DIPLOMA

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

SYLLABUS

H- SCHEME

WITH EFFECT FROM JUNE 2025

175, DR.DHARMAMBAL GOVERNMENT POLYTECHNIC COLLEGE FOR WOMEN (AUTONOMOUS), THARAMANI, CHENNAI

NBA has defined the following seven POs for an Engineering diploma graduate:

i. **Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.

ii. **Problem analysis:** Identify and analyse well-defined engineering problems using codified standard methods.

iii. **Design/ development of solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

iv. **Engineering Tools, Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

v. **Engineering practices for society, sustainability and environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.

vi. **Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well- defined engineering activities.

vii. **Life-long learning:** Ability to analyse individual needs and engage in updating in the context of technological changes.

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1. Preamble

Dr. Dharmambal Government Polytechnic College for Women, Chennai-113, was established in 1962. As many as 10 (Ten) diploma programmes are offered in this polytechnic college. Semester system is followed during the entire course of study. This institution contributes significantly to the state's talent pipeline, and it was initially started with the primary objective of producing women skilled technicians to support mass industrialization.

Today there is an evolving 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 institution envisions reimagining and redefining the diploma programme to make it relevant for the ever-changing economic, industrial, and regulatory landscapes of the new era. 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 programme is modelled to incorporate all these areas.

The challenges of the 21st century demand young women diploma Engineers/Architects to have a command over 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.

The rapid adoption of Advanced Technologies is changing the nature of work today. Technologies such as advanced robotics, knowledge work automation, the internet of things, cloud computing, autonomous & near-autonomous vehicles, next-generation genomics, energy storage, 3D printing, advanced materials, additive manufacturing and renewable energy are changing industries in an unprecedented manner. These technologies are making companies become leaner and more productive and also pave the way for future technologies to be invented. This makes companies constantly look for talent that can fit into the dynamic technological environment.

The objective of the new applied-to-learn track is to train a pool of graduates who are technically competent, professionally proficient and socially responsible in quality management, regulatory compliance and manufacturing processes in the respective sectors. This is followed by an iterative process of developing the learning outcomes, aligning the learning outcomes, designing the learning activities and applying the assessment methods of the modules offered on this track in an integrated manner to meet the industry's needs.

The programme 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 the diversified needs, dynamic contexts, and differentiated expectations in a learner-centric

environment. The crux of this programme lies in the way experiential learning, divergent thinking, problem-solving creativity and so on are integrated into one.

1 (a) - Objective

To retain and further strengthen the quality of the human capital produced by our institution at the diploma level as the force behind the state's social, cultural, and economic pre- eminence.

1 (b) - Admission

Candidates seeking admission to the first semester of the Diploma programme 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.

1 (c) - Lateral Entry Admission:

Engineering and Technology / Commercial Practice

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 programmes, 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.

1 (d) - Age limit:

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

1 (e) - Medium of Instruction:

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

2. Structure of the Programme

The redesigning and revamp of the Diploma programme in this institution 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.

2 (a) - Pathways for Progressive Learning Experience

The programme 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, 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.

2 (b) - Various Dimensions for Transformation

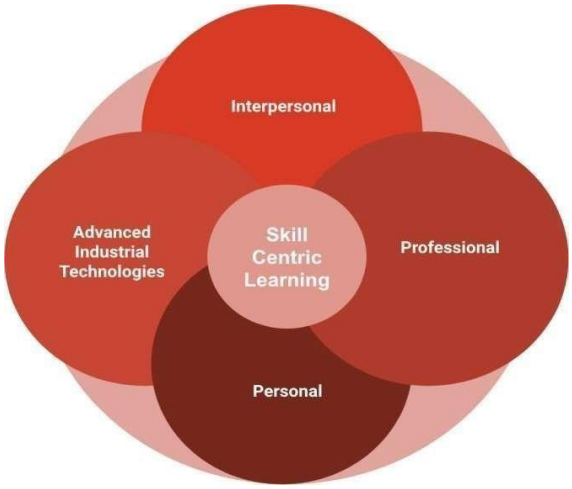
Today's world is rapidly changing and increasingly interconnected, and the future talent pipeline to be sourced from the campuses needs to adapt to changes that will keep accelerating in the future. The new diploma programme focuses on equipping learners with skills that will enable them to cope with 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.

2 (c) - 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 programme. 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 programmes consist of various levels of courses, structured as Foundation (F), Concentration (C) and the 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 (C) | Year II:** Concentration courses shall deliver domain-specific knowledge and technological skills. They are offered as core and electives to provide the requisite mandatory working knowledge of the chosen domain.

- **Specialisation (S) | Year III:** Specialization courses are focused on a particular area of study leading to a specific pathway. Some of the courses can also be beyond the programme, leading to skills and competencies in emerging technology domains.

Course Types

Every diploma programme shall have a curriculum with syllabi comprising Theory, Practicum and Practical courses with well-defined Programme 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 programme shall have a distinct curriculum with syllabi consisting of courses broadly categorized under:

- **Core (C)/Elective (E)** - Core / Elective courses are offered to students of a particular programme to gain basic and specialized knowledge/skills in a selected field. Core courses are mandatory to complete the programme 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. Based on the student's willingness, any number of elective courses may be offered.

- **Practicum (P) -** Integrated course taught in a hands-on learning environment. This may be offered wherever theoretical concepts are to be learned simultaneously with relevant practical sessions. Such courses shall be offered only if sufficient laboratory facilities are available to conduct such courses, and both laboratory and theory components shall be considered for continuous assessment. Final evaluation is based on the proportion of the credit awarded for the respective component.

- **Lab (L) -** Practical Courses taught in a designated lab. This may be offered when conceptual learning has to be augmented by practical experiments and also to bring focus on acquiring skills through doing. Such courses shall be offered only if sufficient laboratory facilities are available to conduct such courses.

- **Field Study (FS) -** Offered as a special / curriculum-enriching component to understand certain practical issues / work practices / hands-on training / immersion project / market survey. Field Study, if it forms a part of the course, then credit(s) shall be assigned accordingly. Otherwise, such course(s) may be specified in the Grade Sheet without grades.

- **Certification (Cer)** - Industry-driven course shall be offered, jointly with an industry that would result in learning the emerging trends / employment potential topics / solving real-time problems. The contents of the course shall be jointly designed by an industry expert and a suitable faculty member, with relevant assessment and evaluation. Hybrid / Online learning options shall be available. Students are permitted to complete these courses through MOOCs / Professional Certification and credit equivalence (Programme Elective or Open Elective), to maximum of 6 credits.

- **In-House Projects (J) -** Capstone Project shall be offered once a student completes >95% of the core courses related to the Diploma programme. 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 by the students from the relevant Department for successful completion. Capstone Project may be offered in phases, i.e. Phase I and Phase II (single topic or two different topics). Students are encouraged to submit the softcopy of the complete report for evaluation and abstract in the printed form during the final presentation.

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

- **Boot Camp (B) -** 2 to 5 days 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 programme. 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 programme or may re-do the same course whenever offered.

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

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

- **Audit Courses** are optionally registered by a student to understand certain basic / advanced concepts in his / her own discipline or other disciplines offered by the college. In this case, if a student 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".

2 (d) 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

2 (e) - Curriculum Structure

Every programme shall have a distinct curriculum with syllabi consisting of courses broadly categorized under Basic Sciences, Basic Engineering, Professional Core, Programme 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 Board of Studies.

Category	**Credit Range**
Humanities and Social Sciences	11-17
Basic Science Courses	15-20
Engineering Sciences	6-13
Programme Core	40-51
Programme Elective	9-12
Open Elective	6-10
Industrial Training / Project Work	10-15
Health & Wellness	0 – 1
Audit course	0

Integrated Learning Experiences	
Induction Programme	Non-Credit Course
I&E / Club Activity / Community Initiatives	Non-Credit Course
Shop Floor Immersion	Non-Credit Course
Student-Led Initiative	Non-Credit Course
Special Interest Groups (Placement Training)	Non-Credit Course
Emerging Technology Seminars	Non-Credit Course

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

1. **Basic Sciences:** This course is common to all programmes 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 programme, which are major courses of the discipline, are required to attain desired outcomes and to ignite critical thinking skills amongst students.

4. **Programme 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 programme of study or nurtures the student's proficiency / skill.

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

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

9. **In-House Project / Internships / Fellowships:** Every student must do one major project in the Final year of their programme. 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.

2 (f) - Outcome-Based Education

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

All the programmes 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 Programme Outcomes (POs) of the respective programme 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 programme 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 programme. They form the Programme 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 programme 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 programme outcomes.

5. For each PO, the skills and competencies implied generally require a different assessment methodology. This helps us to create a shared understanding of the competencies that students want to achieve.

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

7. Revised Bloom's Taxonomy for Assessment Design: It attempts to divide learning into three types of domains (cognitive. affective, and behavioural) and then defines the level of performance for each domain. Conscious efforts to map the curriculum and assessment to these levels can help the programmes 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 correlation respectively. This also ensures that every PO is covered across the courses offered as a part of the programme. The matrix will be adopted for all the courses run by the department.

9. The attainment of COs of any course can be assessed from the performance of the students through continuous and final assessments. The goal of continuous assessment is to understand / realise the critical information about student comprehension throughout the learning process and provides an opportunity for the facilitator to

   improve their pedagogical approach and for students to improve learning outcomes. The goal of the final assessment is to evaluate student learning outcomes at the end of the course instruction. According to the new regulation, 40% weightage is for the continuous assessment, and 60% weightage is for the final assessment.

10. The 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 as not to have the POs themselves as direct questions.

11. Each PO attainment corresponding to a specific course can be determined from the attainment values obtained for each course outcome related to that PO and the CO-PO mapping values. The threshold value of 60%, shall be set for the POs and the same can be modified with due approval of the Authorities.

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

3. 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

3 (a) - Break of Study

If a student intends to take a break / temporarily discontinue the programme 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 programme in the next academic year, student shall intimate stating the reasons.

Break of study is permitted only once during the entire period of the dipolma programme for a maximum period of one year. The student is permitted to re-join the programme after the break and shall be governed by the rules and regulations in force, at the time of re-joining. 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.

3 (b) - Course Add / Drop

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

3 (c) - 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 programme core/ programme elective / open elective – Global)

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

(iii) Credits accumulated through Capsule courses, One-Credit courses

Such courses and credits earned shall be presented in the Board comprising the Principal, the Head of the department and committee member along with the Equivalent Credit(s).

3 (d) - 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 programme electives) shall be considered as "Transferred Credits" (specified in the Grade Sheet) and considered for the calculation of CGPA.

3 (e) - 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 programme. 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 / Chairman 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 programme 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.

3 (f) - Fast-Track

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

(i) 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.

3 (g) - Flexi-Credit System

It offers a student to earn additional credits than that specified (minimum credits) to a programme 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.

3 (h) - Bridge Course

This is specifically designed for Lateral Entry (LE) students who join the Diploma Programme 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 programme specific to the department concerned.

4. Integrated Learning Experience

Integrated learning experiences encompasses 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' programme of study. It prioritizes the holistic development of students, fostering their growth and well roundedness.

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

4 (a) - Innovation Track

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

4 (b) - Peer to 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, understanding of societal needs, project management and life-long learning activities.

4 (c) - Growth Lab

Growth lab plays an integral role to stimulate and develop a student's personality & skills in various fields of life. It also teaches about a growth mind-set 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.

4 (d) - Shop Floor Immersion

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

4 (e) - Induction Programme

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

4 (f) - 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.

4 (g) - 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

4 (h) - 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.

4 (i) - Emerging Technology 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.

4 (j) - 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.

4.(k) - 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.

A student is ordinarily expected to complete the Diploma programme in 6 semesters (for SSLC students) and four semesters (for Lateral Entry students) but in any case, not more than 12.

5. Duration of the Programme

Semesters for SSLC (or equivalent) students and not more than 10 semesters for Lateral Entry students.

- Each semester shall normally consist of 16 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 programme 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 dipolma. The minimum and maximum period of study shall be:

Diploma programme	**Min. Period**	**Max. Period**
Full Time	3 Years	6 Years
Full Time [Lateral Entry]	2 Years	5 Years

6. Attendance Requirements

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

- Ideally every student is expected to attend all classes of all the courses and secure 100% attendance.
- However, in order to make provision for certain unavoidable reasons such as medical / participation in sports, the student is expected to attend at least 75% of the classes.

- Therefore, the student shall secure not less than 75% (after rounding off to the nearest integer) of overall attendance for each semester.

- However, a student who secures overall attendance between 65% and 74% in the current semester due to medical reasons (prolonged hospitalization / accident / specific illness) / participation in sports events may be permitted to appear for the current semester examinations, subject to the condition that the student shall submit the medical certificate / sports participation certificate attested by the Head of the Institution.

- Students who secure less than 65% overall attendance shall not be permitted to write the end semester examination and not permitted to move to the next semester. They are required to repeat the incomplete semester in the next academic year, as per the norms prescribed.
- Students 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 programme of study. For such students by default, the classification of class shall be second class on successful passing of course.

7. Class Committee

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

- Solving problems experienced by students in the classroom and in the laboratories.
  Clarifying the regulations of the diploma programme and the details of rules therein.

- Informing the student representatives, the academic schedule including the dates of assessments and the syllabus coverage for each assessment.

- Informing the student representatives, the details of regulations regarding weightage used for each assessment. In the case of practical courses (laboratory / drawing / project work / seminar etc.) the breakup of marks for each experiment / exercise / module of work, should be clearly discussed in the class committee meeting and informed to the students.

- Analysing the performance of the students of the class after each test and finding the ways and means of solving problems, if any.

- Identifying the slow learners, if any, and requesting the faculty concerned to provide some additional help or guidance or coaching to such students.

- The class committee for a class under a particular branch is normally constituted by the Head of the Department. However, if the students of different branches are mixed in a class (like the first semester which is generally common to all branches), the class committee is to be constituted by the Head of the Institution.

- The class committee shall be constituted within the first week of each semester. At least 4 student representatives 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.

7 (a) - 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).

8. Assessment and Examination

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

8.(a) Continuous Assessment [40%]:

- 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 the respective syllabi.
- For one credit courses and Advanced Skill Certification programmes, no end semester examination shall be conducted, and final grade will be awarded based on continuous assessment for 100 marks.
- Continuous assessment shall be carried out for 40 marks as mentioned below.
- Table for theory papers and practicum papers with end exam theory.

ASSESSMENT FOR THEORY PAPERS				
Assessment	**Duration**	**Portions covered**	**Mark allocation**	**Reduced to**
CAT 1	2 Periods	UNITS I &II	30 Marks 1 Mark Questions (10) ->10Marks 10 Mark Questions (2out of 4) ->20 Marks	15 Marks
CAT 2	2 Periods	UNITS III & IV	30 Marks 1 Mark Questions (10) ->10Marks 10 Mark Questions (2out of 4) ->20 Marks	15 Marks
CAT 3 (OR) SEMINAR	1 Period	UNIT V	15 1 Mark Questions (5) -> 5Marks 10 Mark Questions (1out of 2) ->10Marks	10 Marks
	During the semester	Subject/General		
Total				40 Marks

ASSESSMENT FOR PRACTICUM PAPERS WITH END EXAM INATION THEORY				
Assessment	**Duration**	**Portions covered**	**Mark allocation**	**Reduced to**
CAT 1	2 Periods	UNITS I &II	30 Marks 1 Mark Questions (10) ->10Marks 10 Mark Questions (2out of 4) ->20 Marks	15 Marks
		UNITS I &II and Activity	30 Marks Theory ->18 Marks Activity ->12 Marks	
CAT 2	2 Periods	UNITS III & IV	30 Marks 1 Mark Questions (10) ->10Marks 10 Mark Questions (2out of 4) ->20 Marks	15 Marks
		UNITS III & IV and Activity	30 Marks Theory ->18 Marks Activity ->12 Marks	
PRACTICALS (OR) CAT 3	2 Periods	All Experiments	60 Marks	10 Marks
	1 Period	UNIT V And Activity	15 Marks Theory ->10 Marks Activity ->5 Marks	
Total				40 Marks

- For practical papers and practicum papers with end exam practicals, continuous assessment shall be carried out for 40 marks. Each department is given flexibility to determine and implement its own assessment pattern for 40 marks based on the nature and requirements of their respective courses.

