a drive-steady-state stability.		6
UNIT II	**DC MOTOR DRIVES**	Period
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.		6
UNIT III	**INDUCTION MOTOR DRIVES**	Period
Regenerative braking - Dynamic braking – Plugging - Numerical based on braking and speed control -Voltage Source Inverter (VSI) control - SteadyStateAnalysis – Current Source Inverter (CSI) control-Open and closed loop-Regenerative braking-Multiquadrant operation of Induction motor drives-Principle of vector control- Block diagram of Vector control of induction motor- Failure modes of Drives.		6
UNIT IV	**BLDC DRIVE**	Period
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).		6
UNIT V	**SYNCHRONOUS MOTOR DRIVES & DRIVES APPLICATIONS**	Period

2G236236	**ELECTRICAL DRIVES AND CONTROLS**	L	T	P	C	END EXAM
PRACTICUM		2	0	2	3	THEORY

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).	6

Practical Exercises:

Ex.No	Name of the Experiment	Period
1.	Electrical braking of D.C. Shunt motor (Rheostatic,Plugging).	30
2.	Closed Loop Speed Control of AC Motor	
3.	Closed Loop Speed Control of BLDC Motor	
4.	Closed loop control of PMSM drive.	
5.	Single phase fully converter fed separately excited D.C. Motor	
6.	Simulation of Induction Motor Vector Control	
7.	VSI fed 3 phase Induction motor (using V/f control PWM inverter) Speed control characteristics	
8.	Simulation of closed loop control of BLDC/ PMSM drive.	
	TOTAL PERIODS	**60**

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

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:

1. Gopal K. Dubey, Fundamentals of Electric Drives, 2nd Edition, Narosa Publishing House, 2010.
2. NisitK.De, Prasanta K.Sen, Electric Drives, Ninth Printing, Prentice Hall of India Pvt Ltd., 2006.
3. M.D.SinghandK.B.Khanchandani,PowerElectronics,SecondEdition,TataMc-GrawHill, 2017.
4. AustinHuges,BillDrury,ElectricMotorsandDrives:Fundamentals,Typesand

Applications, Fifth Edition, Newnes, 2019.

Web-based/Online Resources:

- https://instrumentationtools.com/electrical-drive-types-advantages-disadvantages/
- https://www.electrical4u.com/control-of-electrical-drives/

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

S.No	Name of the Equipment's	Quantity Required
1.	D.C. Shunt Motor Braking Kit	1 No
2.	Closed Loop Speed Control of AC Motor System	1 No
3.	Closed Loop Speed Control of BLDC Motor System	1 No
4.	Closed loop control of PMSM drive.	1 No
5.	Single phase fully converter fed separately excited D.C. Motor	1 No
6.	Simulation Software	1 No
7.	VSI fed 3 phase Induction motor Kit	1 No

***

2G236151	INTERNSHIP	Period	C	END EXAM
PROJECT		540	12	PROJECT

Introduction:

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 class room 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 a realistic 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 with supervisor,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.

2G236151	INTERNSHIP	Period	C	END EXAM
PROJECT		540	12	PROJECT

- Foster personal growth by challenging interns to step out of their comfort zones and take 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

CO 1 : Demonstrate improved skills.

CO 2 : Apply theoretical knowledge and principles in real-world practices.

CO 3 : Apply theoretical knowledge and principles in real-world practices.

CO 4 : Develop and utilize assessment tools to evaluate the learning and practices.

CO 5 : Engage in reflective practice to continually improve their learning and professional growth.

Facilitating the Interns by an Internship Provider:

- Orient internin 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

2G236151	INTERNSHIP	Period	C	END EXAM
PROJECT		540	12	PROJECT

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 facilitatethe 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 logbook 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.

2G236151	INTERNSHIP	Period	C	END EXAM
PROJECT		540	12	PROJECT

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 submitit 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 Assessment mark.

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 organisation 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 Organisation.

***

2G236153	FELLOWSHIP	Period	C	END EXAM
PROJECT		540	12	PROJECT

Introduction:

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 he challenges of a rapidly evolving technological land scape.

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 in to 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.

2G236153	FELLOWSHIP	Period	C	END EXAM
PROJECT		540	12	PROJECT

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 inter disciplinary 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 fort ackling 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 team work skills through group project sand collaborative activities, preparing fellows for leadership roles in their future careers.
- In still 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 life long learning , encouraging fellows to continually update their knowledge and skills in response to technological advancements and industry trends.
- Prepare fellows to working a global engineering environment by exposing them to international best practices, standards, andcross-cultural experiences.

Course Outcomes:

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

CO 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.

2G236153	FELLOWSHIP	Period	C	END EXAM
PROJECT		540	12	PROJECT

CO 2 : Apply theoretical knowledge to practical scenarios , effectively solving engineering Problems through hands – on projects , laboratory work , and internships.

CO 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.

CO 4 : Understand and adhere to professional and ethical standards in engineering practice, Demonstrating responsibility , integrity,and a commitment to sustainable and socially responsible engineering.

CO 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 and professional 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.

2G236153	FELLOWSHIP	Period	C	END EXAM
PROJECT		540	12	PROJECT

- **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.
- Ensureit covers coreengineeringprinciplesthat alignwith yourinterestsandcareergoals.
- 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 careersofpastgraduatescanindicatetheprogram'seffectivenessinpreparingstudents 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 Chairman Board of Examinations with there commendations of 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.
- In still 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 guide lines 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 projector study you plant 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 off undoing 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 a output 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.

2G236153	FELLOWSHIP	Period	C	END EXAM
PROJECT		540	12	PROJECT

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 aspectsoutlined 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).

2G236153	FELLOWSHIP	Period	C	END EXAM
PROJECT		540	12	PROJECT

4	Methodology andData Collection:	Evaluate the appropriateness and justification of the research methodology. Assess the methods used for data collection and theirrelevance to the research questions.
5	Analysis and Interpretatio n:	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 totimelines and milestones. Assess the student's ability to plan and execute the project effectively.
7	Documentatio nand Reporting:	Check the quality of documentation, including code, experimentaldetails, 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-SolvingSkills:	Evaluate the student's ability to identify and solve problemsencountered during the project. Assess adaptability and resilience in the face of challenges.