8.(b) End Semester Examination [60%]:

- The End Semester Examination will be conducted for 60 marks.
- The End Semester Examinations (Theory, Practical, Project) will be conducted for a duration of 150 minutes.
- For theory papers and practicum papers with end examination theory, the question paper will consist of two parts – Part (A) and Part (B). Part (A) carries a total of 30 marks and will have Multiple Choice Questions (MCQs), True or False questions, Match the following, Image based Multiple Choice Questions covering all the five units. Part (B) carries a total of 30 marks and students are required to answer 3 questions out of 6 questions. The six questions will be distributed across five units with each unit contributing at least one question and no unit can have more than two questions.
- 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 Institution.
- Every practical exercise/experiment shall be evaluated based on conduct of exercise / experiment and records to be maintained. The students shall submit a record work duly completed and signed by faculty in charge and the Head of the Department.
- For the Final Year project work (in-house / Industry), the Department will constitute a three-member committee consisting of head of the department, internal guide & external expert from industry to monitor the progress of the project (online/offline) and conduct reviews regularly.
- 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 (40 Marks)			**End Semester (60 Marks)**		
Review 1 (10 Marks)	Review 2 (15 Marks)	Review 3 (15 marks)	Record / report writing (20 Marks)	Presentation (20 Marks)	Viva Voce (20 Marks)
Committee: 10 Marks	Committee: 15 Marks	Committee: 15 Marks	Examiners:20	Examiners:20	Examiners: 20

- 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 one month. For those students who extend the project work for one month, 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.

9. Pass Requirement for Award of Diploma

- A student who secures not less than 40% of total marks prescribed for the course [Internal Assessment + End semester Examinations] with a minimum of 40% of the marks prescribed for the end semester examination (Minimum Marks to be secured in end semester exam is 24 marks out of 60 marks for Theory Papers) shall be declared to have passed the course and acquired the relevant number of credits. This is applicable for theory subjects.

- A student who secures not less than 50% of total marks prescribed for the course [Internal Assessment + End semester Examinations] with a minimum of 50% of the marks prescribed for the end semester examination (Minimum Marks to be secured in end semester exam is 30 marks out of 60 marks for Practical Papers), shall be declared to have passed the course and acquired the relevant number of credits. This is applicable for practical subjects.

- No Minimum marks for continuous assessment (Internal).

- If a student fails to secure a pass in a theory course / laboratory course / 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, if a supplementary 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 40% marks in theory examinations and 50% marks in Practical while appearing in the supplementary examinations.

- 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 be considered as supplementary student, and she should reappear for the next examination.

- A student can apply for getting the copy of her manuscripts of semester examination (theory course only), as per the guidelines of the Autonomous Examinations cell (AE) on payment of a prescribed fee along with prescribed application through the Head of the Institution.

- A student can apply for revaluation directly or after getting the copy of her manuscripts of semester examination (theory course only), as per the guidelines of the Autonomous Examinations cell (AE) on payment of a prescribed fee along with prescribed application through respective department and the Head of the Institution.

- The AE cell will arrange for the revaluation process and the results will be intimated to the student concerned through Notice Board. Revaluation is not permitted for laboratory courses and projects.

10. Award of Grades

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

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

MP (Malpractice)	-	-
WH (withheld)	-	-
W (Withdrawal)	-	-
AB (Absent)	-	-

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: 'S', 'A', 'B', 'C', 'D', 'E'.

'SA' denotes shortage of attendance and hence prevents students from writing the end semester examinations.

"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 in the Grade 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 fulfil 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 Institution. 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 Head of the respective departments and Chairman. The grades S, A, B, C, D, E 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.

10 (a) - Grade Sheet

After results are declared, Grade Sheets will be issued to each student which will contain the following details: The college in which the student has studied, the list of courses registered during the semester and the grade scored. The Grade Point Average (GPA) for the semester and the Cumulative Grade Point Average (CGPA) of all courses enrolled from the first semester onwards. GPA for a semester is

the ratio of the sum of the products of the number of credits acquired for courses and the corresponding points to the sum of the number of credits acquired for the courses in the semester. CGPA will be calculated in a similar manner, considering all the courses registered from the first semester. RA grades will be excluded for calculating GPA and CGPA.

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

where, C_i is the number of Credits assigned to the course, GP_i is the point corresponding to the grade obtained for each course and 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.

11. 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 programme 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 autonomous examination council whenever the student is readmitted under Regulations 2024 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 Autonomous Examinations Council.

12. Classification of Diploma Awarded

12 (a) - 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 programme

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- year period (three years in the case of lateral entry) for award of First class with Distinction.

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

12 (b) - 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 programme shall be extended upto 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.

12.(c) - SECOND CLASS: All other students who qualify for the award of the degree shall be declared to have passed the examination in Second Class.

13. Discipline

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

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

In case of any serious disciplinary action which leads to suspension or dismissal, then a committee shall be constituted. If a student indulges in malpractice in any of the end semester examinations, student shall be liable for punitive action as prescribed by the Autonomous Examination Council 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.

14. Revision of Regulation, Curriculum and Syllabi

The Autonomous board 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.

DIPLOMA IN ELECTRONICS AND COMMUNICATION ENGINEERING

SYLLABUS

(WITH EFFECT FROM JUNE 2025)

H- SCHEME

DR. DHARMAMBAL GOVERNMENT POLYTECHNIC COLLEGE FOR WOMEN, THARAMANI, CHENNAI –600113.

H Scheme
Program Structure

Diploma in Electronics and Communication Engineering

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Diploma in Electronics and Communication Engineering curriculum is designed to prepare the graduates to acquire knowledge, skills and attitudes in order to:

PEO 1: Electronics and Communication Engineering diploma graduates after 3-5 years of graduation will be equipped to compete globally and build successful careers in Electronics and Communication Engineering and related fields.

PEO 2: Electronics and Communication Engineering diploma graduates after 3-5 years of graduation will pursue higher education and continuously enhance their professional knowledge and technical skills to adapt to evolving technologies.

PEO 3: Electronics and Communication Engineering diploma graduates after 3-5 years of graduation will demonstrate effective communication, ethical conduct, and professionalism while working collaboratively in multidisciplinary and diverse team environments.

PROGRAM OUTCOMES (POs)

POs are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, analytical ability, attitude, and behavior that students acquire through the program.

The POs essentially indicate what the students can do from subject-wise knowledge acquired by them during the program. As such, POs define the professional profile of an engineering diploma graduate.

NBA has defined the following seven POs for an Engineering diploma graduate:

PO1: Basic and Discipline-specific knowledge: Apply knowledge of basic mathematics, science and engineering fundamentals and an engineering specialization to solve the engineering problems.

PO2: Problem analysis: Identify and analyse well-defined engineering problems using codified standard methods.

PO3: Design/ development of solutions: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

PO4: Engineering Tools, Experimentation, and Testing: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

PO5: Engineering practices for society, sustainability and environment: Apply appropriate technology in the context of society, sustainability, environment and ethical practices.

PO6: Project Management: Use engineering management principles individually, as a team member or as a leader to manage projects and effectively communicate about well-defined engineering activities.

PO7: Life-long learning: Ability to analyze individual needs and engage in updating in the context of technological changes.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Electronic Circuit Design and Application

"Design and develop basic electronic circuits using appropriate components, and apply them to build and test systems for real-time applications."

PSO2: Communication System Implementation

"Implement and operate basic wired and wireless communication systems, and perform standard tests to ensure proper signal transmission and reception."

PSO3: System Simulation and Cloud-Based Applications

"Simulate basic electronic systems using microcontrollers and simulation tools, and apply cloud-based platforms for simple remote monitoring and control tasks."

PEOs – POs & PSOs MAPPING

PEO	PO							PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**1**	**2**	**3**
1	1	1	1	1	2	1	1	3	1	1
2	2	2	2	2	-	-	2	3	2	2
3	1	1	1	2	-	-	-	-	3	3

Credit Distribution

S.NO	COURSE CATEGORY	CREDITS
1	Program Core	50
2	Open Elective	6
3	Program Elective	10
4	Humanities & Social science	2
5	Audit Course (Health & Wellness)	1
6	Project/ Internship /Industrial Training	10
7	Project / Internship (Summer Vacation)	1

Semester	No of Courses	Periods	Credits
III Semester	7	640	21
IV Semester	7	640	21
V Semester	8	640	23
VI Semester	3	405/555	15
		Total	**80**

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

H-SCHEME CURRICULUM OUTLINE

III SEMESTER

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	ECH301	Electronic Devices and Circuits	4-0-0	60	4	Theory
2	Program Core	Theory	ECH302	Digital Electronics	4-0-0	60	4	Theory
3	Program Core	Practicum	ECH371	Electrical Circuits, Machines and E-vehicle	1-0-4	75	3	Practical
4	Program Core	Practicum	ECH372	C programming	1-0-4	75	3	Practical
5	Program Core	Practical	ECH373	Electronic Devices and Circuits Lab	0-0-4	60	2	Practical
6	Program Core	Practical	ECH374	Digital Electronics Lab	0-0-4	60	2	Practical
7	Open Elective	Advanced Skill Certification	ASH393	Advanced Skills Certification-3	2-0-2	60	2	NA
8	Humanities & Social Science	Integrated Learning Experience		Growth Lab	-	30	0	-
9	Audit Course	Integrated Learning Experience		Induction Program–II	-	16	0	-
10	Audit Course	Integrated Learning Experience		I&E/ Club Activity / Community Initiatives	-	16	0	-
11	Audit Course	Integrated Learning Experience		Emerging Technology Seminars	-	8	0	-
12	Audit Course	Integrated Learning Experience		Shop floor Immersion	-	8	0	-
13	Audit Course	Integrated Learning Experience		Health & Wellness	0-0-1	30	1	NA
14	Audit Course	Integrated Learning Experience		Student-Led Initiative	-	15	0	-
				Test &Revision/Seminar		52		
				Library		15		
				Total		**640**	**21**	

Note: *Test -10 hours for each theory Subject

Semester IV

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	ECH401	Analog Electronics	4-0-0	60	4	Theory
2	Program Core	Theory	ECH402	Measurements and Instrumentation	4-0-0	60	4	Theory
3	Program Core	Practicum	ECH471	Communication Engineering – I	1-0-4	75	3	Practical
4	Program Core	Practicum	ECH472	8051 Microcontroller and Embedded Systems	1-0-S4	75	3	Practical
5	Program Core	Practical	ECH473	Analog Electronics Lab	0-0-4	60	2	Practical
6	Program Core	Practical	ECH474	Arduino Programming, IoT with Mini-project	0-0-6	90	3	Practical
7	Open Elective	Advanced Skill Certification	ASH494	Advanced Skills Certification–4	2-0-2	60	2	NA
9	Audit Course	Integrated Learning Experience		I&E/Club Activity/Community Initiatives	-	15	0	-
10	Audit Course	Integrated Learning Experience		Special Interest groups *(Placement training)*	-	30	0	-
11	Audit Course	Integrated Learning Experience		Emerging technology seminars	-	8	0	-
12	Audit Course	Integrated Learning Experience		Shop Floor Immersion	-	8	0	-
13	Audit Course	Integrated Learning Experience		Health & Wellness	-	30	0	-
14	Audit Course	Integrated Learning Experience		Student Led Initiative	-	24	0	-
				Test & Revision/Seminar		30		
				Library		15		
				Total		**640**	**21**	

Note: *Test -10 hours for each theory Subject

Semester V

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	ECH501	Communication Systems	4-0-0	60	4	Theory
2	Program Core	Theory	ECH502	Industrial Electronics and Medical Electronics, PLC and Robotics	4-0-0	60	4	Theory
3	Program Elective	Practicum	*ECH58X	ELECTIVE I	1-0-4	75	3	Practical
4	Program Core	Practicum	ECH571	Implementation of AI using Python	1-0-4	75	3	Practical
5	Program Elective	Practical	*ECH58X	ELECTIVE II	0-0-4	60	2	Practical
6	Program Core	Practical	ECH572	Computer Networking Lab	0-0-2	30	1	Practical
7	Program Core	Practical	ECH573	Communication Systems Lab	0-0-2	30	1	Practical
8	Humanities & Social Science	Practicum	ECH574	Innovation and startup	1-0-2	45	2	Project
9	Project/Internship	Internship	ECH575	Internship (Summer vacation – 45 hours) with Mini-project	-	-	1	project
10	Open Elective	Practicum	ASH595	Advanced Skills Certification - 5	2-0-2	60	2	NA
11	Audit Course	Integrated Learning Experience		Induction program III	-	30	0	-
12	Audit Course	Integrated Learning Experience		Special Interest Groups (Placement Training)	-	30	0	-
13	Audit Course	Integrated Learning Experience		Health & Wellness	-	30	0	-
14	Audit Course	Integrated Learning Experience		Student-Led Initiative	-	15	0	-
	Test & Revision					25		
	Library					15		
	Total					**640**	**23**	

Note: ** 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*

Elective 1

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Elective	Practicum	*ECH581	Signals & Systems and Image Processing	1-0-4	75	3	Practical
2	Program Elective	Practicum	*ECH582	Consumer Electronics	1-0-4	75	3	Practical
3	Program Elective	Practicum0	*ECH583	Power Electronic Devices	1-0-4	75	3	Practical
4	Program Elective	Practicum	*ECH584	Wireless Communication	1-0-4	75	3	Practical

Elective 2

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Elective	Practical	*ECH585	Embedded Systems with Raspberry Pi PICO Lab	0-0-4	60	2	Practical
2	Program Elective	Practical	*ECH586	PLC and Robotics Lab	0-0-4	60	2	Practical
3	Program Elective	Practical	*ECH587	Very Large-Scale Integration Lab	0-0-4	60	2	Practical
4	Program Elective	Practical	*ECH588	Computer Aided Design Simulation Lab	0-0-4	60	2	Practical

Semester VI

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Elective	THEORY	*ECH68X	Elective 3 (Pathways)	3-0-0	45	3	Theory
2	Program Elective	PRACTICAL	*ECH68X	Elective-4 (Specialization)	0-0-4	60	2	Practical
3	Project / Internship	Project	ECH67X	Internship or Industrial Training / Fellowship / In-house Project	0-0-20	300 /450	10	Project
	Test &Revision/Seminar					**40**	15	
				TOTAL		**405/555**		
3	Project / Internship	Project / Internship	ECH671	In-house Project	-	450	10	Project
	Project / Internship	Project / Internship	ECH672	Internship or Industrial Training	-	300	10	Project
	Project / Internship	Project / Internship	ECH673	Fellowship	-	300	10	Project

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

Elective 3 (Pathway)

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Elective - Higher Education	Theory	*ECH681	Advanced Engineering Mathematics	3-0-0	45	3	Theory
2	Program Elective	Theory	*ECH682	Machine Learning and Deep Learning	3-0-0	45	3	Theory
3	Program Elective	Theory	*ECH683	Unmanned Aerial Vehicle / Automated Vehicle	3-0-0	45	3	Theory
4	Program Elective	Theory	*ECH684	Biomedical Instrumentation	3-0-0	45	3	Theory
5	Program Elective	Theory	*ECH685	E-Vehicle	3-0-0	45	3	Theory
6	Program Elective	Theory	*ECH686	Data communication and Networking	3-0-0	45	3	Theory
7	Program Elective	Theory	*ECH687	$ Online Elective Course *	3-0-0	45	3	Theory

$ Online Courses with the same credit available in AICTE / SWAYAM and reputed Institutions with proper evaluation system and certification can be considered after proper approval from the Chairman, Board of Examinations.