2G236153	FELLOWSHIP	Period	C	END EXAM
PROJECT		540	12	PROJECT

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		**40**

END TERM EXAMINATION- Project Exam

Students should be assessed for 100 Marks both by the internal examiner and external examiner appointed by the Chairman Board of Examinations after the completion of fellowship. The marks scored will be converted to 60 marks for the End TERM Examination.

Sl. 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		100

2G236174	IN-HOUSE PROJECT	Period	C	END EXAM
PROJECT		540	12	PROJECT

Introduction:

- 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 Labor 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.

2G236174	IN-HOUSE PROJECT	Period	C	END EXAM
PROJECT		540	12	PROJECT

Problem-Solving Abilities: Develop critical thinking and problem-solving abilities by addressing complex engineering issues within a defined scope.

- **ProjectManagement:** 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 stake holders.
- **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 life cycle.

Course Outcomes:

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

CO 1	:	Demonstrate the ability to apply theoretical concepts and principles learned in Course work to solve practical engineering problems encountered during the project.
CO 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.
CO 3	:	Apply critical thinking and problem-solving skills to identify, analyze, and propose Solutions to engineering challenges encountered throughout the project lifecycle.
CO 4		Acquire project management skills by effectively planning, organizing, and executing Pr project tasks within defined timelines and resource constraints.
CO 5	:	Improve communication skills through the preparation and delivery of project reports, presentations, and documentation that effectively convey technical information to stakeholders.

2G236174	**IN-HOUSE PROJECT**	Period	C	END EXAM
PROJECT		540	12	PROJECT

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 course work 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 time frame, 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 through out the project .Effective mentorship is crucial for success.
- Clearly define the learning objectives and expected out comes 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. Inter disciplinary 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.

2G236174	IN-HOUSE PROJECT	Period	C	END EXAM
PROJECT		540	12	PROJECT

- 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 Chairman Board of Examinations.
- The in-house project should be selected in the fifth TERM itself. Each in-house projectshall 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.
- In still and uphold high ethical and professional standards, encouraging students to practice integrity and responsibility in their work.

2G236174	IN-HOUSE PROJECT	Period	C	END EXAM
PROJECT		540	12	PROJECT

- 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

2G236174	IN-HOUSE PROJECT	Period	C	END EXAM
PROJECT		540	12	PROJECT

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 TERM 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 there search design. Appropriateness and justification of chosen research methods.
4.	Project Management	Adherence to project time line 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
8.	Problem-Solving	Demonstrated ability to identify and address challenges encountered during the project.

2G236174	IN-HOUSE PROJECT	Period	C	END EXAM
PROJECT		540	12	PROJECT

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 TERM Viva Voce are as below.

Internal Mark Split (40 Marks)*		
Review1 (10 Marks)	Review2 (15 Marks)	Review3 (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 TERM 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 TERM (100)#			
Record (20Marks)	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 TERM can apply for an extension to the Head of the Department, with there commendation 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.

G SCHEME

Diploma in Electrical and Electronics Engineering

14. MODEL QUESTION PAPERS

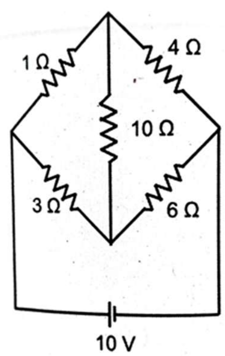
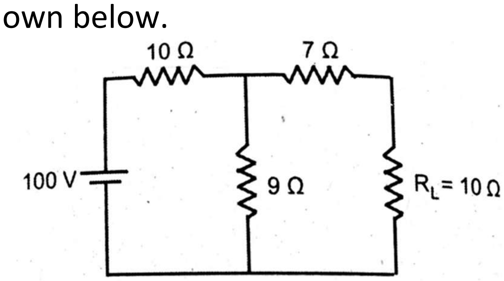
SESHASAYEE INSTITUTE OF TECHNOLOGY (Autonomous),TRICHY-10

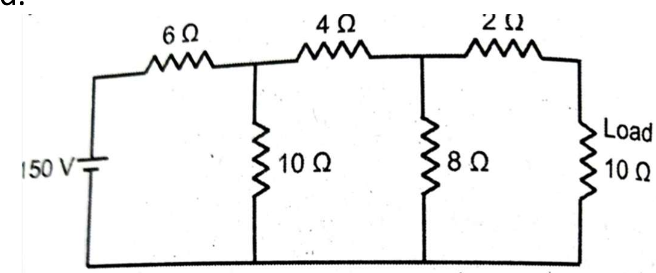
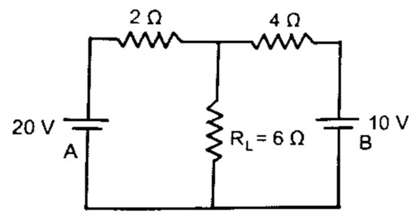
MODEL QUESTION PAPER

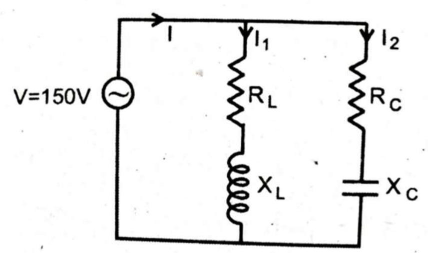
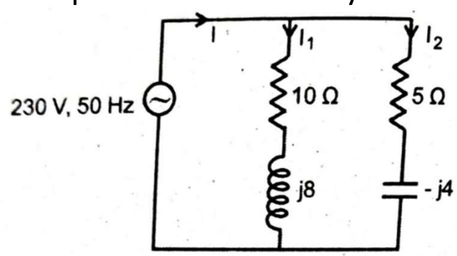
Programme	DEEE	Term	III
Course Code	2G233110	Course Name	ELECTRICAL CIRCUIT THEORY