Elective 4 (Specialization)

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Special Course	Practical	*ECH688	Multimedia / App designing Lab	0-0-4	60	2	Practical
2	Program Special Course	Practical	*ECH689	PCB Design and Assembly Lab	0-0-4	60	2	Practical
3	Program Special Course	Practical	*ECH68A	Industrial IoT Lab	0-0-4	60	2	Practical
4	Program Special Course	Practical	*ECH68B	Virtual Instrumentation Lab	0-0-4	60	2	Practical
5	Program Special Course	Practical	*ECH68C	Paper presentation through conference/ Journal or other equivalent system	0-0-4	60	2	Practical

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING-CORE COURSES

COURSE CODE	COURSE NAME	THEORY	PR/TU	DRAWING	CONTACT HOURS
ECH301	ELECTRONIC DEVICES AND CIRCUITS	4	-	-	4
ECH302	DIGITAL ELECTRONICS	4	-	-	4
ECH401	ANALOG ELECTRONICS	4	-	-	4
ECH471	COMMUNICATION ENGINEERING I	1	4	-	5
*ECH581	*SIGNALS & SYSTEMS AND IMAGE PROCESSING	3	2		5
*ECH587	* VERY LARGE-SCALE INTEGRATION LAB	-	4	-	4
ECH373	ELECTRONIC DEVICES AND CIRCUITS LAB	-	4	-	4
ECH374	DIGITAL ELECTRONICS LAB	-	4	-	4
ECH473	ANALOG CIRCUITS LAB	-	4	-	4
ECH501	COMMUNICATION SYSTEMS	4	-	-	4
ECH502	INDUSTRIAL ELECTRONICS AND MEDICAL ELECTRONICS, PLC AND ROBOTICS	4	-	-	4
ECH573	COMMUNICATION SYSTEM LAB	-	2	-	2
*ECH584	*WIRELESS COMMUNICATION	3	2	-	5
*ECH689	*PCB DESIGN AND ASSEMBLY LAB	-	6	-	6
	TOTAL	27	32		59

* Elective courses

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

APPLIED COURSES

COURSE CODE	COURSE NAME	THEORY	PR/TU	DRAWING	CONTACT HOURS
ECH371	ELECTRIC CIRCUITS, MACHINES AND E-VEHICLE	1	4	-	5
ECH401	MEASUREMENTS AND INSTRUMENTATION	4	-	-	4
ECH472	8051 MICROCONTROLLERS AND EMBEDDED SYSTEMS	1	4	-	5
ECH474	ARDUINO PROGRAMMING, IoT WITH MINI PROJECT	-	6		6
ECH67X	PROJECT/Internship	-	20	-	20
*ECH582	*CONSUMER ELECTRONICS	3	2		5
*ECH583	*POWER ELECTRONIC DEVICES	3	2	-	5
*ECH585	*EMBEDDED SYSTEMS WITH RASPBERRY PI PICO LAB	-	4	-	4
*ECH586	*PLC AND ROBOTICS LAB	-	4	-	4
*ECH683	*UNMANNED AERIAL VEHICLE/ AUTOMATED VEHICLE	3	-	-	3
*ECH68A	*INDUSTRIAL IoT LAB	-	6	-	6
*ECH68B	*VIRTUAL INSTRUMENTATION LAB	-	6	-	6
*ECH588	*COMPUTER AIDED DESIGN SIMULATION LAB	-	6	-	6
	TOTAL	15	64		79

* Elective courses

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

DIVERSIFIED COURSES

COURSE CODE	COURSE NAME	THEORY	PR/TU	DRAWING	CONTACT HOURS
ECH372	C PROGRAMMING	1	4	-	5
ECH572	COMPUTER NETWORKING LAB	-	2	-	2
ECH571	IMPLEMENTATION OF AI USING PYTHON	1	4	-	5
*ECH681	*ADVANCED ENGINEERING MATHEMATICS	3	-	-	3
*ECH682	*MACHINE LEARNING AND DEEP LEARNING	3	-	-	3
*ECH684	*BIOMEDICAL INSTRUMENTATION	3	-	-	3
*ECH685	*E-VEHICLE	3	-	-	3
*ECH686	*DATE COMMNUCATION AND NETWORKING	-	4	-	4
*ECH688	*MULTIMEDIA / APP DESIGNING LAB	-	6	-	6
	TOTAL	14	20		34

* Elective courses

DEPARTMENT OFELECTRONICS AND COMMUNICATION ENGINEERING

DISCIPLINE WISE TASK FORCE MEETING HELD ON 28.10.2024

EXTERNAL EXPERTS

Dr. P. SIVASANKAR, M.E., Ph.D,
Professor & HOD
Department of Electronics and Communication Engineering,
NITTTR,Chennai

Mr. P. VIMAL LAXMAN, B.E.,
Scientist.E,
C-DAC,8th Floor,Dsouth & North block,
TIDEL Park ltd,Tharamani,Chennai.

Dr. T.V. NARMADHA, (Alumni) Ph.d.,
Professor,
Department of Electrical and Electronics Engineering,
St.Joseph's College of Engineering.

Ms. M. NANDHINI, (Alumni), DECE,
Project Assistant,
EMI & EMC division,
Sameer,Tharamani,Chennai.

Mrs. M.J. ANITHA, M.E.,
HOD,Dept.of ECE,
Central Polytechnic College,
Chennai-113.

Mr. SRINIVAS ACHARY, B.E.,
Staff Engineer,
Aerlync Labs,
India Pvt.Ltd,
Chennai.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

APEX BODY MEETING HELD ON 11.11.2024

EXTERNAL EXPERTS

Dr. J. SAMINATHAN, M.E, Ph.D.,

Assistant Professor,

Department of BME,

SRM-IST,

Ramapuram, Chennai-89.

THIRU.P. ALAGAPPAN, M.E.,

Managing Director,

Vasee Electronics, Saligramam,

Chennai-600093.

L. PUNITHA, M.Tech.,

Scientist,

SAMEER,

Centre for Electromagnetics, Chennai.

Dr. E.M. SRINIVASAN, Ph.D.

Principal,

Central Polytechnic College,

Chennai-113.

V.G. DISMITHA, DECE.,

Associate Instrumentation Designer,

MCDermott

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

INTERNAL EXPERTS

TMT.HEPZHIBA ANGELA DURAIRAJ, M. Tech.,
Principal,
DDGPCW, Chennai-113.

Dr. K. SUDHAMATHI, M.E, Ph.D.,
HOD /ECE,
DDGPCW, Chennai-113.

Mr. N. KARTHIK, M.E.,
Lecturer /ECE,
DDGPCW, Chennai-113.

Mrs. N. AISWARYA, M.E.,
Lecturer /ECE,
SDDGPCW, Chennai-113.

Mrs. A. JENETA MAGDALENE, B.E.,
Lecturer /ECE,
DDGPCW, Chennai-113.

Mrs. K. SABARI, M.E.,
Lecturer /ECE,
DDGPCW, Chennai-113.

Mr. PS. Vikas, M.E., From 20.12.2024 onwards
Lecturer/ECE,
DDGPCW, Chennai-113.

Mrs. M. SASIKALA, M.E., From 13.2.2025 onwards
Lecturer/ECE,
DDGPCW, Chennai-113.

III Semester

S. No.	Course code	Course Title	Mode	End - exam	Credits	Hours per week	Total hours
1	ECH301	Electronic Devices and Circuits	Theory	Theory	4	4-0-0	60
2	ECH302	Digital Electronics	Theory	Theory	4	4-0-0	60
3	ECH371	Electric Circuits, Machines and E-Vehicles	Practicum	Practical	3	1-0-4	75
4	ECH372	C Programming	Practicum	Practical	3	1-0-4	75
5	ECH373	Electronic Devices and Circuits Lab	Practical	Practical	2	0-0-4	60
6	ECH374	Digital Electronics Lab	Practical	Practical	2	0-0-4	60
7	ASH393	Advanced Skills Certification - 3	-	-	2	0-0-2	60
		Health and Well ness			1	0-0-2	30
					21		480

ECH301	Electronic Devices and Circuits	L	T	P	C
Theory		4	0	0	4

Introduction:

This course provides fundamental knowledge on rectifiers, transistors and amplifiers which is vital for Telecommunications and Consumer Electronics. It equips students with essential skills in circuit design, analysis and troubleshooting, thus, preparing them for real-world engineering challenges.

Course Objectives:

- Understand the principles and applications of rectifiers and optoelectronic devices in electronic circuits.
- Examine the construction and operation of wave-shaping circuits such as clippers and clampers.
- Analyze the construction, working principles and characteristics of Bipolar Junction Transistors (BJTs), Field-Effect Transistors (FETs), and Uni-Junction Transistors (UJTs).
- Explore the structure, operation, and applications of various semiconductor devices including diodes, transistors, thyristors, and optoelectronic components.

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the fundamental concepts and principles of electronic devices and circuits.	
CO1	Apply the basic knowledge of electronic devices and circuits to obtain the desired parameter.	PO1
CO2	Analyze the characteristics of semiconductor and optoelectronic devices in electronic circuits to arrive at a suitable conclusion.	PO2
CO3	Design electronic circuits using appropriate electronic devices to meet specific requirements.	PO3
CO4	Demonstrate practical understanding of electronic devices and circuits through seminar/assignments emphasizing their applications in different fields.	PO1, PO6, PO7

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	3	-	-
CO2	-	2	-	-	-	-	-			
CO3	-	-	1	-	-	-	-			
CO4	-	-	-	-	-	1	1			
CAM	3	2	1	-	-	1	1			

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

Pre-requisites:

Basics of electronics.

Instructional Strategy:

- **Engage and Motivate:**
  Instructors should actively engage students by connecting theoretical concepts to real-life applications, encouraging curiosity and confidence in learning.
- **Concept Visualization:**
  Use circuit diagrams, block diagrams, animations, and multimedia tools to help students visualize the internal operation and behavior of electronic components and devices.
- **Step-by-Step Explanation:**
  Introduce topics progressively from basic to advanced levels, reinforcing prerequisite knowledge and ensuring clarity of core principles.
- **Encourage Critical Thinking:**
  Promote classroom discussions that require students to analyze circuit behavior, compare device characteristics, and predict outcomes under different configurations.
- **Real-World Relevance:**
  Illustrate how the theoretical concepts apply to real-world electronics, such as mobile phones, LED lighting, or solar panels to enhance contextual understanding.
- **Interactive Questioning and Feedback:**
  Regularly use questioning techniques, short quizzes, or peer discussions to assess understanding and address misconceptions promptly.

ECH301	ELECTRONIC DEVICES AND CIRCUITS	L	T	P	C
THEORY		4	0	4	4

Unit I	ELECTRONIC COMPONENTS	
Introduction - Electronic components classification - active & passive components - resistors - types (names) & applications of resistors - Capacitors - types (names) - Capacitors in series - capacitors in parallel (no numerical) - Inductors - types (names) - Inductors in series - Inductors in parallel (no numerical) - Switches - Switch function - types - SPDT (definition) - Electromagnetic switches - Relay - Principle of operation - MEMS - Applications		12

Unit II	SEMICONDUCTOR DIODES	
Review of semiconductors & PN junction diode (not for examination) - Rectifier classification - half wave rectifier - full wave rectifier - center tapped - bridge (no mathematical equations) - comparison - Applications. Filters - LC and PI filters - Clipper - Types - Positive clipper - Negative Clipper - Clampers - Types - Positive clamper - Negative clamper. Special purpose diodes: Types (names only) - Working and characteristics of Zener diode - Zener diode as Voltage regulator - LED		12

Unit III	BJT AND UJT	
BJT: Transistor action - PNP & NPN transistor - transistor circuit configurations: common base - common emitter - common collector - BJT as amplifier - BJT as a switch **BIASING:** Need for biasing - thermal run away - Biasing Types (names Only) - Voltage divider bias (operation only) **UJT:** Construction, operation, characteristics and applications.		12

Unit IV	FET	
FET: Introduction - Construction, operation and characteristics of JFET - Construction, operation and characteristics of MOSFET in Depletion mode - Comparison of FET and BJT - Comparison of FET and MOSFET **FET APPLICATIONS:** Common source amplifier.		12

Unit V	THYRISTORS & OPTOELECTRONIC DEVICES	
SCR: Constructional details - principle of operation - transistor analogy - applications. DIAC and TRIAC: construction - operation - characteristics - applications. Opto- electronic devices: Principle of working, characteristics of photo diodes - solar panel – Optocoupler - LCD - seven segment display		12
TOTAL		**60**

Text Books

- R.S. Sedha, *A Textbook of Applied Electronics*, 3rd Edition, S. Chand Publications, 2012.
- Thomas L. Floyd, *Electronic Devices*, 10th Edition, Pearson Education, 2018.
- Robert L. Boylestad & Louis Nashelsky, *Electronic Devices and Circuit Theory*, 10th Edition, Prentice Hall of India (PHI), 2009.

Suggested links for Students activities:

https://www.allaboutcircuits.com/
https://www.electronics-tutorials.ws/
https://circuitverse.org/
https://www.learnabout-electronics.org/
https://www.khanacademy.org/science/electrical-engineering
https://nptel.ac.in/course.html
https://www.ti.com/tool/TINA-TI

ECH302	DIGITAL ELECTRONICS	L	T	P	C
THEORY		4	0	4	4

Introduction:

This course introduces the fundamentals of digital electronics, focusing on switching algebra, logic gates, combinational and sequential circuits, memory devices, and an introduction to VLSI concepts. Students will learn how to design, analyze, and implement digital systems using logic gates, flip-flops, counters, and VHDL programming.

Course Objectives:

- Understand number systems, logic gates, and Boolean algebra used in digital system design.
- Analyze, design, and implement combinational and sequential digital circuits.
- Acquire knowledge of memory types, counters, and their practical applications in digital electronics.
- Comprehend the fundamentals of Programmable Logic Devices (PLDs) and the VLSI design process.
- Develop and simulate basic digital circuits using VHDL in data flow, behavioural, and structural modelling styles.

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the fundamental concepts and principles of digital electronics.	
CO1	Apply the fundamental knowledge of digital electronics to solve problems in digital circuit design and simplification.	PO1
CO2	Analyze the operation and behavior of combinational and sequential circuits using digital logic principles to arrive at a suitable conclusion.	PO2
CO3	Design and implement digital circuits using appropriate logic components and techniques to meet specific requirements.	PO3
CO4	Demonstrate practical understanding of digital electronics through assignments or seminars emphasizing real-world applications and recent advancements.	PO6, PO7

Pre-requisites:

Knowledge of basic science and mathematics

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	3	-	-
CO2	-	2	-	-	-	-	-			
CO3	-	-	1	-	-	-	-			
CO4	-	-	-	-	-	1	1			
CAM	3	2	1	-	-	1	1			

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

Instructional Strategy:

- **Conceptual Engagement**: Begin each unit by connecting digital logic concepts to real-world applications (e.g., calculators, digital clocks, memory units) to build relevance and interest.
- **Use of Visual Aids and Truth Tables**: Utilize truth tables, logic diagrams, Karnaugh maps, and timing diagrams to reinforce abstract concepts through visual representation.
- **Interactive Problem Solving**: Encourage students to simplify logic expressions, design basic circuits, and solve Karnaugh map problems during class discussions.
- **Digital Simulation Tools**: Introduce free tools like Logisim, Circuit Verse, or TinkerCAD Circuits to simulate and test digital circuits virtually.
- **VHDL Exposure via Code Demonstration**: Demonstrate VHDL programs for basic gates and circuits using projector or screen share to illustrate structural, behavioral, and dataflow modeling.
- **Regular Concept Checks**: Conduct brief quizzes or peer discussions to assess understanding of key concepts like flip-flops, counters, and multiplexers.

ECH302	DIGITAL ELECTRONICS	L	T	P	C
THEORY		4	0	4	4
Unit I	**SWITCHING ALGEBRA AND LOGIC GATES**				
Switching algebra: Number system - Binary number representation - 1'scomplement - 2'scomplement - Code conversion - Decimal to Binary & Hexadecimal (Integer part) - Binary to Decimal & Hexadecimal (Integer part). Logic gates-Positive and negative logic - Boolean algebra - Basic laws - DeMorgan's theorems - Symbolic representation and truth tables for logic gates OR, AND, NOT, NAND, NOR, EX-OR, EX-NOR - Realization of gates using universal gates NAND and NOR - Simplification of logic functions using Karnaugh Map (simple problems up to 4 variables).					12
Unit II	**COMBINATIONAL CIRCUITS**				
Basics of combinational digital logic system - Logic diagram Truth table and working of Half adder - Half subtractor Full adder - Full subtractor - Digital comparator (one bit) - Parity generator and checker (3 Bit) - Decoder (2 × 4) - Demultiplexer (1 × 4) - Encoder (4 × 2) - Multiplexer (4 × 1) - Tri state logic.					12
Unit III	**SEQUENTIAL CIRCUITS**				
Basic sequential digital system - Latches -SR Latch - Flip-flop: RS Flip-flop, JK Flip-flop, T Flip-flop, D Flip-flop - Master Slave JK Flip-flop. Register: Shift registers- SIPO, SISO, PISO and PIPO (4 Bit)					12
Unit IV	**COUNTERS &MEMORIES**				
Counters (4 Bit)- Asynchronous / Ripple counter - UP counter, DOWN counter - Decade Counter - Synchronous counter - UP counter, DOWN counter - Ring counter, Twisted Ring counter. Memories: Classification - RAM: SRAM, DRAM - Simple structure of SRAM & DRAM; ROM: PROM, EPROM, EEPROM, FLASH Memory - Applications					12
Unit V	**INTRODUCTION TO VLSI**				
Introduction to PLA & PAL - General block diagram of FPGA. VLSI design process: Steps involved in VLSI design process - Different levels of abstraction (names only) General format for VHDL program - VHDL codes for AND, OR, NOT gates - VHDL code for half adder using Data flow modelling, Behavioral modelling and Structural modeling					12
TOTAL					**60**

Textbooks:

- Thomas L. Floyd, *Digital Fundamentals*, 11th Edition, Pearson Education, 2017.
- S. Salivahanan and S. Arivazhagan, *Digital Circuits and Design*, 5th Edition, Vikas Publishing House Pvt. Ltd., 2019.
- Anil K. Maini, *Digital Electronics: Principles and Integrated Circuits*, 1st Edition, Wiley Publications, 2007.

Web-based/Online Resources:

1. https://www.allaboutcircuits.com/textbook/digital/
2. https://www.electronics-tutorials.ws/logic/logic_1.html
3. https://nptel.ac.in/courses/117/105/117105115/
4. https://www.tutorialspoint.com/digital_electronics/index.htm
5. https://vhdlwhiz.com/
6. https://www.edaplayground.com/
7. https://circuitverse.org/

ECH371	Electrical Circuits, Machines and E-vehicle	L	T	P	C
Practicum		1	0	4	3

Introduction:

This practicum-based course provides fundamental knowledge of electrical circuits, network theorems, AC circuits, electrical machines, and electric vehicles. Emphasis is given to hands-on experiments and simulations that help students understand real-world electrical and EV concepts through practical exposure.

Course Objectives:

- Understand fundamental electrical quantities, circuit laws, and their applications in basic electrical circuits.
- Analyze DC and AC circuits effectively using network theorems and key circuit parameters.
- Comprehend the construction, working principles, and characteristics of electrical machines such as DC motors and single-phase induction motors.
- Gain knowledge of electric vehicle (EV) technology, including their environmental benefits, system architecture, and battery technologies.
- Develop practical skills through hands-on circuit construction, measurements, and simulation of electrical circuits and EV systems.

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the fundamental concepts and principles of electrical circuits, machines, and electric vehicles.	
CO1	Apply the fundamental knowledge of electrical circuits and machines to obtain a desired parameter.	PO1
CO2	Analyze the behavior of AC/DC circuits and machines using electrical principles to arrive at a suitable conclusion.	PO2
CO3	Construct and test basic electrical circuits or machine setups using standard components to meet specific requirements.	PO3
CO4	Perform hardware experiments and simulate electrical circuits and machine models using appropriate software tools to validate theoretical concepts and obtain a desired parameter.	PO4
CO5	Collaborate effectively in teams to perform experiments, observe results, maintain detailed records, and present findings, emphasizing practical understanding of electrical circuits, machines, and electric vehicles.	PO6, PO7

Pre-requisites:

Knowledge of Basic Science

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	3	-	-
CO2	-	2	-	-	-	-	-			
CO3	-	-	1	-	-	-	-			
CO4	-	-	-	3	-	-	-			
CO5	-	-	-	-	-	2	1			
CAM	3	2	1	3	-	2	1			

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

Instructional Strategy:

- **Demonstration and Explanation**: Introduce each concept through simple demonstrations and explanations using real components or simulation tools.
- **Hands-on Practice**: Encourage students to construct and test circuits using breadboards and simulation software.
- **Step-by-step Problem Solving**: Guide students in solving problems related to circuit analysis and machine characteristics.
- **Simulation-Based Learning**: Use tools like Tinkercad, Multisim, or other relevant software to visualize and analyze circuits.
- **Team-based Experiments**: Promote collaborative learning through group experiments and discussions.
- **Assessment through Observation**: Evaluate students based on their practical work, observation and viva questions.

List of components / equipments / tools required:

S.No.	Component / Equipment / Tools	Suggested Quantity
1	Resistors, Inductors, Capacitors - various values	30 per batch
4	Batteries - Lead Acid, Lithium-ion types (for demo and EV experiments)	5 per batch
5	DC Motor	5 per batch

6	Breadboards	1 per batch

7	Connecting Wires (Jumper Wires)	20 per batch
8	Multimeters (Digital or Analog)	1 per batch
9	Dual Power Supply (0-30V)	1 per batch
10	Function Generator	1 per batch
11	DSO	1 per batch
12	Computer with simulation Software (LTspice, Multisim, Proteus, MATLAB Simulink, etc.)	1 per batch

Theory: 15 hours, Practical: 60 hours

ECH371	Electrical Circuits, Machines and E-vehicle	L	T	P	C
Practicum		1	0	4	3

Unit I	**BASIC ELECTRICAL CIRCUITS**	
Concept of electrical quantity - Voltage - Current – Power - Resistance, Ohm's law, and Equivalent Resistance of Resistors Connected in Series and Parallel (formula only) - Voltage Division Rule - Current Division Rule for two Branch Parallel Resistive Network.		3
Unit II	**NETWORK THEOREMS**	
Thevenin's Theorem - Norton's Theorem - Superposition Theorem - Maximum Power Transfer Theorem		3
Unit III	**AC CIRCUITS AND RESONANCE**	
Definition of Impedance, Reactance, Susceptance, Admittance and Power Factor - Series Resonance Circuit - Parallel Resonance Circuit - Condition for Resonance - Quality Factor (Q), Band Width, Resonance Frequency and Frequency Response Curve (definition and formula only)		3
Unit IV	**ELECTRICAL MACHINES**	
Construction and Working Principle of DC Generator and DC Motor - AC motor(Basic Concepts) -Types Names only) - Construction and Working Principle of Single-phase induction motor		3
Unit V	**E- VEHICLE**	
Electric Vehicles (EVs) - Definition - Environmental impact of conventional vehicle - Block diagram and working principle of BEVs - Comparison between conventional vehicles and BEVs - Battery types (names only)		3

Ex. No	Name of the Experiment	
1.	Kirchhoff's Voltage Law - statement and explanation Construct a resistive network to verify Kirchhoff's Voltage Law (Mesh analysis / Loop analysis)	4
2.	Kirchhoff's Current Law - statement and explanation Construct a resistive network to verify Kirchhoff's Current Law	4
3.	Concept on Nodal analysis Using simulation tool, solve the resistive circuit using nodal analysis to find current.	4

4. a) 4. b)	Construct a resistive network to verify Thevenin's Theorem. Using simulation tool, verify Norton's Theorem.	4
5.	Construct a resistive network to verify the Superposition Theorem.	4
6.	Using simulation tool, verify maximum power transfer Theorem.	4
7.	Concept on sinusoidal waveform: Analysis of the sinusoidal waveform (Measurement of Peak Voltage, Time Period, Frequency and Phase difference between two waveforms)	4
8.	Concept on Analysis of AC Response in Resistive, Inductive, and Capacitive Circuits and Analysis of the AC Response to sinusoidal inputs to RLC in series and parallel. Construct series RLC circuit and determine the Resonant frequency experimentally.	4
9.	Characteristics of DC motor: Simulate the torque speed characteristics of dc motor.	4
10.	Simulation of Battery Status Monitoring of E- Vehicle	4
	TOTAL	**75**

Textbooks:

- Robert L. Boylestad – Introductory Circuit Analysis, 13th ed., Pearson, 2015
- D.P. Kothari and I.J. Nagrath – Electrical Machines, Tata McGraw Hill
- S. Rama Reddy – Electric Vehicles and their Technologies, Narosa Publishing

Reference Books:

- J.B. Gupta, *A Course in Electrical and Electronic Measurements and Instrumentation*, S.K. Kataria & Sons.
- V.K. Mehta and Rohit Mehta, *Principles of Electrical Machines*, S. Chand Publishing.
- S.K. Bhattacharya, *Electrical Machines*, Tata McGraw-Hill Education.
- Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, and Ali Emadi, *Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design*, CRC Press.

Theory: 15 hours, Practical: 60 hours

ECH372	C PROGRAMMING	L	T	P	C
Practicum		1	0	4	3

Introduction:

This course provides foundational knowledge of the C programming language, enabling students to develop logic-based thinking and problem-solving skills. Through hands-on practice, students will learn to write, debug, and execute C programs for a variety of real-life applications involving decision-making, loops, arrays, functions, pointers, and file operations.

Course Objectives:

- Understand the basic structure and syntax of C programs.
- Apply programming constructs such as variables, operators, conditionals, loops, arrays, and functions to solve simple problems.
- Gain practical skills in using pointers, structures, and memory management.
- Develop confidence in writing and executing C programs for problem-solving.

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the fundamental concepts and principles of the C programming language.	
CO1	Apply the knowledge of C programming constructs, operators, and programming skills to develop simple programs in C.	PO1
CO2	Analyze and debug C programs to predict outputs and resolve logical errors based on fundamental programming concepts.	PO2
CO3	Develop, debug, and test C programs in teams using appropriate software tools (e.g., Turbo C, Dev C++, or other IDEs) for the given problems.	PO3, PO4
CO4	Work in teams to perform programming experiments, document observations in an observation note, and maintain records in a practical record book.	PO6, PO7

Pre-requisites:

Basic knowledge of Computers and Logical Reasoning.

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	3
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	3	-	-	-			
CO4	-	-	-	-	-	2	1			
CAM	3	2	2	3	-	2	1			

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

Instructional Strategy:

- Concept Introduction: Explain new concepts using real-life analogies and logical reasoning.
- Live Demonstrations: Illustrate sample programs with step-by-step walkthroughs in class.
- Hands-on Practice: Facilitate individual coding practice during lab sessions to build confidence.
- Collaborative Learning: Encourage pair and group programming exercises for select problems.
- Problem-Solving Activities: Assign targeted programming tasks for reinforcement after each concept.
- Debugging Workshops: Guide students through common syntax and logic errors for better understanding.
- Algorithm Design: Use flowcharts and pseudo-code to foster algorithmic thinking before implementation.

S.No.	Tool	Quantity per batch
1	Desktop Computers with any C compiler (Turbo C, Dev C++ or other IDEs)	1

ECH372	C PROGRAMMING	L	T	P	C
Practicum		1	0	4	3

Unit I	BASICS OF 'C' LANGUAGE AND OPERATORS	
Algorithm - Definition - Flow Chart - Flow chart symbols - Structure of a C program - Character set in 'C' - Declaration - Input and Output functions [printf() and scanf()] - C Operators (types only) - Built-in functions: Math functions, character functions (isalpha(), isalnum(),islower(),isupper())		3
Unit II	**DECISION MAKING, BRANCHING AND LOOPING STATEMENTS - SYNTAX ONLY**	
Decision making & Branching: Introduction - simple if statement - if-else, else-if ladder, nested if-else - switch statement **Looping Statements:** While loop, for loop, do…while loop **Unconditional Branching Statements:** goto, break & continue statements		3
Unit III	**ARRAY AND STRINGS**	
Arrays: Definition- syntax, declaration, initialization of One dimensional (1D), Two - dimensional (2D) integer arrays **Strings:** Definition of string - syntax, declaration and initialization of string variables - gets() and puts() functions		3
Unit IV	**FUNCTIONS , STRUCTURE AND PREPROCESSOR DIRECTIVES**	
Functions: User Defined functions: Function Prototype, Function Definition and Function Call - Return statement -- Recursion **Structure:** Basic template of a structure (syntax) - Structure Variable declaration and initialization - Difference between array and structure – Union **Preprocessor Directives-**Definition		3
Unit V	**POINTER, MEMORY MANAGEMENT, AND FILE MANAGEMENT USING 'C'**	
Pointer: Definition of a pointer - Pointer declaration and initialisation - address and dereferencing operators Dynamic memory Management - definition - malloc - calloc - realloc - syntax only.		3
Ex.no	**Name of the Experiment**	
1.	Write a C Program to (a) calculate and display the volume of a CUBOID having its height (h=10cm), width (w=12cm) and depth (8cm). (b) Write and Execute a C program to calculate the equivalent resistance of THREE resistors connected in parallel.	4

2.	**Using if, else:** Write a C Program to (a) find whether the given integer is even or odd (b) find whether the person is eligible to vote or not	4
3.	Write a C Program to swap two variables using a third variable	4
4.	**Switch case:** Accept two numbers from the user and perform addition, subtraction multiplication and division based on user's choice.	4
5.	**WHILE loop:** Write and execute a C Program to find the sum of first ten natural numbers using "while" loop	4
6.	**FOR loop:** Write a program to generate Fibonacci series.	4
7.	Write a program to find the length of a string without using inbuilt function.	4
8.	Write and Execute a C program to check whether the given string is a palindrome (a) using string handling function (b) without using string handling function	4
9.	**1D array:** Write a program to add N numbers using arrays	4
10.	**2D array :** Write a program to implement matrix addition	4
11.	**Pointers:** Write a program to swap values of two variables using pointer	4
12.	**Array of structures :** Write and Execute a C program to prepare the total mark of each student by reading their "Name, Reg.No, Marks for four subjects" (for a class of five students) using array of structures.	4
13.	**Function:** Write a program to add two integers using user defined function with return type.	4
14.	**Recursion:** Write a program to find the factorial of a given number using recursion function	4
15.	**FILES:** Write a program to copy contents of one file to another file	4
	TOTAL	**75**

Do It Yourself Programs (DIY Programs) Simple programs:

Without if else:

1. Write a program to print the size of char, float, double and long double data types in C
2. Write a program to declare two integers and one float variable and then initialize them to 10, 15, and 12.6. Also print the variable values in the screen.
3. Write a C program to prompt the user to input 3 integer values and print these values in forward and reversed order.
4. Write and Execute a C program to implement Ohm's law
5. Write and Execute a C program to calculate the equivalent capacitance of THREE capacitors connected in series.
6. Write and execute a C program to find the resonant frequency of a series resonant circuit.
7. Write a program to swap two variables without using a third variable.
8. Write and Execute a C Program to convert a given temperature in degree Celsius to Fahrenheit
9. Write and Execute a C Program to convert a given temperature in degree Fahrenheit to Celsius
10. Write a program to calculate simple and compound interest.
11. Write a program to take character input from keyboard and check if it is a number or alphabet or special character using ASCII CODE Again check if the character is using character functions below:
    a) Alphanumeric => isalnum()
    b) Alphabetic => isalpha()
    c) Number-digit => isdigit()
    d) Upper case => isupper()
    e) Lower case => islower()
12. Print the value of y for given x=2 & z=4 and analyze the output.
    a) `y = x++ + ++x;`
    b) `y= ++x + ++x;`
    c) `y= ++x + ++x + ++x;`
    d) `y = x>z;`
    e) `y= x>z? x:z;`
    f) `y = x & z;`
    g) `y= x>>2 + z<<1;`
13. Based on the marks, print the grade of the student.

For loop:

14. Write a program to input two integer numbers and display the sum of even numbers between these two input numbers.
15. Write and Execute a C program to check if a number is present in an array.
16. Write a program to initialize one dimensional array of size 8 and display the sum and average of array elements
17. Write a program to display the largest element of an array.
18. Write a program to find GCD (greatest common divisor or HCF) and LCM (least common multiple) of two numbers.
19. Write a program to read a sentence and count the number of characters & words in that sentence.
20. Write a program to display the following:

Strings:

21. Write a program to arrange the given N names in alphabetical order
22. Write a program to concatenate two strings using inbuilt function.
23. Write a program to find the length of a string with and without using string handling function.
24. Write a program to concatenate two strings without using inbuilt functions.
25. Write a program to copy one string to another string with and without using string handling function.
26. Write a program to compare two strings with and without using inbuilt function.

Matrix:

27. Write and Execute a C Program to store a simple 2D array of four elements (2x2) and print each element using "for" Loop
28. Write a program to read two matrices of order 3 * 2, add them and display the resultant matrix in matrix form.
29. Write a program to multiply two 3*3 matrices

Structure:

30. Write a program to prepare the total marks for N students by reading the Regno, Name, Mark1

to Mark6 by using array of structures.

Functions:

31. Define a function named fact() to calculate factorial of a number n and then write a program that uses this function fact() to calculate combination and permutation.
32. Write a function to calculate the sum and average of given N numbers. Write a main function to call the above function
33. Write a program to find sum as Y of the following series excluding prime numbers in the series. Y=1 + 1/1! + 22/2! + 32/3! +⋯+ 102/10!

Recursion:

34. Write and Execute a C program to find the GCD of two numbers using recursive function.
35. Write a recursive function to generate Fibonacci series.

Pointers:

36. Using pointers, find the length of the given string.
37. Write a program to find the sum of all the elements of an array using pointers.

Preprocessor directives:

38. Given the three numbers a(=8), b(=4),c and constant value PI=3.1415, calculate and display the following result using macros (preprocessor directives)
    a) c = PI * mult(a,b) //the macro mult(a,b) perform the multiplication of a & b (a*b)
    b) c = PI* sum(a,b) //the macro mult(a,b) perform the sum of a & b (a+b)
    c) c = PI *sub(a,b) //the macro mult(a,b) perform the subtraction of a & b (a-b)
    d) c = PI*div(a,b) //the macro mult(a,b) perform the division of a & b (a/b)

Files:

39. Write characters into a file “filec.txt”. The set of characters are read form the keyboard until an enterkey is pressed (use putc() and getc() function).
40. Read characters form file “filec.txt” created in question 1. Also count the number of characters in the file (use fputs() and fgets() function).