	PART-A (10X2=20marks) Answer any two questions from 1,2,3 & 4	CO	Bloom's Level
1.	State Ohm's law	1	R
2.	Differentiate series and parallel circuits	1	An
3.	Two resistances of 10 Ω and 20 Ω are connected in parallel. This parallel combination is connected in series with another resistance of 5 Ω. Find the equivalent resistance.	1	A
4.	3 resistors, each of 5 Ω are connected in Star. What is the value of resistor, if they are connected in Delta?	1	A
	Answer any two questions from 5,6,7 & 8		
5.	State Superposition theorem	2	R
6.	Draw Norton's equivalent circuit	2	R
7.	State Maximum Power Transfer theorem	2	R
8.	If Thevenin's voltage is 120 V and Thevenin's Resistance is 1.5 Ω, what is the maximum power?	2	A
	Answer any two questions from 9,10,11 & 12		
9.	Define Peak factor and state its value for a sinusoidal waveform	3	R
10.	An alternating voltage is given by the equation v= 342 sin314 t. Calculate a) Frequency, b) RMS Value	3	A
11.	Draw Power Triangle and Explain	3	R
12.	Write the expression for impedance in RLC series circuit	3	R
	Answer any two questions from 13,14,15 & 16		
13	Convert (33+j4) into polar form	4	A
14	Define Admittance and state its unit	4	R
15	Compare Series & Parallel Resonant circuits	4	An
16	Define Q Factor of a series resonance circuit	4	R
	Answer any two questions from 17,18,19 & 20		
17	Define Phase Voltage & Line Voltage in a 3-phase system	5	R
18	Draw the symbol of a Wattmeter, indicate the points and name the	5	R

	coils		
19	Power in a 3 phase circuit is measured by 2 watt meters. If one of the wattmeter reading is zero, what is the power factor?	5	A
20	Draw the vector diagrams and write the expressions of Positive, Negative and Zero sequence components	5	R

PART-B (5x2x8=80marks)		CO	Bloom's Level
Answer any two subdivisions from question number 21			
21.(a)	State and explain Kirchhoff's current and voltage laws.	1	U
(b)	A 10 Ω resistance is connected in series with a parallel combination of 3 resistances of 6 Ω, 12 Ω,and 18 Ω respectively and this whole combination is connected across a 40 Volts DC supply. Calculate, i) Equivalent resistance, ii) Current through each resistance & iii) Voltage across easchresistance	1	A
(c)	By using the Mesh current method, find the current through the 10 Ω resistor. 	1	A
(d)	Explain the procedure to find the node voltages in a ciruit with an example.	1	U
Answer any two subdivisions from question number 22.			
22.(a)	State Thevenin's theorem. Explain the steps to be followed for finding the solution.	2	U
(b)	Using Norton's theorem, find the current in the load resistance R_L of the circuit shown below. 	2	A

(c)	In the circuit given below, obtain the current in the load and power to the load. 	2	A
(d)	Find the current through the 6 Ohm load resistor in the following circuit, by using superposition theorem. 	2	A
	Answer any two subdivisions from question number 23.		
23. (a)	Compare Pure Resistance, Pure Inductance and Pure Capacitance circuits.	3	U
(b)	Find the Inductive Reactance, Impedance, Current, Phase angle, Power Factor, Voltage across the resistor, Voltage across the Inductor and Power of a series circuit having a resistance of 20 Ohm and inductance of 15 mH. The applied voltage is 200 V, 50 Hz.	3	A
(c)	A series RLC circuit with a resistance of 50 Ω, an inductance of 0.15 H and a Capacitor of 75 μF are connected across a 230 V, 50 Hz, AC supply. Draw the circuit and find the Inductive Reactance, Capacitive Reactance, Impedance, Current, Phase angle, Power Factor and Power.	3	A
(d)	An of Inductance L = 0.5 H, Resistance R = 15 Ohm are connected in series with a capacitor across a 50 Hz supply. Draw the arrangement and calculate the capacitance required to give the circuit power factor of 0.5 lagging.	3	A
	Answer any two subdivisions from question number 24.		
24. (a)	For the following circuit, given that R_L = 3.6 Ω, X_L = 4.8 Ω, R_c = 3 Ω and Xc = 4 Ω, V= 150 V. Calculate a) Conductance and Susceptance of each branch, b) Total Conductance and Susceptance, c) Total Current, d) Current through R_L and Rc.	4	A

			
(b)	By using Admittance method, find the current on each branch, total current and total power consumed by the circuit. 	4	A
(c)	A coil of 2 Ω resistance, and an inductance of 0.01 H is connected in parallel with a Capacitor of Capacitance C. Given that the supply voltage is 200 V, 50 Hz. Determine, a) Value of Capacitance at Resonance, b) Total Current in the circuit, c) Current in each branch of the circuit.	4	A
(d)	A coil having a resistance of 10 Ohm and an inductance of 20 mH is connected in parallel with a 100 µF Capacitor. Calculate i) Resonant frequency, ii) Quality factor, & iii) Dynamic Resistance	4	A
Answer any two subdivisions from question number 25.			
25. (a)	State and prove the relation between Line & Phase quantities of a 3-phase star connected system with circuit diagram & vector diagram.	5	A
(b)	A 400 V, 3 Φ voltage is applied to a balanced delta connected load of phase impedance (15+j20) Ω. Find the Impedance, Phase current, Power Factor and Power consumed per phase.	5	A
(c)	A 3-phase motor load has a power factor of 0.4. Two watt meters connected to measure the power show the input to be 30 KW. Find the readings of two watt meters.	5	A
(d)	Explain the method of 3 phase voltage generation with a sketch and waveform. List the significance of 3 phase vsystems.	5	U