Textbooks:

1. E. Balagurusamy, Programming in ANSI C, 8th edition, Tata McGrawHill Publications, 2019
2. Yashavant Kanetkar, Let us C, 19th edition, BPB Publications, 2022

3. Venkatesh Ramasamy, ANSI C Programming Guide, 1st edition, LuLuPublishing Solutions, 2013

Web-based/Online Resources:

- https://www.programiz.com/c-programming
- https://www.tutorialspoint.com/cprogramming/index.htm
- https://www.cprogramming.com
- https://www.geeksforgeeks.org/c-programming-language/
- https://www.freecodecamp.org/news/the-c-beginners-handbook/
- https://www.onlinegdb.com/online_c_compiler

ECH372	ELECTRONIC DEVICES AND CIRCUITS LAB	L	T	P	C
Practical		0	0	4	2

Introduction:

This course introduces students to the practical understanding of various electronic components and devices such as diodes, transistors, FETs, UJTs, and power control devices like SCR, DIAC, and TRIAC. Through hands-on experiments and simulation tools, students will analyze device characteristics and understand their behaviour in different electronic circuits.

Course Objectives:

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

- identify and test the functionality of basic electronic components using a multimeter.
- understand and analyse the V-I characteristics of semiconductor devices including diodes, transistors, FETs, UJTs, and LEDs.
- construct and examine the performance of rectifier circuits with and without filters.
- analyse the working of power electronic devices like SCR, DIAC, TRIAC using practical and simulation-based methods.
- gain familiarity in using simulation tools for circuit verification and analysis.

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome Mapping
CO1	Conduct experiments on semiconductor devices and rectifier circuits to measure electrical parameters and validate theoretical predictions.	PO1
CO2	Analyze the V-I characteristics of diodes, BJTs, and other semiconductor devices, interpret results in the context of theoretical concepts, and arrive at a conclusion.	PO2
CO3	Construct and test electronic circuits such as rectifiers, amplifiers, and switching devices (JFET, SCR, TRIAC) using hardware setup and simulation tools to meet the desired specifications and evaluate their performance.	PO3, PO4
CO4	Collaborate in teams to perform experiments, record observations in the observation note, and document the procedure, results, and inferences in the record note for both practical and simulation-based electronic circuits.	PO6, PO7

Pre-requisites:

Basic knowledge of electronic components and circuits

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	3	-	-
CO2	-	2	-	-	-	-	-			
CO3	-	-	1	3	-	-	-			
CO4	-	-	-	-	-	2	1			
CAM	3	2	1	3	-	2	1			

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

Instructional Strategy:

- Component Demonstration: Begin each session by identifying and testing electronic components (e.g., resistors, diodes, transistors) using tools like a multimeter to build foundational understanding.
- Circuit Construction: Guide students through the step-by-step process of assembling circuits on a breadboard or trainer kit, emphasizing correct connections and safety precautions.
- Measurement and Plotting: Instruct students to observe electrical parameters (voltage, current) using instruments and manually plot the V-I characteristics for analysis and interpretation.
- Simulation-Based Learning: Reinforce theoretical understanding by verifying circuit behavior using simulation software tools such as Multisim, Proteus, or Tinkercad.
- Collaborative Learning: Encourage teamwork during experiments to foster problem-solving skills, peer learning, and effective technical communication.

List of components / equipments / tools required:

S.No.	Component / Equipments	Suggested Quantity
1	PN Junction Diode (e.g., 1N4007)	6 per batch
2	Zener Diode (e.g., 5.1V, 6.8V)	2 per batch
3	LED	2 per batch
4	LDR	2 per batch

5	BJT (e.g., BC547/548)	3 per batch
6	JFET (e.g., BF245 or 2N3819)	2 per batch
7	UJT (e.g., 2N2646)	2 per batch
8	MOSFET	2 per batch
9	DIAC	2 per batch
10	TRIAC	2 per batch
11	SCR	2 per batch
12	Resistors (Various values)	30 per batch
13	Capacitors (Various values)	10 per batch
14	Breadboards	1 per batch
15	Connecting Wires (Jumper Wires)	20 per batch
16	Multimeters (Digital or Analog)	1 per batch
17	Dual Power Supply (0-30V)	1 per batch
18	Function Generator	1 per batch
19	DSO	1 per batch

ECH372	ELECTRONIC DEVICES AND CIRCUITS LAB	L	T	P	C
Practical		0	0	4	2
Ex. No.	**Name of the Experiment**				
	Familiarization: Conducting the cold check using Multimeter on the following devices and checking for their conditions such as identification of 1) Open or shorted junctions. 2) anode and cathode of diode. 3) base, collector and emitter of transistor. 4) emitter, base1 and base2 of UJT and 5) gate, drain and source of a FET 6) Anode, Cathode and Gate of SCR 7) Resistance Colour Coding				
1.	V-I characteristics of PN junction diode				4
2.	V-I characteristics of Zener diode				4
3.	Half wave rectifier with and without capacitor filter				4
4.	Centre tapped Full wave rectifier with and without capacitor filter				4
5.	Bridge rectifier with and without capacitor filter				4
6.	Input and Output Characteristics of BJT in Common Emitter Configuration				4
7.	V-I Characteristics of JFET (Junction Field Effect Transistor)				4
8.	V-I Characteristics of UJT (Unijunction Transistor)				4
9.	V-I Characteristics of LED and LDR Circuits				4
10.	V-I Characteristics of SCR (Silicon Controlled Rectifier)				4
11.	V-I Characteristics of DIAC				4
12.	V-I Characteristics of TRIAC				4
13.	Simulation of V-I Characteristics of PN Junction Diode				4
14.	Simulation of V-I Characteristics of UJT				4
15.	Simulation of Depletion-Mode MOSFET Characteristics				4
TOTAL					**60**

ECH374	DIGITAL ELECTRONICS LAB	L	T	P	C
Practical		0	0	4	2

Introduction:

This course provides hands-on experience in designing, constructing, and analyzing basic digital circuits using logic gates, combinational and sequential logic components. It also introduces simulation using VHDL to model digital systems. Students will gain practical skills necessary for designing digital systems used in embedded, communication and computing applications.

Course Objectives:

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

- Understand the working principles and realization of basic logic gates using digital ICs.
- Design and implement combinational circuits such as adders, subtractors, comparators, multiplexers, demultiplexers, encoders, and decoders.
- Analyze, construct, and test sequential circuits including flip-flops, counters, and shift registers.
- Develop and simulate VHDL code for simple digital logic functions and arithmetic circuits.
- Integrate theoretical digital electronics concepts with practical circuit implementation to build a strong foundational skillset.

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome Mapping
CO1	Apply digital electronics principles to construct and test basic combinational circuits, demonstrating proficiency in circuit realization and logical functionality.	PO1
CO2	Analyze the behavior of combinational circuits and sequential devices through practical experiments integrating theoretical knowledge with hands-on implementation.	PO2
CO3	Develop and simulate VHDL code for logic gates and combinational circuits using VHDL simulation tools to verify functionality.	PO3, PO4
CO4	Collaborate in teams to conduct experiments, record observations in observation note and document procedures, results, and inferences in the record note for both hardware and simulation-based digital circuits.	PO6, PO7

Pre-requisites:

- Basic knowledge of number systems and Boolean algebra
- Basic understanding of combinational and sequential logic

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	3	-	-
CO2	-	2	-	-	-	-	-			
CO3	-	-	1	3	-	-	-			
CO4	-	-	-	-	-	2	1			
CAM	3	2	1	3	-	2	1			

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

Instructional Strategy:

- Demonstration: Begin each experiment with a clear demonstration of the circuit setup and its working principle.
- Hands-on Practice: Encourage students to independently or collaboratively build circuits using ICs and breadboards.
- Simulation: Integrate VHDL programming and simulation tools to validate and reinforce circuit functionality.
- Circuit Analysis: Guide students in analyzing circuit outputs through truth tables and timing diagrams to deepen understanding.

List of components / equipments / tools required:

S.No.	Component / IC	Quantity (per batch)
1	IC 7400 - Quad 2-input NAND gates	2
2	IC 7402 - Quad 2-input NOR gates	2
3	IC 7404 - Hex Inverter (NOT)	2
4	IC 7408 - Quad 2-input AND gates	2
5	IC 7432 - Quad 2-input OR gates	2
6	IC 7486 - Quad 2-input XOR gates	2

7	IC 7483 / 74283 - 4-bit full adder	1
8	IC 7485 - 4-bit magnitude comparator	1
9	IC 74151 - 8:1 Multiplexer	1
10	IC 74139 or 74154 - Demux (1x4)	1
11	IC 74138 - 3:8 Decoder	1
12	Encoder ICs (or logic gate ICs)	1
13	IC 7474 - D Flip-flop	1
14	IC 7476 or 7473 - JK/T Flip-flops	1
15	IC 7490 / 7493 - Ripple counter	1
16	IC 74195 / 7495 / 7496 - Shift register	1
17	Resistors (220Ω, 330Ω, 1kΩ)	20+
18	LEDs (Red/Green)	10
19	Tactile push switches	5
20	Connecting jumper wires	50+
21	Digital Trainer Kits	1
22	Breadboards (if no trainer kit)	1
23	Multimeter (digital)	1
24	Digital Signal Oscilloscope (optional)	1
25	Desktop Computers with VHDL Software (ModelSim / Xilinx ISE / Vivado / online simulators)	1

ECH374	DIGITAL ELECTRONICS LAB	L	T	P	C
Practical		0	0	4	2
Ex. No	Name of the Experiment	Hours			
1.	Realization of basic logic gates: AND, OR, NOT, NAND, NOR, XOR using logic gate ICs	4			
2.	Implementation of AND and OR gates using only NAND and NOR gates	4			
3.	Design and implementation of Half Adder and Half Subtractor using logic gates	4			
4.	Design and implementation of Full Adder using logic gates	4			
5.	Construction and testing of 1-bit digital comparator	4			
6.	Testing of 8×1 Multiplexer using IC	4			
7.	Construction and testing of 1×4 Demultiplexer using IC	4			
8.	Testing of 3×8 Decoder using IC	4			
9.	Construction and testing of 4×2 Encoder using logic gates	4			
10.	Testing of D, JK, and T Flip-Flops using ICs (7474, 7476, etc.)				
11.	Testing the operation of Ripple Counter using IC	4			
12.	Testing the operation of Shift Register using IC	4			
13.	Write and simulate a VHDL program for basic logic gates (AND, OR, NOT)	4			
14.	Write and simulate a VHDL program for Half Adder	4			
15.	Write and simulate a VHDL program for Half Subtractor	4			
TOTAL		**60**			

IV Semester

S. No	Course. code	Course	Mode	End - exam	Credits	Hours per week	Total hours
1	ECH 401	Analog Electronics	THEORY	Theory	4	4-0-0	60
2	ECH 402	Measurements and Instrumentation	THEORY	Theory	4	4-0-0	60
3	ECH 471	Communication Engineering -I	PRACTICUM	Practical	3	1-0-4	75
4	ECH 472	8051 Microcontroller and Embedded Systems	PRACTICUM	Practical	3	1-0-4	75
5	ECH 473	Analog Electronics Lab	PRACTICAL	Practical	2	0-0-4	60
6	ECH474	Arduino Programming with Mini project	PRACTICAL	Practical	3	0-0-6	90
7	ASH 292	Advanced Skills Certification-4	-	-	2	2-0-2	60
					21		480

ECH401	ANALOG ELECTRONICS	L	T	P	C
Theory		4	0	0	4

Introduction:

This course introduces students to the principles and applications of analog electronic circuits. It covers multistage amplifiers, power and tuned amplifiers, feedback techniques, oscillators, operational amplifiers, data converters and multivibrators. Special focus is placed on understanding circuit configurations, frequency response, performance analysis, and practical implementations in analog signal processing.

Course Objectives:

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

1. Identify different types of multistage amplifier and its application.
2. Examine power amplifiers and tuned amplifiers.
3. Analyze feedback in amplifiers and the conditions for sustained oscillations.
4. Implement analog signal processing circuits using Op-Amps
5. Construct and analyze various ADC, DAC, and IC 555 based timer circuits.

Course Outcomes

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

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the fundamental concepts of analog Circuits	---
CO1	Apply the knowledge of analog circuits to obtain the gain, frequency response, and performance characteristics of multistage amplifiers.	PO1
CO2	Analyze circuit behavior in Analog Electronics to arrive at a suitable conclusion.	PO2
CO3	Design amplifier and oscillator circuits in Analog Electronics to meet given specification.	PO3
CO4	Make an oral presentation or prepare an assignment related to Analog Electronics to demonstrate understanding and communication skills.	PO6, PO7

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	3	-	-
CO2	-	3	-	-	-	-	-			
CO3	-	-	3	-	-	-	-			
CO4	-	-	-	-	-	1	1			
CAM	-	3	3	-	-	1	1			

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

Instructional Strategy:

- **Lectures & Multimedia Presentations –** To explain amplifier types, feedback concepts, and theory behind ADC/DAC circuits.
- **Hands-on Lab Sessions** – For building and testing amplifiers, Op-Amp circuits, and IC 555 timer applications.
- **Circuit Simulations** – Using tools like Multisim or LTSpice to visualize amplifier and oscillator behavior.
- **Mini Projects & Group Activities** – To encourage teamwork and real-world problem-solving (e.g., designing audio amplifiers or timer circuits).
- **Assignments & Quizzes** – To assess conceptual clarity and analytical skills.
- **Use of E-content & Visual Aids** – Including videos, animations, and datasheets to enhance understanding of complex concepts.

ECH401	ANALOG ELECTRONICS	L	T	P	C
Theory		4	0	0	4

Unit I	MULTISTAGE AMPLIFIERS	
Multistage amplifiers – need for multistage amplifier- Cascade amplifier without RC coupling -Principle and frequency response of RC coupled amplifier, Cascade and Darlington pair Configuration (Circuit diagram and advantages) – Differential Amplifier - CMRR-Common mode gain-Differential mode gain-Construction and operation. Concept on Voltage regulator		**12**
Unit II	**POWER AMPLIFIER AND TUNED AMPLIFIER**	
Power amplifiers: Construction, Operation and Characteristics of Class A, Class B, Class B push pull Amplifier, Class C Amplifier. **Tuned amplifiers:** characteristics of tank circuit - Working of single tuned amplifier (capacitor coupled) -Advantages -Frequency response.		**12**
Unit III	**FEEDBACK AMPLIFIERS AND OSCILLATORS**	
Feedback Amplifiers: Concept–Types of feedback-Positive feedback and Negative feedback- Types of negative feedback amplifiers (current series, current shunt, voltage series and voltage shunt - Concept and Block diagram only) –Comparison (gain, Bandwidth, input impedance, output impedance) **Oscillators:** Barkhausen Criterion – Classifications-Construction and Operation of Hartley Oscillator-ColpittsOscillator-WienbridgeOscillator-RCPhaseShiftOscillator-CrystalOscillator		**12**
Unit IV	**OPERATIONALAMPLIFIERS**	
Block diagram of an Op-Amp-Operational Amplifier IC741-pin diagram- Characteristics of an ideal Op-Amp – CMRR – Slew Rate. Applications of Op amp: Inverting amplifier – Noninverting amplifier – Summing amplifier – Difference amplifier –Voltage follower-Comparator-zero crossing detector– Integrator-Differentiator-Schmitt Trigger-principles of PLL. (Qualitative treatment only)		**12**
Unit V	**ADC, DAC and IC555**	
DAC: Weighted resistorDAC-R-2R DAC, ADC: Types- Flash ADC-Successive Approximation ADC-Dual slope ADC IC555Timer–Pin Diagram-Applications-Astable Multivibrator(Concepts , Circuit diagram, working),Monostable Multivibrator (Concepts only)-Bistable Multivibrator(Concepts only)		**12**
	TOTAL	**60**

Textbooks:

1. Electronic Devices and Circuits–G.K. Mithal
2. Electronic Principles–Metha
3. Electronic Devices and Circuits–David A. Bel

Reference Books:

1. Electronic Devices and Circuits – Millman and Halkias
2. Electronic Circuit Analysis and Design – Donald A. Neamen
3. Operational Amplifiers and Linear Integrated Circuits – Robert F. Coughlin & Frederick F. Driscoll
4. Linear Integrated Circuits – Roy Choudhury

ECH402	MEASUREMENTS AND INSTRUMENTATION	L	T	P	C
Theory		4	0	0	4

Introduction:

This course provides foundational and applied knowledge in electrical and electronic measurement systems. Students will explore both analog and digital instruments, measurement of physical quantities using sensors and transducers, and the use of signal generators and analyzers. Emphasis is placed on the working principles, system analysis, and real-world applications in engineering diagnostics and automation.

Course Objectives:

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

- Understand the principles and characteristics of electrical and electronic measuring instruments.
- Analyze the construction and operation of bridges, meters, and digital instruments.
- Apply knowledge of transducers and sensors for measuring non-electrical quantities.
- Explore actuators and sensor systems used in industrial and embedded systems.
- Evaluate the working of signal generators and analyzers used in instrumentation systems.

Course Outcomes

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

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the fundamental concepts of Measurements and Instrumentation.	---
CO1	Apply the fundamental concepts of measurement systems, Sensor/Actuator-based instruments, signal generator and analyzer to obtain a desired parameter.	PO1
CO2	Analyze measurement and instrumentation systems for their accuracy and performance.	PO2
CO3	Ability to design measurement and instrumentation systems that meet specified performance requirements.	PO3
CO4	Engage in independent study as a member of a team and make an effective oral presentation /Assignment on the contribution of Measurements and Instrumentation.	PO6, PO7

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	3	-	-
CO2	-	3	-	-	-	-	-			
CO3	-	-	3	-	-	-	-			
CO4	-	-	-	-	-	1	2			
CAM	3	3	3	-	-	1	2			

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

Instructional Strategy:

- **Engage & Motivate**: Start with real-life examples like weighing scales and multimeters.
- **Conceptual Learning**: Use demos to explain measurement theory and errors.
- **Interactive Demos**: Showcase DMM, DSO, and sensor usage live.
- **Hands-on Practice**: Involve students in circuit building and sensor testing.
- **Visualization Tools**: Use simulations for bridges, LVDT, and analyzers.
- **Problem Solving**: Train students to detect errors and interpret measurement data.

ECH402	MEASUREMENTS AND INSTRUMENTATION	L	T	P	C
Theory		4	0	0	4

Unit I	**INDICATING INSTRUMENTS**	
Basics of Measurement: Static and dynamic Characteristics-errors in measurement and calibration-Types of AC/ DC meters. Construction and working principle of PMMC instrument - Shunt and series Multipliers -Construction and working principle of MI meter-attraction type-repulsion type		**12**
Unit II	**BRIDGES & DIGITAL INSTRUMENTS**	
Bridges: Types of Bridges – Wheat stone Bridge, Schering Bridge, Maxwell's induction Bridge **Digital instruments:** Comparison of Digital & Analog Instruments – Characteristics of digital meters–Block diagram: Digital Voltmeter-Digital Storage oscilloscope (DSO)-Digital Multimeter.		**12**
Unit III	**MEASURMENT OF NON-ELECTRICALQUANTITIES**	
Transducer and its classification -Measurement of load: Block diagram & working of electronic weighing machine-Loadcell –Strain gauge **Measurement of temperature:** RTD, Thermistor-Types, Thermocouple- Seeback effect-Radiation Pyrometer **Measurement of Displacement:** LVDT and its application		**12**
Unit IV	**ACOUSTICS ACTUATOR & SENSORS**	
Microphones: Definition – Types – Construction and working of Carbon microphone **Loudspeakers:** Construction and working of dynamic cone type-Surround-sound systems –Woofer– Tweeter– Mid-range **Actuator: Classification (Concepts only)** **Sensors -** Ultrasonic sensor, IR sensor, Proximity sensor, Touch sensor, Humidity sensor, Pressure sensors, motion sensor, smoke sensor, acceleration sensor–concepts only		**12**
Unit V	**SIGNAL GENERATORS & ANALYZERS**	
Generators: Block Diagram & Principle of operation of AF signal Generator, RF signal Generator-Function Generator **Signal Analyzers:** Analyzer -Definition and its application -Types-Spectrum Analyzer-Block diagram &Working principle of Frequency Synthesizer.		**12**
	TOTAL HOURS	**60**

Textbooks:

1. Electrical & Electronics and Measurements & Instrumentation byA.K.Sawhney
2. Modern Electronic Instrumentation & Measurements Techniques by Albert D. Helfrick and William David Cooper
3. Modern Electronic Instrumentation and Measurement Techniques" by David A. Bell
4. Transducers and Instrumentation" by D.V.S. Murthy
5. Sensors and Transducers" by D.Patranabis

Reference Books:

1. Instrumentation- Devices & Systems by C.S. Rangan, G.R. Sarma & VSV. Mani
2. Electrical & Electronics–Measurements and Instrumentation by Umesh Sinha Electronic Instrumentation G.K. Mithal

Theory-15, Practical:60

ECH471	COMMUNICATION ENGINEERING I	L	T	P	C
Practicum		1	0	4	3

Introduction:

Communication Engineering – I introduce the foundational principles of analog and digital communication systems. It provides students with practical and theoretical knowledge of signals, filters, modulation techniques, and multiplexing methods. The course bridges the gap between circuit-level understanding and system-level applications. Through hands-on experiments, students will gain experience in building, testing, and analyzing communication circuits. This practicum equips diploma students with the skills needed for entry-level roles in electronics and communication domains.

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome Mapping
	Describe and explain Signals, Filters and Modulation Techniques	
CO1:	Apply the Knowledge of Communication Engineering fundamentals to obtain desired parameter.	PO1
CO2:	Analyze the given signals, filters, and modulation techniques to evaluate their characteristics and performance in communication Engineering.	PO2
CO3:	Design communication circuits and systems including signal generators, modulators, and demodulators to meet desired specifications.	PO3
CO4:	Conduct experiments to demonstrate concepts related to Communication Engineering using signal generators, filters, and modulation techniques.	PO4
CO5:	Make use of experimental observations and results to prepare clear and comprehensive reports and documentation.	PO4, PO6, PO7

Pre-requisites

Knowledge of Basic Science

Mapping of COs to Pos:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	3	-
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	3	-	-	-			
CO4	-	-	-	-	-	1	2			
CAM	3	2	2	3	-	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.

Apparatus Required (For one Batch)

S.No	Name of the Equipments	Range	Required Nos
1	Dual Power Supply	0 – 30V	2
2	Function Generator	0-1 MHz	2
3	DSO	0-1 MHz	2
4	Digital Multimeter		2
5	Amplitude Modulator & Detector kit		2
6	Frequency Modulator kit & Demodulator kit		2
7	Sample and Hold circuit kit		
8	PAM kit		2
9	PWM kit		2
10	PPM kit		2
11	PCM kit		2
12	Time division Multiplexing & De-Multiplexing kit		2
13	Frequency division Multiplexing & De-Multiplexing kit		2
14	ASK kit		
15	FSK kit		
16	PSK kit		
17	Simulation tools	MATLAB/SIMULINK /any Simulation tool	

ECH471	COMMUNICATION ENGINEERING I	L	T	P	C
Practicum		1	0	4	3

UNIT I	SIGNALS AND FILTERS	
Classification of signals - Continuous time (CT) and Discrete Time (DT) signals - Elementary signals **Filters:** Definition, Types of Filters - LPF, HPF and BPF (Frequency Response Characteristics only) - applications		**3**
Ex. No	**Name of the Experiment**	
	Generation of sine wave, sawtooth and square waveform using function generator with different periods and amplitude (Study experiment)	
1	Construct and test the performance of LPF and HPF (Draw the characteristic curve and determine the cut off frequency)	4
2	Construct and test the performance of BPF. (Draw the characteristic curve and determine the cut off frequency)	4
Unit II	**AMPLITUDE MODULATION**	
Introduction to Modulation: Definition - Need for Modulation - Types of modulation Amplitude modulation (AM): Definition - Modulation index – Over modulation - Under modulation – Critical modulation – Waveform representation of AM –Expression for AM (No derivation) - Frequency spectrum of AM – Bandwidth – Power – Types of AM - DSB, SSB and VSB		**3**
Ex. No	**Name of the Experiment**	
3	Concept of AM transmitter: Construct and test the Performance of AM Modulator. (Determine modulation index)	4

4	Concept of AM receiver - sensitivity, selectivity and fidelity Explain Super Heterodyne Receiver Construct and test the Performance of AM demodulation using envelope detector.	4
Unit III	**ANGLE MODULATION**	
Frequency Modulation (FM): Concept of Angle Modulation- Waveform representation of FM - Modulation index Effect of noise – Noise triangle - Pre-emphasis - De-emphasis. – Comparison of AM and FM- Basics of Phase modulation		**3**
Ex. No	**Name of the Experiment**	
5	FM generation using varactor diode FM demodulation using Ratio slope detector Construct and test the performance of FM Modulator and FM Demodulator.	**6**
Unit IV	**PULSEMODULATION AND MULTIPLEXING**	
Pulse Analog Modulation Techniques: Ideal sampling, Sampling theorem – Nyquist criterion - interpolation - natural and flat top sampling Pulse Digital Modulation Techniques: PCM Need for Multiplexing – FDM – TDM - comparison of FDM and TDM		**3**
Ex. No	**Name of the Experiment**	
6	Construct and test the performance of Sample and Hold circuit.	4
7	Concept of PAM: Construct and test the performance of Pulse Amplitude Modulator.	4
8	Concept of PWM: Construct and test the performance of Pulse Width Modulator.	4
9	Concept of PPM: Construct and test the performance of Pulse Position Modulator.	4
10	Simulate the performance of Pulse Code Modulation and observe the waveforms using any simulation tool (SIMULINK etc.)	4

11	Perform an experiment on Time Division Multiplexing/ De-multiplexing circuit and observe the waveforms.	4
12	Perform an experiment on Frequency Division Multiplexing/ De-multiplexing circuit and observe the waveforms.	4

Unit V	**Digital Modulation Techniques**	
Baseband transmission: Line coding (RZ, NRZ) Polar, Bipolar, Unipolar, Manchester coding, Differential Manchester coding - Duobinary coding Digital modulation: Information capacity of channel – Bit rate – Baud rate - Digital Modulation techniques: Block diagram and operation of ASK modulation /demodulation- FSK modulation/demodulation –PSK modulation/demodulation – M-ary PSK (names only) – BPSK – Intersymbol interference – Eye diagram – Error detection and correction codes – Types (names only)		**3**
Ex. No	**Name of the Experiment**	
13	Set up an ASK modulator and demodulator and observe the waveforms using any simulation tool.(MATLAB /SIMULINK etc.)	4
14	Set up an FSK modulator and demodulator and observe the waveforms using any simulation tool.(MATLAB /SIMULINK etc.)	4
15	Set up a PSK modulator and demodulator and observe the waveforms using any simulation tool.(MATLAB /SIMULINK etc.)	4
	TOTAL	75

Textbook:

1. Principles of Communication Systems**,** Taub and Schilling, Mc Graw Hill Education
2. Communication Systems**,** Simon Haykin, Wiley India
3. Analog and Digital Communication**,** B.P. Lathi**,** Oxford University Press

ECH472	8051 Microcontroller and Embedded systems	L	T	P	C
Practicum		1	0	4	3

Introduction:

This course provides an in-depth study of the 8051 Microcontroller, covering its architecture, instruction set, programming techniques, and peripheral interfacing. Students will gain practical experience through hands-on experiments involving timers, interrupts, serial communication, and the interfacing of devices like LEDs, LCDs, motors, and DACs. The course also introduces basic embedded system concepts and ARM processor fundamentals, with a focus on the LPC2148 controller. Emphasis is placed on developing both programming and hardware integration skills, preparing students to design and implement real-time embedded solutions for practical applications.

Course Objectives:

- To understand the architecture, instruction set, and programming concepts of the 8051 Microcontroller.
- To develop skills in writing and debugging assembly language programs using arithmetic, logical, and control instructions.
- To interface the 8051 with peripheral devices such as LEDs, LCDs, motors, and DACs for real-time applications.
- To implement serial communication, timer-based control, and interrupt-driven programs on the 8051.
- To introduce embedded systems and ARM processor basics, focusing on LPC2148 and its relevance in modern embedded applications.

Course Outcomes:

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

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the fundamental concepts of 8051 Microcontroller and embedded system	
CO1:	Apply the concepts of microcontroller and embedded systems of the 8051 and ARM-based microcontrollers.	PO1
CO2:	Analyze the interfacing and control of peripheral devices such as LEDs, stepper motors, LCDs, seven-segment displays, and DACs with the 8051 microcontroller to arrive at a suitable solution.	PO2

CO3:	Design and develop timer, counter, serial communication, and interrupt-based applications using the 8051 microcontroller to meet given specifications.	PO3
CO4:	Conduct experiments on embedded system applications using 8051 by integrating software and hardware and assess performance based on practical observations and debugging.	PO4
CO5:	Prepare clear documentation and reports based on practical experiments involving microcontroller programming and peripheral interfacing.	PO4, PO6, PO7

Pre-Requisites:

Knowledge of Digital electronics, basic programming knowledge

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	3
CO2	-	3	-	-	-	-	-			
CO3	-	-	3		-	-	-			
CO4	-	-	-	3	-	-	-			
CO5	-	-	-	2	-	1	1			
CAM	3	3	3	3	-	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.

Apparatus Required (For one Batch)

S.NO	NAME OF THE EQUIPMENTS	RANGE	REQUIRED NOS
1	8051 microcontroller kit		10
2	Interface support and devices like Stepper motor, LCD, Seven segment display, DAC		2

ECH472	8051 Microcontroller and Embedded systems	L	T	P	C
Practicum		1	0	4	3

Unit I	**ARCHITECTURE OF 8051 MICROCONTROLLER**	
Comparison of Microprocessor and Microcontroller - Architecture of Microcontroller 8051 - Pin details of 8051		**3**
Unit II	**8051 INSTRUCTIONS SET AND PROGRAMMING**	
Instruction set of 8051-Classification of 8051 Instructions - Data Transfer Instructions - Arithmetic Instructions - Logical Instructions - Branching Instructions - Bit Manipulation Instructions		**3**
Unit III	**PERIPHERALS OF 8051**	
I/O Ports - Bit Addresses for I/O Ports - Timer/Counter - SFRs for Timer - Modes of Timers/counters – Serial Communication – SFRs for Serial Communication		**3**
Unit IV	**8051 INTERFACING and Interrupts**	
Hardware description and interfacing of peripheral devices with 8051: LED – stepper motor – LCD – Seven segment display – DAC – Interrupts: Types – SFRs for interrupts.		**3**
Unit V	**Embedded Systems**	
Definition of Embedded System – Features of Embedded System – Types of Embedded Systems – RISC and CISC Processors (comparison) **ARM PROCESSOR FUNDAMENTALS:** Data Flow model – Registers - Modes of operation - Current Program Status Register – Pipeline – Exceptions - Interrupts - Vector Table **ARM PROCESSOR:** Introduction to LPC 2148 ARM controller – Block Diagram - Families		**3**
		15
	Experiments	**60**
	TOTAL	**75**

Experiments: TOTAL HOURS- 60 HOURS

Use of Arithmetic instructions and Data transfer instructions:

1. Write an assembly language program (ALP) to perform

   (a) Addition of two 8-bit data.

   (b) Multiplication of two 8-bit data.

2. Write an assembly language program (ALP) to perform addition of two 16-bit data.
3. Write a program to copy the value 55H into RAM memory locations 40H to 45H using

   (a) Direct addressing mode

   (b) Register indirect addressing mode

Use of Arithmetic instructions, Data transfer and Branching instructions:

4. Write an assembly language program (ALP) to add an array of n elements.

Use of Logical, Bit manipulation and Branching instructions:

5. Write an assembly level program to count the number of even numbers and number of odd numbers in an array of 'N' bytes of data
6. Check whether the given byte of data is present in an array of 'N' bytes of data. If present send 00 in Port 0 else send FF in Port 0
7. Write an assembly level program to determine the largest element in an array.

Concept for Programming 8051 Timer:

8. Interfacing LED with 8051: Write an assembly language program (ALP) to generate a blink an LED connected to P1.5 using timer in mode 1. Assume XTAL = 11.0592 MHz.
9. Interfacing LED with 8051: Write an assembly language program (ALP) to generate blink an LED connected to P1.5 using delay routine.
10. Write an assembly level program to interface stepper motor with 8051.
11. Write an assembly level program to interface LCD with 8051.
12. Write an assembly level program to interface 7 segment display with 8051.

Concept for Programming Serial port:

13. Write an assembly level program to transfer the letter "B" continuously using serial communication. Use Timer1 at baud rate of 9600.