SESHASAYEE INSTITUTEOF TECHNOLOGY(Autonomous) ,
TRICHY-10

MODEL QUESTION PAPER

Programme	DEEE	Term	III
Course Code	2G233210	Course Name	ELECTRICAL MACHINES-I

PART-A (10X2=20marks) Answer any two questions from 1,2,3 & 4		CO	Bloom's Level
1.	Define magnetic flux.	1	R
2.	State Fleming's right hand rule.	1	R
3.	What is critical field resistance?	1	R
4	What is meant by commutation?	1	R
Answer any two questions from 5,6,7 & 8			
5	What is meant by Back EMF in DC motor?	2	R
6	Mention the losses occur in DC motor.	2	R
7	State the applications of DC shunt motor.	2	U
8	what is meant by step angle in stepper motor?	2	R
	Answer any two questions from 9,10,11 & 12		
9	Define voltage ratio of transformer	3	R
10	Define regulation of transformer.	3	R
11	Define All day efficiency of a transformer.	3	R
12	Compare two winding transformer and auto transformer	3	U
Answer any two questions from 13, 14, 15 & 16			
13	What are the advantages of three phase transformer?	4	U
14	State any two conditions for parallel operation of 3 phase transformer.	4	U
15	Name the three protective devices used in a transformer.	4	U
16	What is the necessity of tap changer in a transformer?	4	U
Answer any two questions from 17,18,19 & 20			
17	What is preventive maintenance?	5	U
18	Write any two causes for sparking in commutator.	5	U
19	Write any two requirements of brushes.	5	U
20	What is meant by earthing?	5	U

PART-B (5x2x8=80marks)		CO	Bloom's Level
Answer any two subdivisions from question number 21			
21. (a)	With a neat sketch, explain the constructional details of a DC Generator.	1	U
(b)	Derive EMF equation of a DC Generator.	1	U
(c)	State the applications of DC Generators.	1	U
(d)	Explain the armature reaction in DC generator.	1	U
Answer any two subdivisions from question number 22			
22. (a)	Explain the principle of operation of DC motor	2	U
(b)	Explain the speed control of DC shunt motor.	2	U
(c)	Draw and explain the working of 3-point starter.	2	U
(d)	Explain the construction and working of permanent magnet DC motor.	2	U
Answer any two subdivisions from question number 23			
23. (a)	Derive the EMF equation of transformer.	3	U
(b)	Determine the equivalent circuit constants of transformer by conductingopen circuit and short circuit test.	3	U
(c)	Write short notes on Autotransformer.	3	U
(d)	Derive the conditions for maximum efficiency of transformer.	3	U
Answer any two subdivisions from question number 24			
24. (a)	Explain the different connections of three phase transformer.	4	U
(b)	Explain any three methods of cooling of transformer.	4	U
(c)	Explain the operation of ON load tap changer.	4	U
(d)	Explain the operation of (1) Conservator (2) Breather (3) Explosion vent.	4	U
Answer any two subdivisions from question number 25			
25. (a)	Explain the resurfacing process of commutator in DC machine.	5	U
(b)	Explain the common defects in commutator and how it can be rectified.	5	U
(c)	Explain with neat sketch the working of transformer oil tester.	5	U
(d)	Explain how the Earth resistance is measured by using earth tester.	5	U

****

SESHASAYEEINSTITUTEOF TECHNOLOGY(Autonomous), TRICHY-10

MODEL QUESTION PAPER

Programme	DEEE	**Term**	IV
Course Code	2G234110	**Course Name**	ELECTRICAL MACHINES-II

	PART-A (10X2=20 Marks) **Answer any two questions from 1,2,3 & 4-**	**CO**	**Blooms Level**
1.	Write any three advantages of rotating field system in a three-phase alternator	1	U
2.	Define pitch factor.	1	R
3.	Define distribution factor.	1	R
4.	Define slot angle.	1	R
	Answer any two questions from 5,6,7 & 8		
5.	What are the causes of voltage drop in alternator?	2	R
6.	What is synchronous impedance?	2	R
7.	What are the conditions to be fulfilled for parallel operation of alternators?	2	U
8.	What is meant by alternator on infinite busbar?	2	U
	Answer any two questions from 9,10,11 & 12		
9.	Define slip in induction motor.	3	R
10.	Define slip frequency.	3	R
11.	Compare squirrel cage and slip ring induction motor.	3	U
12.	What is meant by crawling in induction motor?	3	R
	Answer any two questions from 13, 14, 15 & 16		
13	why single phase induction motor is not self starting	4	U
14	What are the types of single-phase induction motor?	4	R
15	What is continuous rating?	4	R
16	What is static balancing?	4	R
	Answer any two questions from 17,18,19 & 20		
17	Compare synchronous motor and 3 phase induction motor.	5	U
18	What is meant by hunting?	5	R
19	What is switched reluctance motor?	5	R
20	What is AC servo motor?	5	R

PART-B (5x2x8=80marks)		CO	Bloom's Level
Answer any two subdivisions from question number 21			
21 (a)	Explain with neat sketch the constructional details of turbo alternator.	1	U
(b)	Derive the EMF equation of an alternator.	1	U
(c)	Discuss various methods to obtain sine wave in an alternator.	1	U
(d)	Describe hydrogen cooling of alternator.	1	U
Answer any two subdivisions from question number 22			
22. (a)	Explain armature reaction of alternator on load at various power factor.	2	U
(b)	Explain the synchronous impedance method of determining the voltageregulation of alternator.	2	U
(c)	Explain briefly the synchronizing of two three phase alternators synchroscope method.	2	U
(d)	Explain synchronising current, synchronising power, synchronising torque.	2	U
Answer any two subdivisions from question number 23			
23(a)	Explain the slip-torque characteristics of 3-phase induction motor.	3	U
(b)	Briefly explain the no load and blocked rotor tests conducted on an induction motor.	3	U
(c)	Explain the different methods of speed control of three phase induction motor.	3	U
(d)	Explain the working of star-delta starter with a neat sketch.	3	U
Answer any two subdivisions from question number 24			
24.(a)	Explain with neat diagram, the working of a capacitor start motor.	4	U
(b)	Explain construction and working of universal motor.	4	U
(c)	Explain the various types of enclosures.	4	U
(d)	Explain vaccum impregnation.	4	U
Answer any two subdivisions from question number 25			
25.(a)	Explain why synchronous motor is not self-starting.	5	U
(b)	Explain any three methods of starting of three phase synchronous motor.	5	U
(c)	Explain V curves and inverted V curves of the synchronous motor atconstant input power.	5	U
(d)	Explain the construction and working principle of linear induction motor.	5	U