Concept for Programming Interrupts for Timer:

14. Write an assembly level program to generate a square wave of 100 Hz with Timer 0 in mode 2. Use interrupt concept. In the main program, the microcontroller displays "Y" at port 0 and "N" at port 2 continuously.

15. Interface DAC with 8051 and develop an algorithm to generate the following outputs (a) Square wave with 50% duty cycle (b) Triangular wave (c) Ramp signal

DIY programs:

Data transfer related programs:

1. Write an 8051 assembly level program to transfer 5 bytes of data from location starting at 35h to location 30h.
2. Write an 8051 assembly level program to exchange 10 bytes of data from location starting at 30h with data from location starting from 1000h.
3. Write an 8051 assembly level program to transfer 10 bytes of data starting from location 8000h to location 9000h within the external memory.

Mathematical programs:

4. Write an 8051-assembly level program to check whether the lower nibble is greater than upper nibble of A. If 'yes' send 00 to Port 0 else send FF to Port 0.
5. Write an alp to add N bytes of BCD numbers talking into account the possible carry output.
6. Write an ALP to find the average of N bytes of data.
7. Write an ALP to subtract two BCD numbers.
8. Write an ALP to add 2 three byte numbers. Numbers starts from location with address 30h and 40h. Store the results starting from location 30h.
9. Write an 8051 assembly level program to count the number of +ve numbers and number of –ve numbers in an array of 'N' bytes of data.
10. Write an 8051 assembly level program to compute square of a number.
11. Read the data from Port1. IfP1.1 is at logic0, find the largest number in an array of 'N' bytes of data and store in location 40h. If P1.0 is at logic1, find the smallest number in the array and store in the location 40h.
12. Write an 8051 assembly level program to arrange an array of 'N' bytes of data in ascending order.
13. Write an 8051 assembly level program to arrange an array of 'N' bytes of data in descending order.
14. Write an 8051 assembly level program to find whether the given number is prime or not. If prime send FF to Port 0 else send 00 to Port 0.

15. Write an 8051 assembly level program to find the square of a number from 1 to 10 using look up table technique.
16. Write an 8051 assembly level program to convert Decimal to ASCII.

Counter related programs:

13. Write an 8051-assembly level program for BCD up counter. Show each count in Port 0 with appropriate delay.
14. Write an 8051-assembly level program for BCD down counter. Show each count in Port 0 with appropriate delay.

Timer / interrupt related programs:

15. Interfacing LED with 8051: Write an assembly language program (ALP) to generate a square wave on P1.5 with 50% Duty Cycle. Use a timer in mode 1 with Ton = Toff = 19.93145 microseconds. Assume XTAL freq = 11.0592 MHz.
16. Interfacing LED with 8051: Write an assembly language program (ALP) to generate a square wave on P1.5 with 50% Duty Cycle. Use timer in mode 1 with Ton = Toff = 5 microseconds. Assume XTAL freq = 11.0592 MHz.
17. Generate a square wave on P0.3 with Ton = 3 ms and Toff = 10 ms. Use timer 0 in mode 1.
18. Write an assembly level program to generate two square waves – one of 5 KHz frequency at pin P1.3, and another of frequency 25 KHz at pin P2.3. Use two timers in mode 2. Use interrupt concept. [In the main program, the microcontroller transmits “A” to port 0 continously]

Serial communication and Interrupts:

19. Take data in through the port 0 and transfer this data serially.
20. Take data sent in serial form and transfer this data to port 0 in parallel form..
21. A switch is connected to P2.5. Write an 8051 assembly level program to read the status of switch and if switch is closed send serially "HELL0', else send WELCOME' at baud rate 9600.
22. Write an 8051 ALP to read data from P1 and write it to P2 continuously while giving a copy of it to serial COM port to be transferred serially. Use interrupt concept.
23. Write an 8051 ALP to send message HELLO serially once in every 2 sec. User interrupt concept.

Interfacing related programs:

28. Interfacing DAC with 8051 and developing an algorithm to generate the following outputs (a) Square wave with 75% duty cycle (b) sine wave

29. Interface a multichannel ADC to 8051 and develop a program to read the analog data, convert into digital value and display the digitized value on port 0 connected to LED

ECH473	ANALOG ELECTRONICS LAB	L	T	P	C
Practical		0	0	4	2

Introduction:

This course provides students with a comprehensive understanding of analog electronics through hands-on experiments. It focuses on various amplifier circuits, oscillators, op-amp configurations, and voltage regulators. Students will gain practical knowledge by testing and analyzing the performance of different electronic components and systems, including amplifiers, oscillators, and regulators. The lab-based approach will ensure that students can apply theoretical concepts in real-world scenarios.

Course Objectives

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

1. Apply the working principles of various amplifiers, oscillators, and voltage regulators.
2. Build the practical knowledge in testing and analyzing the frequency response of amplifiers and the performance of different types of oscillators and amplifiers.
3. Test the behavior of active devices such as op-amps and timers in different configurations (inverting, non-inverting, integrators, differentiators, multivibrator etc.).
4. Analyze and measure the performance characteristics of power amplifiers and regulators.
5. Design and test multivibrator circuits (astable and monostable) and understand their applications in practical electronics.

Course Outcomes

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

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the fundamental concepts of Analog circuits	
CO1	Apply the concepts of analog circuits to construct and test amplifier and oscillator circuits.	PO1
CO2	Analyze the given analog circuits to arrive at a suitable conclusion	PO2
CO3	Ability to predict the output of the given analog circuit and conduct experiment to validate the result .	PO3, PO4

CO4	Make use of experimental observations and results to prepare clear and comprehensive reports and documentation on analog electronic circuits.	PO4,PO6,PO7

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	3	-	-
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	2	-	-	-			
CO4	-	-		2	-	1	2			
CAM	3	2	2	3	-	1	2			

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

Instructional Strategy:

- **Hands-on Practice:** Students will build and test amplifiers, oscillators, and regulator circuits. Use lab tools like function generators, multimeters, and oscilloscopes.
- **Demonstrations and Simulation:** Basic concepts such as frequency response, gain, and circuit behavior will be demonstrated through real-time lab experiments and simulations.
- **Group Work:** Students will work in pairs or teams to promote teamwork and shared learning.
- **Assessments:** Evaluation through lab records, viva-voce, and performance in experiments.
- **Use of Tools:** Students will use modern tools like Multisim, LTSpice, and lab instruments for circuit analysis.

Textbooks:

1. Electronics laboratory primer, S. Poorna Chandra, B. Sasikala, S. Chand Technical Publication. ISBN 81-219-2459-6
2. Fundamentals of Electronic Devices and Circuits Laboratory Manual, David A. Bell Oxford University Press, ISBN 978-0-19-542988-6
3. Electronic Devices, Thomas L Floyd, ISBN10: 8177586432

Apparatus Required (For one Batch)

S.No	Name of the Equipments	Range	Required Nos
1	Dual Power Supply	0 – 15V	6
2	Function Generator	0-1 MHz	6
3	DSO	30MHz	6
4	Digital Multimeter		6
5	RC coupled Amplifier kit		2
6	Class A power amplifier kit		2
7	Single tuned amplifier kit		2
8	Common emitter amplifier kit		2
9	Hartley Oscillator kit		2
10	RC Phase shift oscillator kit		2
11	Astable multivibrator kit using 555Timer		2
12	Monostable multivibrator kit using 555Timer		2
13	Software Required	Any Simulation Software such as MULTISIM etc.	

ECH473	ANALOG ELECTRONICS LAB	L	T	P	C
Practical		0	0	4	2

Ex. No	Name of the Experiment	Hours
1.	Test and Plot the frequency response of Common Emitter amplifier.	4
2.	Test the performance of Class A Power amplifier	4
3.	Test the performance of single tuned amplifier.	4
4.	Simulate the performance of RC Coupled amplifier using any simulation tool.(MULTISIM etc.)	4
5.	Simulate the performance of Hartley Oscillator using any simulation tool.(MULTISIM etc.)	4
6.	Simulate the performance of RC phase shift oscillator using any simulation tool.(MULTISIM etc.)	4
7.	Test the performance of Inverting Amplifier with waveforms for Input and output signals.	4
8.	Test the performance of Non-Inverting Amplifier with waveforms for Input and output signals.	4
9.	Test the performance of Summing Amplifier with waveforms for Input and output signals.	4
10.	Test the performance of voltage follower using Op-Amp IC741.	4
11.	Test the performance of Integrator and Differentiator using Op-Amp IC741.	4
12.	Test the performance of Astable Multivibrator using IC555 Timer.	4
13.	Test the performance of Monostable Multivibrator using IC555 Timer.	4
14.	Test the line regulation for any one positive voltage regulator using IC78xx	4
15.	Test the line regulation for any one negative voltage regulator using IC79xx	4

	TOTAL	**60**

ECH474	**Arduino Programming, IoT with Mini project**	**L**	**T**	**P**	**C**
Practical		**0**	**0**	**6**	**3**

Introduction:

This course introduces students to Arduino programming and IoT through sensor interfacing and real-time data applications. It emphasizes hands-on experimentation with transducers, embedded systems, and wireless modules, fostering the development of smart IoT systems. Students will also design and execute a mini project, applying concepts learned to solve real-world challenges.

Course Objectives:

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

- Understand the basics of sensor interfacing and embedded system control using Arduino.
- Gain practical experience in using transducers for measurement applications.
- Interface various input/output devices with Arduino for automation tasks.
- Implement wireless communication and remote monitoring through IoT devices.
- Develop and present a mini project based on real-time IoT applications.

Course Outcomes:

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

CO	Course Outcome (CO)	Program Outcome Mapping
CO1	Describe and explain the basics of Python programming in Arduino.	---
CO2	Apply Arduino programming to interface LEDs, switches, motors, and sensors to obtain accurate and reliable operation.	PO1
CO3	Design and develop IoT-based applications through hands-on experimentation using Python programming and wireless modules (e.g., Wi-Fi, Bluetooth) .	PO2,PO3

CO4	Conduct experiments using python compiler and Formulate the application/Problem statement	PO4
CO3	Present a team-based mini-project demonstrating real-time monitoring or automation for industrial/societal relevance.	PO4, PO5, PO7

Pre-requisites:

Basic knowledge of microcontrollers and electronics.

Mapping of CO and POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	3
CO2	-	2	1	-	-	-	-			
CO3	-	-	-	3	-	-	-			
CO4	-	-	-	2	1	-	2			
CAM	3	2	-	3	1	-	2			

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

Instructional Strategy (Short Form)

- **Hands-on Practice**: Engage students in direct programming and circuit building.
- **Real-Time Applications**: Use sensors and actuators for monitoring and control tasks.
- **Wireless Integration**: Introduce ESP32, Wi-Fi modules, and IoT platforms.
- **Project-Based Learning**: Guide students through end-to-end mini-project development.
- **Visual Demos**: Use serial monitors, dashboards, and simulation tools for feedback.

Apparatus Required (For one Batch)

S.NO	NAME OF THE EQUIPMENTS	RANGE	REQUIRED NOS
1	Strain gauge kit		2
2	Thermistor kit		2
3	LVDT kit		2
4	Computer		10
5	Arduino Board		10
6	Android studio		
7	IOT trainer kit		2
8	ESP32 board		5

ECH474	Arduino Programming, IoT with Mini-project	L	T	P	C
Practical		0	0	6	3

Ex. No	Name of the Experiment	Hours
1.	Measurement of displacement using LVDT	4
2.	Measurement of temperature using Thermistor.	4
3.	Measurement of strain using strain Guage.	4
4.	Installation of Arduino IDE. Interfacing Light Emitting Diode (LED)with Arduino to blink the LED every 1 second.	4
5.	Interfacing switch and LED with Arduino to switch on the LED when the switch is pressed and switch off the LED when switch is released.	4
6.	Automatic night lamp: Interfacing Light Dependent Resistor (LDR) and LED.	4
7.	Interfacing Servo Motors with Arduino for Position Control and Movement	4
8.	Interfacing Touch Sensor with Arduino for Input Control and Feedback	4
9.	Controlling WS2812B Addressable RGBLEDs with Arduino.	4
10.	Interfacing I2C LCD with Arduino to Display Scrolling Text and Custom Characters.	4
11.	Measure the distance by interfacing HC-SR04 Ultrasonic Sensor With Arduino	4
12.	Interfacing IR sensor with Arduino	4
13.	Real-time Object Tracking and Gesture Control using ESP32 /Arduino and IMU Sensor (Simulation)	4
14.	IOT based smart home Monitoring system using Arduino. (Controlling Light)	4

15.	IoT-based Smart Security System with Motion Detection, Camera and Alerts using ESP32	4
	Mini Project	30
	TOTAL	**90**

DIY EXPERIMENTS:
Simulation of 6 Experiments using software like LabVIEW, Tinker cad, etc.

1. Blinking inbuilt LED of Arduino
2. Interfacing buzzer with Arduino
3. Interfacing temperature sensor with Arduino
4. Interfacing seven segment display with Arduino
5. Interfacing proximity sensor with Arduino
6. Traffic light control system using Arduino

Mini projects (Arduino based Projects):

1. Weather Station
2. Smart Home Security System
3. Line Following Robot
4. RFID Asset Tracking System
5. Traffic Light Controller
6. Bluetooth Controlled Car
7. Temperature and Humidity Monitoring System
8. Home Automation System
9. Soil Moisture Sensor for Plant Watering
10. Obstacle Avoidance Robot
11. Ultrasonic Distance Measurement Device
12. Smart Doorbell
13. GPS Tracker
14. PIR Motion Sensor Alarm System
15. LED Cube Display
16. Morse Code Translator
17. Automated Plant Watering System
18. Heart Rate Monitoring System
19. Digital Clock Temperature Display
20. Smart Door Lock System
21. Security Surveillance System
22. Smart Waste Management System
23. Automated Pet Feeder
24. Air Quality Monitoring System
25. Health Monitoring System

V Semester

S. No	Course code	Course Title	Mode	End - exam	Credits	Hours per week	Total hours
1	ECH501	Communication Systems	THEORY	Theory	4	4-0-0	60
2	ECH502	Industrial Electronics and Medical Electronics, PLC and Robotics	THEORY	Theory	4	4-0-0	60
3	*ECH58X	ELECTIVE I	PRACTICUM	Practical	3	1-0-4	75
4	ECH571	Implementation of AI using Python	PRACTICUM	Practical	3	1-0-4	75
5	*ECH58X	ELECTIVE II	PRACTICAL	Practical	2	0-0-4	60
6	ECH572	Computer Networking Lab	PRACTICAL	Practical	1	0-0-2	30
7	ECH573	Communication Systems Lab	PRACTICAL	Practical	1	0-0-2	30
8	ASH595	Advanced Skills Certification - 5			2	2-0-2	60
9	ECH574	Innovation and Startup		Practicum	2	1-0-2	45
10	ECH575	Internship (Summer vacation - 90 hours) with Mini-project			1		-
					23		495

ELECTIVE I	
*ECH581	Signals & Systems and Image Processing
*ECH582	Consumer Electronics
*ECH583	Power Electronic Devices
*ECH584	Wireless Communication
ELECTIVE II	
*ECH585	Embedded Systems with Raspberry Pi PICO Lab
*ECH586	Robotics and PLC LAB
*ECH587	Very Large-Scale Integration Lab
*ECH588	Computer Aided Design Simulation Lab

ECH501	COMMUNICATION SYSTEMS	L	T	P	C
Theory		4	0	0	4

Introduction

This course provides fundamental knowledge of various modern communication technologies and its components including transmission lines, antennas, cellular networks, satellite and optical communication, microwave systems, and radar. It builds the foundation for understanding how data is transmitted, received, and processed in electronic systems.

Course Objective:

1. Understand the fundamentals of electromagnetic spectrum, transmission lines, wave propagation, and antenna parameters.
2. Learn the architecture, standards, and technologies used in cellular, satellite, optical, and microwave communication systems.
3. Analyze and interpret system block diagrams for GSM, satellite, radar, and optical networks.
4. Explore societal relevance and emerging trends in communication technologies such as 5G, GPS, and DTH.