SESHASAYEE INSTITUTEOF TECHNOLOGY(Autonomous), TRICHY-10

MODEL QUESTION PAPER

Programme	DEEE	**Term**	IV
Course Code	2G234210	**Course Name**	GENERATION, TRANSMISSION & DISTRIBUTION

	PART-A (10X2=20marks) **Answer any two questions from 1,2,3 & 4**	**CO**	**Bloom's Level**
1	Compare any two points about Hydel, Thermal & Nuclear power plants	1	R
2	Draw a Daily load curve showing variations of load in a day with respect to time	1	An
3	State the roles of load dispatching centre	1	A
4	Define Load Factor	1	R
	Answer any two questions from 5,6,7 & 8		
5	List few desirable properties of transmission line supports	2	R
6	State and prove Ferranti's effect with a vector diagram	2	R
7	Define Transmission efficiency of a transmission line	2	R
8	What is Skin effect?	2	R
	Answer any two questions from 9,10,11 & 12		
9	Name the HVDC Locations in India	3	R
10	What is the need for FACTS controllers?	3	A
11	Expand SVS, STATCOM & UPFC	3	R
12	What are the types of FACTS controllers?	3	R
	Answer any two questions from 13, 14, 15 & 16		
13	State few causes of failure of insulators	4	A
14	What is string efficiency? Why is it not 100%?	4	R
15	Name the types of oil pressure cables	4	An
16	Expand EHT & ST cables	4	R
	Answer any two questions from 17,18,19 & 20		
17	Compare AC & DC distribution systems	5	R
18	Classify Substations	5	R
19	What are the types of bus bar arrangements?	5	R
20	What is the purpose of using Instrument transformers in Substations?	5	A

PART-B (5x2x8=80marks)		CO	Bloom's Level
Answer any two subdivisions from question number 21			
21 a)	Explain the schematic arrangement of a Nuclear Power Plant	1	U
b)	Explain various solar cell technologies	1	U
c)	Explain about smart grid	1	U
d)	What are Penstock protective devices in a Hydel power plant? Explain their role with a neat sketch	1	U
Answer any two subdivisions from question number 22			
22 a)	Draw and explain typical layout of A.C. Power supply scheme	2	U
b)	List and explain various conductor materials used in overhead transmission lines	2	U
c)	Explain the method of calculating sag for supports at equal level with a neat sketch	2	U
d)	What is Corona? How it is formed? State its merits and demerits	2	
Answer any two subdivisions from question number 23			
23 a)	Draw the H.V.D.C Transmission: Layout Scheme and explain	3	U
b)	Draw and explain various HVDC links	3	U
c)	Explain about Integration of HVDC & Renewable energy into existing AC grids	3	U
d)	Explain UPFC with a block diagram	3	U
Answer any two subdivisions from question number 24			
24 a)	Explain the Flash over and sample tests on insulators	4	U
b)	In a 33 kV overhead line, there are three units in the string of insulators. If the capacitance between each insulator pin and earth is 11% of self-capacitance of each insulator, find (i) the distribution of voltage over 3 insulators and (ii) string efficiency	4	U
c)	Explain with a neat sketch, the construction of a UG cable	4	U
d)	Explain different methods of laying of UG cables	4	U
Answer any two subdivisions from question number 25			

25 a)	Compare DC 2 wire distribution system with AC 3 phase, 4 wire system	5	U
b)	Draw and explain Layout110/11KV Substation	5	U
c)	List and explain various substation equipments	5	U
d)	Explain Radial, Ring main and interconnected systems of distribution	5	U

SESHASAYEEINSTITUTEOF TECHNOLOGY(Autonomous), TRICHY-10

MODEL QUESTION PAPER

Programme	DEEE	Term	V
Course Code	2G235110	Course Name	POWER SYSTEM PROTECTION & UTILISATION

PART-A (10X2=20marks) Answer any two questions from 1,2,3 & 4		CO	Bloom's Level
1	What is the need for protective schemes?	1	R
2	State the Causes of Over Voltage	1	R
3	Classify fuses	1	A
4	State the types of faults in a power system	1	R
Answer any two questions from 5,6,7 & 8			
5	What is an inverse time relay?	2	R
6	Differentiate Primary and back up Protection	2	An
7	Name the basic elements of static relay	2	R
8	What is a HVDC Breaker?	2	R
Answer any two questions from 9,10,11 & 12			
9	List Different types of electrical drives	3	R
10	State the Advantages of Electric Traction	3	R
11	How much Energy Saving is possible with Series Parallel Starting?	3	A
12	State the advantages of electric traction	3	R
Answer any two questions from 13, 14, 15 & 16			
13	Define Luminous Efficiency and state its unit	4	R
14	Classify light sources	4	A
15	What is flood lighting?	4	R
16	What are the different lighting systems?	4	R
Answer any two questions from 17,18,19 & 20			
17	State the advantages of electric heating	5	R
18	Classify Electric Furnaces	5	A

19	State the types of arc welding	5	An
20	Compare Resistance & Arc welding	5	R
	PART-B (5x2x8=80marks)	**CO**	**Bloom's Level**
	Answer any two subdivisions from question number 21		
21 a)	Explain the Applications of Current Transformers (CT) and Potential Transformers (PT) in protection schemes	1	U
b)	Explain Gapless Arrester with a neat sketch	1	U
c)	Explain the Construction and Working of HRC Fuse	1	U
d)	Explain different types of lightning strokes	1	U
	Answer any two subdivisions from question number 22		
22 a)	Explain the construction and working of a Induction type over current relay (Directional)	2	U
b)	Explain Arcing phenomenon and Arc interruption in Circuit Breakers	2	U
c)	Explain the construction and working of Vacuum Circuit Breakers	2	U
d)	Explain Current and Voltage differential relay with sketches	2	U
	Answer any two subdivisions from question number 23		
23 a)	Explain the Factors governing the selection of Electric Motor for a particular application	3	U
b)	Explain Different Systems of Track Electrification	3	U
c)	Explain Magnetic Levitation (MAGLEV).	3	U
d)	Explain Multiple Unit Control of traction with a sketch	3	U
	Answer any two subdivisions from question number 24		
24 a)	Explain the construction and working of a Mercury Vapour Lamp	4	U
b)	What are the Recent trends in lighting systems? Explain	4	U
c)	Explain how Lighting control is done using Sensors and IoT	4	U
d)	Explain the troubleshooting of florescent lamps	4	U
	Answer any two subdivisions from question number 25		
25 a)	Explain Eddy Current Heating with a sketch	5	U

b)	Explain Indirect Core Type Induction Furnace with a sketch	5	U
c)	Explain various resistance welding methods	5	U
d)	Explain Laser Beam Welding with a sketch	5	U

SESHASAYEE INSTITUTEOF TECHNOLOGY (Autonomous) ,
TRICHY-10

MODEL QUESTION PAPER

Programme	DEEE	Term	VI
Course Code	2G236234	Course Name	RENEWABLE ENERGY SYSTEMS

PART-A (10X2=20marks) Answer any two questions from 1,2,3 & 4		CO	Bloom's Level
1	How much energy is consumed in various sectors in India?	1	A
2	What is the present renewable energy status in India?	1	An
3	State the per capita energy consumption in India	1	R
4	Mention any two potential renewable energy sources in India.	1	R
Answer any two questions from 5,6,7 & 8			
5	Define solar radiation	2	R
6	Differentiate Flat plate and concentrating collectors	2	An
7	State Solar PV applications	2	R
8	Name two types of solar thermal collectors.	2	R
Answer any two questions from 9,10,11 & 12			
9	Define Betz limit	3	R
10	Differentiate Horizontal & Vertical axis wind turbines	3	An
11	Name the types of wind turbine generators	3	R
12	List two applications of wind energy.	3	R
Answer any two questions from 13, 14, 15 & 16			
13	What is thermochemical conversion of biomass?	4	R
14	What is cogeneration?	4	R
15	Define Pyrolysis	4	R
16	List two applications of biogas plants.	4	R
Answer any two questions from 17,18,19 & 20			
17	What are small hydro power plants?	5	R
18	What are the limitations of OTEC?	5	R
19	What are the applications of Geothermal energy?	5	R
20	What is tidal energy?	5	R

PART-B (5x2x8=80marks)		CO	Bloom's Level
Answer any two subdivisions from question number 21			
21 a)	Explain Indian energy scenario in various sectors such as domesticand industrial	1	U
b)	Explain the potential of various renewable energy sources in India	1	U
c)	Explain Future energy plans in India	1	An
d)	Analyze the per capita energy consumption in India compared to global standards.	1	U
Answer any two subdivisions from question number 22			
22 a)	Explain the working of Angstrom pyrheliometer with a neat sketch	2	U
b)	Explain the working of a Flat Plate Collector with a neat sketch	2	U
c)	What is a solar green house? Explain the types. State its advantages	2	U
d)	Describe the fundamentals of solar photovoltaic conversion and its efficiency.	2	U
Answer any two subdivisions from question number 23			
23 a)	Explain site selection for wind farms	3	U
b)	Explain Vertical axis wind turbine with a sketch	3	U
c)	Describe the characteristics and applications of hybrid wind energy systems.	3	U
d)	Evaluate the environmental issues associated with wind energy development.	3	U
Answer any two subdivisions from question number 24			
24 a)	Explain various Bio resources	4	U
b)	Explain the types of biomass gasifiers	4	U
c)	Explain Ethanol production	4	U
d)	Describe the process of biodiesel production and its benefits.	4	U
Answer any two subdivisions from question number 25			
25 a)	Explain Tidal energy generation with sketch	5	U
b)	Explain closed OTEC Cycle with a neat sketch	5	U
c)	Explain the environmental impact of Geothermal energy	5	An
d)	Evaluate the potential and challenges of tidal and wave energy as renewable sources.	5	An

SESHASAYEE INSTITUTEOF TECHNOLOGY(Autonomous), TRICHY-10

MODEL QUESTION PAPER

Programme	DEEE	**Term**	VI
Course Code	2G236235	**Course Name**	ENERGY CONSERVATION AND AUDITING

PART-A (10X2=20marks)	**Answer any two questions from 1,2,3 & 4**	**CO**	**Bloom's Level**
1	What is the need of energy audit?	1	R
2	What is benchmarking	1	R
3	Name few substitutes for energy	1	R
4	State the instrument used to measure temperature and pressure during energy audit	1	R
	Answer any two questions from 5,6,7 & 8		
5	How electricity is billed to industrial consumers?	2	A
6	What are the benefits of power factor improvement?	2	R
7	List the Advantages of Intelligent Power Factor Controller for the Improvement of Energy Efficiency	2	R
8	What are the transformer losses?	2	R
	Answer any two questions from 9,10,11 & 12		
9	What are the common losses in induction motors?	3	R
10	How does motor efficiency affect the performance of an induction motor?	3	R
11	What are the issues associated with rewinding and motor replacement?	3	R
12	How can energy-efficient motors contribute to energy savings?	3	A
	Answer any two questions from 13, 14, 15 & 16		
13	What are the different light sources used in lighting systems?	4	R
14	How is the choice of lighting determined for different applications?	4	R
15	What are the luminance requirements for various lighting applications?	4	R
16	How can energy conservation be achieved in lighting systems?	4	R
	Answer any two questions from 17, 18, 19 & 20		
17	What is the function of maximum demand controllers?	5	R
18	How do automatic power factor controllers improve energy efficiency?	5	R
19	What are the benefits of using energy-efficient motors?	5	R
20	Explain the working principle of soft starters with energy savers.	5	R
	PART-B (5x2x8=80marks)	**CO**	**Bloom's Level**

Answer any two subdivisions from question number 21			
21 a)	Explain the types of Energy Audit	1	U
b)	Explain in detail, how optimizing the input energy requirements are done	1	U
c)	Explain how energy is matched to a requirement?	1	A
d)	Explain Energy Audit instruments	1	U
Answer any two subdivisions from question number 22			
22 a)	Explain Electrical load management and maximum demand control	2	U
b)	Explain various methods of power factor improvement	2	U
c)	Explain how Performance assessment of PF capacitors is done	2	U
d)	Explain various forms of distribution losses and the ways to minimise them	2	U
Answer any two subdivisions from question number 23			
23 a)	Discuss the factors affecting the performance of induction motors and suggest methods to improve their efficiency.	3	U
b)	Analyze the rewinding and motor replacement issues in induction motors and propose solutions.	3	An
c)	Evaluate the energy-saving opportunities with energy-efficient motors in industrial applications.	3	U
d)	Describe the process of motor rewinding and replacement, highlighting the challenges and best practices.	3	U
Answer any two subdivisions from question number 24			
24 a)	Compare different light sources used in lighting systems and their applications.	4	U
b)	Discuss the factors affecting the choice of lighting for residential and commercial buildings.	4	U
c)	Explain the luminance requirements for different lighting applications and their importance.	4	U
d)	Evaluate the energy conservation avenues in lighting systems and their impact on energy consumption.	4	U
Answer any two subdivisions from question number 25			
25 a)	Analyze the role of automatic power factor controllers in improving energy efficiency and reducing power losses.	5	U
b)	Evaluate the benefits and applications of energy-efficient motors in industrial settings.	5	U
c)	Discuss the working principle, advantages, and applications of soft starters with energy savers.	5	U
d)	Explain the working principle, benefits, and applications of variable speed drives in energy-efficient electrical systems.	5	U

G SCHEME

Diploma in Electrical and Electronics Engineering

ASSESSMENT METHODOLOGY

COURSE TYPE: THEORY, END EXAM: THEORY

<table>
<tr><th>Assessment Method</th><th colspan="2">Assessment Marks</th><th>Converted Marks</th><th>Internal Marks</th><th>External Marks</th><th>Total Marks</th></tr>
<tr><td>Cycle Test 1 (Unit 1 & 2) 2 Hours (Written Test)</td><td>60</td><td rowspan="2">Best of CT1 and CT 2</td><td rowspan="2">10 Marks</td><td rowspan="6">40 Marks</td><td rowspan="7">60 Marks</td><td rowspan="8">100 Marks</td></tr>
<tr><td>Cycle Test 2 (Unit 3 & 4) 2 Hours (Written Test)</td><td>60</td></tr>
<tr><td>Model Theory Examinations (All Units) 3 Hours</td><td colspan="2">100 Marks</td><td>10 Marks</td></tr>
<tr><td>Assignments 2 nos (2*10 marks)</td><td colspan="2">20 Marks</td><td>10 Marks</td></tr>
<tr><td>MCQ</td><td colspan="2">10 Marks</td><td>5 Marks</td></tr>
<tr><td>Attendance</td><td colspan="2">5 Marks</td><td>5 Marks</td></tr>
<tr><td>End Theory Examinations 3 hrs</td><td colspan="2">100</td><td colspan="2">60 Marks</td></tr>
<tr><td colspan="6">TOTAL</td></tr>
</table>

CYCLE TEST QUESTION PATTERN

Part A – 6 Questions * 2 marks = 12 Marks

Part B – 6 Questions * 8 marks = 48 Marks

Total Marks = 60 Marks

In Part - A Each Unit (4 Questions answer any 2) and

Part – B (4 Questions answer any 2)

END THEORY EXAMINATION QUESTION PATTERN

Part A – 10 Questions * 2 marks = 20 Marks

Part B – 10 Questions * 8 marks = 80 Marks

Total Marks =100 Marks

In Each Unit Part A (4 Questions answer any 2) and Part B (4 Questions answer any 2)

ASSIGNMENT :

Two assignment covers all 5 units 20 marks converted to 10 marks

MCQ :Each Unit 10 Questions – 50 Questions 50 Marks converted to 5 Marks

COURSE TYPE: PRACTICUM, END EXAM: THEORY

Assessment Method	sessmentMarks		Converted Marks	nternalMarks	xternal Marks	TotalMarks
Cycle Test– I(Unit –I&II) (2Hours)(Written Test)	60 Marks	Best of CT–I AndCT–II	10 Marks	40 Marks	60 Marks	100 Marks
Cycle Test – II (Unit – III &IV)(2 Hours) (Written Test)	60 Marks					
Model Practical Examination (3Hours)	100Marks		10 Marks			
Model Theory Examinations (All Units) (3 Hours)	100Marks		10Marks			
ssignment -2 Nos. x 10 Marks	20Marks		5Marks			
tendance	5Marks		5Marks			
ENDTHEORYEXAMINATIONS (3Hours)	100Marks		60Marks			
TOTAL						

Cycle Test Question Pattern
Part A – 6 Questions x 2 marks = 12 Marks
Part B – 6 Questions x 8 marks = 48 Marks
Total Marks = 60 Marks
In Each Unit (4 Questions answer any 2) and Part – B (4 Questions answer any 2)

SCHEME OF EVALUATION - MODEL PRACTICAL EXAMINATION

PART	DESCRIPTION	MARKS
1	Aim & Apparatus Required	10
2	Circuit Diagram	20
3	Connection	10
4	Execution and Output/Result	20
5	Practical Documents (All Exercises)	30
6	Viva Voce	10
TOTAL		100

Model and End Theory Examination Question Pattern

Part A – 10 Questions x 2 Marks = 20 Marks
Part B – 10 Questions x 8 Marks = 80 Marks
Total Marks = 100 Marks

In Each Unit (4 Questions answer any 2) and Part – B (4 Questions answer any 2)

Assignment :

- 2 Assignments covers all 5 Units 20 Marks converted to 10 Marks

COURSE TYPE: PRACTICUM, END EXAM: PRACTICAL

<table>
<tr><th>Assessment Method</th><th colspan="2">Assessment Marks</th><th>Converted Marks</th><th>Internal Marks</th><th>External Marks</th><th>Total Marks</th></tr>
<tr><td>Cycle Test 1 Practical Exam PART A Exercises (2 Hours)</td><td>50</td><td rowspan="2">Best of CT1 and CT 2</td><td rowspan="2">10 Marks</td><td rowspan="6">40 Marks</td><td rowspan="7">60 Marks</td><td rowspan="8">100 Marks</td></tr>
<tr><td>Cycle Test 2 Practical Exam PART B Exercises (2 Hours)</td><td>50</td></tr>
<tr><td>Model Theory Examination All Exercises (3 Hours)</td><td colspan="2">100 Marks</td><td>15 Marks</td></tr>
<tr><td>Model Practical Examination All Exercises (3 Hours)</td><td colspan="2">100 Marks</td><td>15 Marks</td></tr>
<tr><td>Practical Document Submission (Each Experiment should be Evaluated to 10 Marks)</td><td colspan="2">10 Marks</td><td>10 Marks</td></tr>
<tr><td>Attendance</td><td colspan="2">5 Marks</td><td>5 Marks</td></tr>
<tr><td>End Practical Examination (3 Hours)</td><td colspan="2">100</td><td colspan="2">60 Marks</td></tr>
<tr><td colspan="6">TOTAL</td></tr>
</table>

CYCLE TEST 1 & 2

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

MODEL EXAM THEORY

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 15 Marks for internal assessment. The question setting details are as follows.

	Description	Pattern	Marks
PART-A	10 Questions * 2 Marks	10*2	20
PART-B	10 Questions * 8 Marks	10*8	80
TOTAL MARKS			**100**

In Each Unit, in Part - A, Out of 3 Questions - Answer any 2 &
in Part – B, Out of 3 Questions - Answer any 2

MODEL EXAM PRACTICAL 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 TERM Examination question pattern as given below. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End TERM Examination- Practical Exam

Part	Description	Marks
A	Aim & Apparatus Required	5
B	Circuit Diagram	25
C	Connections	25
D	Execution	25
E	Output/Result	10
F	Viva Voce	10
TOTAL MARKS		**100**

Note: *Practical Document with Bonafide certificate must be submitted to Model Practical Examination* and End TERM Practical Examination.

COURSE TYPE: PRACTICAL, END EXAM: PRACTICAL

<table>
<tr><th>Assessment Method</th><th colspan="2">Assessment Marks</th><th>Converted Marks</th><th>Internal Marks</th><th>External Marks</th><th>Total Marks</th></tr>
<tr><td>Cycle Test 1 Practical Exam PART A Exercise (2 Hours)</td><td>50</td><td rowspan="2">Best of CT1 and CT 2</td><td rowspan="2">10 Marks</td><td rowspan="5">40 Marks</td><td rowspan="6">60 Marks</td><td rowspan="7">100 Marks</td></tr>
<tr><td>Cycle Test 2 Practical Exam PART B Exercise (2 Hours)</td><td>50</td></tr>
<tr><td>Model Practical Examinations All Exercises (3 Hours)</td><td colspan="2">100 Marks</td><td>15 Marks</td></tr>
<tr><td>Practical Document Submission (Each Experiment should be Evaluated to 10 Marks)</td><td colspan="2">10 Marks</td><td>10 Marks</td></tr>
<tr><td>Attendance</td><td colspan="2">5 Marks</td><td>5 Marks</td></tr>
<tr><td>End Practical Examinations (3 Hours)</td><td colspan="2">100</td><td colspan="2">60 Marks</td></tr>
<tr><td colspan="6">TOTAL</td></tr>
</table>

CYCLE TEST 1 & 2

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

MODEL EXAM THEORY: 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 theexam. The model practical examination should be conducted as per the End TERM Examination question pattern as given below. The marks awarded should be convertedto 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical and End TERM 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 MARKS		**100**

Note: Practical Document with Bonafide certificate must be submitted to Model Practical Examination and End TERM Practical Examination.

COURSE TYPE: INTERNSHIP, END EXAM: PROJECT

SCHEME OF EVALUATION

INTERNAL ASSESSMENT:

Students should be assessed for 40 Marks by industry supervisor and polytechnic faculty mentor for the Internal Assessment.

Sl. 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 TERM Examination - Project Exam

Students should be assessed for 100 Marks both by the internal examiner and external examiner appointed by the Chairman Board of Examinations after the completion of industrial training. The marks scored will be converted to 60 marks for the End TERM 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**

COURSE TYPE: PROJECT, END EXAM: PROJECT

Scheme of Evaluation Internal Assessment

Students should be assessed for 50 Marks by industry supervisor and polytechnic faculty mentor during course period. The total marks (50 + 50) scored shall be converted to 40 marks for the Internal Assessment.

Sl. 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/communicationskills. Interpersonal skills /Human Relation.	10
E	Report and Presentation.	10
Total		50

End TERM Examination- Project Exam

Students should be assessed for 100 Marks both by the internal examiner and external examiner appointed by the Chairman Board of Examinations after the completion of internship period. The marks scored will be converted to 60 marks for the End TERM Examination.

Sl. No.	Description	Marks
A	Daily Activity Report.	20
B	Comprehensive report on Internship, Relevant Internship Certificate from the concerned	30
C	Presentation by the student at the end of the Internship.	30
D	Viva Voce	20
Total		100