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome Mapping
	Describe and Explain the fundamental concepts of Communication system	--
CO1	Apply the concepts of Communication system to obtain desired parameters.	PO1
CO2	Analyze communication techniques including cellular, satellite, optical, and microwave communication in the course communication systems to arrive at a suitable conclusion.	PO2
CO3	Design communication systems like GSM, satellite links, optical fibers, and microwave transmitters to meet specific technical and application needs.	PO3

CO4	Prepare and deliver a seminar or assignment on advanced communication topics such as 5G, RADAR systems, or satellite communication subsystems.	PO6 , PO7

Pre-requisites:

Basic knowledge of electronics and electrical circuits

Mapping of COs to Pos

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	3	-
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	-	-	-	-			
CO4	-	-	-	-	-	1	1			
CAM	3	2	2	-	-	1	1			

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

Instructional Strategies

- **Start with visual and conceptual learning** of the electromagnetic spectrum, wave propagation, and antenna parameters using simulation tools and real-world examples.
- **Use case-based analysis and comparative charts** (e.g., 4G vs 5G, GPS vs DTH) to build analytical skills and problem-solving capacity.
- **Incorporate system-level diagram drawing** like creating block diagrams and identifying subsystems of satellite, radar, and optical communication.
- **Assign presentations on societal impact topics** like IoT via 5G, use of GPS in daily life, or DTH in remote learning, encouraging lifelong learning and awareness of emerging tech.

ECH501	COMMUNICATION SYSTEMS	L	T	P	C
Theory		4	0	0	4

Unit I	TRANMISSION LINES, WAVE PROPAGATION, ANTENNA	
Electromagnetic Frequency Spectrum **Transmission line** – Characteristic impedance(definition) - Types (names only) -Wave propagation – Ground wave propagation – Sky wave propagation -Space wave propagation (concepts only) **Antenna** – definition – Parameters – Radiation pattern – Bandwidth –Beamwidth – Directivity – Types of antennas (names only) - Microstrip -patch antenna - Horn antenna		10
Unit II	**CELLULAR COMMUNICATION**	
Cellular concepts- standards (comparison based on data rate) - Block diagram of Global System for Mobile Communication-Hand off mechanisms –Improving coverage & capacity in cellular systems - cell splitting, sectoring – concepts on 4G (LTE) and 5G (NR)		10
Unit III	**SATELLITE COMMUNICATION**	
Frequency allocation for satellite services – Kepler's Law –Orbit types: LEO-MEO – Geostationary orbit – Geosynchronous orbit –Uplink and downlink frequencies - Block diagram of a satellite communication system – **space segment**: Power Supply - Altitude Control - Station Keeping -TT & C Subsystems – Transponders- Antenna Sub systems. **Earth segment**: Block diagram of earth station –Applications of Satellite Communication - Concept of DTH - Basic concept of GPS		14
Unit IV	**OPTICAL COMMUNICATION**	
Optical communication system: Block diagram of optical communication system-Principle of light transmission in a fiber using Ray Theory – Numerical aperture – Acceptance angle – Types of losses (names only) -Advantages of optical communication - single mode fibers - multimode fibers - step index fibers - graded index fibers - Optical sources: LED and Laser principles - optical detectors: PIN and APD– connectors–splices-couplers		14
Unit V	**MICROWAVE COMMUNCIATION AND RADAR**	
Microwave Communication: Block diagram of microwave Transmitter &Receiver- Wave guide Tees - Directional Coupler-Working principle of two cavity Klystron, Magnetron–Applications **RADAR:** Working principle of Radar System–Radar frequency bands - Radar Range Equation (Qualitative Treatment) - Block Diagram of pulse RADAR–Applications		12
	TOTAL	**60**

Textbooks:

1. Electronic Communication Systems-George Kennedy-Tata Mc graw Hill
2. Optical Communication-KEISER
3. Wireless Networks-Pahalavan

Reference Books:

1. Satellite Communication–Dennis Roddy –Mc Graw Hill
2. Wireless communication principles and practice THEODORE S. RAPPERPORT

ECH502	INDUSTRIAL ELECTRONICS AND MEDICAL ELECTRONICS, PLC AND ROBOTICS	L	T	P	C
THEORY		4	0	0	4

Introduction:

This course introduces the use of electronic devices in industrial and medical applications. It covers power devices, converters, inverters, PLCs, robotics, and medical equipment. Students will learn how these systems work and where they are used in real life, such as in factories and hospitals.

Course Objectives:

1. To impart foundational knowledge of power electronic devices, converters, inverters, and their applications in industrial systems.
2. To introduce the architecture and programming of PLCs and the basic building blocks of robotics used in automation.
3. To develop an understanding of diagnostic and therapeutic medical electronic equipment and their functional principles.
4. To promote awareness of technological applications in industries and healthcare while encouraging ethical practices and adaptability to new advancements.

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome Mapping
	Describe and Explain the fundamental concepts of Industrial Electronics, PLC, robotic sand medical electronics	---
CO1	Apply the fundamental concepts of power electronic devices, converters, inverters, PLC, robotics, and medical electronics to understand their operation and applications.	PO1
CO2	Analyze circuit behavior and system functionalities in power electronic converters, choppers, inverters, and medical diagnostic and therapeutic devices using standard engineering methods.	PO2
CO3	Construct PLC ladder diagrams for logic control and Design basic control systems for industrial and medical electronics applications.	PO3

CO4	Prepare and present a seminar or assignment on technical topics related to industrial and medical electronic systems/PLC and Robotics.	PO1, PO6 and PO7

Pre-requisites:

Students should know the basics of:

- Electrical and electronic concepts
- Semiconductor devices
- Digital electronics

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	3	-	-
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	-	-	-	-			
CO4	-	-	-	-	-	1	1			
CAM	3	2	2	-	-	1	1			

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

Instructional Strategy

- **Engage and Motivate:** Start with interactive lectures, using animations, circuit diagrams, and real-life examples to explain power electronics and medical systems.
- **Problem-Based Learning:** Use circuit diagrams and block-based questions to help students analyze working conditions, outputs, and performance issues.
- **Concept Design Activities:** Use paper-based design tasks, like drawing PLC ladder diagrams or block diagrams of medical devices, to develop design thinking.
- **Case Studies and Discussions:** Use short case studies on medical and industrial applications to explore societal impact, ethical practices, and lifelong learning relevance.

ECH502	INDUSTRIAL ELECTRONICS AND MEDICAL ELECTRONICS, PLC AND ROBOTICS	L	T	P	C
THEORY		4	0	0	4

Unit I	POWER DEVICES	
Working Principle, V-I characteristics and operation of IGBT, Power Transistor, Power MOSFET and GTO-Switching characteristics of SCR- Turn on and turn off methods		12

Unit II	CONVERTERS AND CHOPPERS	
Converters: Single phase semi bridge half-controlled converters with R, RL and freewheel diode- single phase fully controlled bridge converters with R, RL and freewheeling diode **Choppers:** Principle of chopper operation-DC choppers: step down choppers- step up chopper - AC chopper- Chopper drives: Concept - Types		12

Unit III	INVERTERS AND POWER SUPPLIES	
Inverters- Types (names only)- Single phase full bridge inverter- McMurray inverter circuit - voltage control in inverter - method of obtaining sine wave output from an inverter **Power supply**- Types (Names only)- Switched mode Power Supply (SMPS) - advantages of SMPS - Uninterrupted Power Supply (UPS)- Online and Offline UPS		12

Unit IV	PLC AND ROBOTICS	
PLC: block diagram of PLC - CPU - memory - I/Os- programming of PLC: Ladder programming of logic gates-timer-conveyor control **Robotics-** basic building blocks of robot-end effectors: Types, functions and gripping techniques- sensors in robotics: Types (names only)		12

Unit V	MEDICAL ELECTRONICS	
Sources of Bioelectric Potential -resting and action potential- Electrode – types. Diagnostic Equipment-classification- Block diagram of ECG Recorder- EMG Recorder. Therapeutic Equipment-classification-Block diagram of **external** pacemaker- DC Defibrillators – peritoneal dialysis- heart lung machine		12
	TOTAL	**60**

Textbooks:

1. Industrial Electronics and Control – S. K. Bhattacharya & S. Chatterjee
2. Industrial Electronics – G. K. Mithal
3. Programmable Logic Controller – Pradeep Kumar & Srivastava, BPB Publications
4. Robotics: Principles and Practice – K. C. Jain and L. N. Agarwal, 1st Edition, Khanna Publications, 2009
5. Biomedical Instrumentation and Measurement – Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer

Reference Books:

1. Industrial Electronics – Thomas E. Kissell
2. Introduction to Programmable Logic Controllers – Gary Dunning
3. Robotics Technology and Flexible Automation – S. R. Deb and S. Deb, 2nd Edition, McGraw Hill Publications, 201

ELECTIVE 1:

ECH581	SIGNALS & SYSTEMS AND IMAGE PROCESSING	L	T	P	C
Practicum		1	0	4	3

Introduction:

This course imparts foundational knowledge of signals and systems, as well as practical techniques in digital image processing. It covers the analysis of both continuous and discrete-time signals using transforms, along with hands-on exposure to real-time image enhancement, restoration, and compression techniques. The course equips learners with skills applicable in electronics, communication, and computer vision fields.

Course Objectives:

1. To provide foundational knowledge of signals and systems, including their classification, properties, and analysis using mathematical transforms like Fourier and Laplace.
2. To introduce the principles of digital image processing such as enhancement, restoration, segmentation, and compression techniques.
3. To equip students with hands-on skills in simulating and analyzing signals and image operations using Scilab software.
4. To develop the ability to apply signal and image processing concepts in real-world applications while encouraging continuous learning in the evolving field of AI and imaging.

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the fundamental principles of signals, systems and image processing techniques.	---
CO1	Apply the fundamental concepts of continuous-time and discrete-time signals and systems to obtain the desired parameter.	PO1
CO2	Analyze continuous-time signals and systems in signals & systems and image processing to meet specific signal processing requirements.	PO2
CO3	Design algorithms and systems for signal and image processing to analyze, enhance, and transform signals and images in real time applications.	P03
CO4	Conduct experiments using Scilab for signal generation, system response analysis, and implement basic image processing techniques, while demonstrating effective use	PO4

	of tools and teamwork.	
CO5	Present an oral presentation / assignment on the application of signals & systems and image Processing concepts and demonstrating effective communication skills.	P06, PO7

Pre-requisites:

- Basics of Mathematics and Complex Numbers
- Fundamentals of Signals and Communication
- Basic Programming Knowledge

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	3	-
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	-	-	-	-			
CO4	-	-	-	2	-	-	-			
CO5	-	-	-	-	-	1	2			
CAM	3	2	2	2	-	1	2			

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

Instructional Strategies:

- **Deliver theory through visual aids and signal graphs** to strengthen foundational understanding of CT/DT signals and systems.
- **Incorporate problem-solving sessions and worked examples** on Fourier, Laplace, and transform-based image processing operations.
- **Conduct Scilab-based practical regularly** to ensure students can simulate, visualize, and analyze signal behavior and image processing results.

Apparatus Required (For one Batch)

S. No	Name of the Equipment / Component	Specification / Range	Quantity Required
1	Computer System with Scilab and Image Processing Tools	Minimum i3 processor, 4GB RAM, Windows/Linux OS, Scilab with relevant toolboxes installed	10
2	Scilab Software	Latest stable version, open source, with Signal and Image Processing toolboxes	Installed on all 10 systems
3	Internet Connection	Minimum 10 Mbps (LAN/Wi-Fi)	1 (shared lab connection)
4	Sample Image Dataset	RGB images in PNG/JPEG format for processing (grayscale, histogram, filtering etc.)	Available in all systems digitally

ECH581	SIGNALS & SYSTEMS AND IMAGE PROCESSING	L	T	P	C
Practicum		1	0	4	3

Unit I	CLASSIFICATION OF SIGNALS AND SYSTEMS	
Signals: Standard signals- Step, Ramp, Impulse, Real and complex exponentials and Sinusoids - Classification of signals(Names Only). **Systems:** Classification of systems- CT systems and DT systems-Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable		3

Unit II	ANALYSIS OF CONTINUOUS TIME SIGNALS AND SYSTEMS	
Fourier Transform: Fourier Transform – Properties-Inverse Fourier Transform **Laplace Transform:** Laplace Transforms and properties		3

Unit III	DIGITAL IMAGE FUNDAMENTALS	
Basics of Image Processing: Steps in Digital Image Processing –Concepts of Visual Perception – Image Sensing and Acquisition **Image Sampling and Quantization:** Introduction to image sampling and quantization **Color Image Fundamentals:** RGB, HSI models		3

Unit IV	IMAGE ENHANCEMENT AND IMAGE RESTORATION	
Image Enhancement: Spatial Domain: Gray level transformations-Image negative-contrast stretching - Smoothing and Sharpening Spatial filtering **Restoration:** Image Restoration – introduction to degradation model & Noise Models		3

Unit V	IMAGE SEGMENTATION AND COMPRESSION	
Image Segmentation: Edge detection, Region based segmentation – Region growing – Region splitting and merging **Image Compression:** Need for data compression, Huffman, JPEG standard, MPEG		3

Ex. No	Name of the Experiment	
1.	Generate Step, ramp, sine, cosine signals using Scilab/any simulation tool	
2.	Find FFT of a sequence using Scilab/ any simulation tool	
3.	Apply an input to a given second order system and find the output using scilab/ any simulation tool.	

4.	Convert RGB images to grayscale image. Then plot image histogram and plot histogram equalization	60
5.	Perform edge detection of an image	
6.	Resize and rotate an image	
7.	Sharpen an image using Laplacian filter	
	TOTAL	**75**

Textbooks:

1. A.V. Oppenheim, A.S. willsky and S.H. Nawab, Signals and Systems, 2nd Edition, Prentice-Hall of India, 2015
2. Rafe lC. Gonzalez and Richard E. woods, Digital Image processing, 4thedition, Pearson Inc, 2018
3. Simon Haykin and Barry Van Veen, Signals and Systems, 2nd edition, Wiley,2007

ELECTIVE 1:

ECH582	CONSUMER ELECTRONICS	L	T	P	C
Practicum		1	0	4	3

Introduction:

The **Consumer Electronics** course provides an in-depth understanding of modern electronic devices used in households and industries, including audio/video systems, digital transmission, appliances, and smart gadgets. Students gain both theoretical knowledge and hands-on experience through lab activities involving microphones, speakers, CCTV, digital cameras, and smartphones, preparing them for roles in installation, maintenance, and troubleshooting of consumer electronics.

Course Objectives:

1. To provide a strong foundation in the principles and working of consumer electronic devices including audio, video, and digital communication systems.
2. To develop analytical skills for diagnosing faults and assessing performance in various consumer appliances and systems.
3. To impart practical knowledge and skills for installing, testing, and maintaining electronic devices such as CCTV, satellite systems, and smart gadgets.
4. To encourage innovation and sustainable design in consumer electronics, promoting energy-efficient technologies and continuous adaptation to digital advancements.

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the fundamental concepts of Consumer Electronics.	---
CO1	Apply the principles of Consumer Electronics to obtain a desired parameter/system functions.	PO1
CO2	Analyze different systems and technologies in Consumer Electronics to interpret results and arrive at a suitable solution.	PO2
CO3	Design functional block diagrams of audio, video, digital transmission, consumer appliances, and modern consumer electronic systems.	PO3
CO4	Conduct experiments related to consumer electronic devices to understand their operation and performance.	PO4

CO5	Prepare assignment report or Visual presentations related to Consumer Electronics concepts.	PO6, PO7

Pre-requisites:

- Basic Electronics and Electrical Components
- Fundamentals of Analog and Digital Communication

Mapping of COs to POs

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	3	-	-
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	-	-	-	-			
CO4	-	-	-	2	-	-	-			
CO5	-	-	-	-	-	1	2			
CAM	3	2	2	2	-	1	2			

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

Instructional Strategies

- **Theory-Based Sessions with Visual Aids** Use block diagrams, videos, and demonstrations for systems like Smart TVs, Digital Cameras, Wearables
- **Case-Based Discussions** Diagnose faults and discuss real-world problem-solving in appliances and communication devices
- **Hands-on Lab Experiments** Include installation of CCTV, Dish Antenna, and configuration of smartphones and digital cameras
- **Peer Presentations** Explore and design solutions (e.g., low-cost home surveillance system, smart appliance proposal)

Apparatus Required (For one Batch)

S. No	Name of the Equipment / Component	Specification / Range	Quantity Required
1	Microphone (Condenser/Dynamic)	Omnidirectional / Unidirectional, with stand	2
2	Loudspeaker	Standard speaker with frequency range 20Hz–20kHz	2
3	CD/DVD Player	Functional model with audio/video output	2
4	Dish Antenna with Set-Top Box	DTH antenna, signal strength indicator, coaxial cable	2
5	CCTV System	CCTV camera, DVR/NVR, monitor, connectors, power supply	2 setups
6	Smartphone and Tablet	Android/iOS devices with system settings access	2 smartphones, 2 tablets
7	Digital Camera	DSLR / Point-and-shoot with manual and auto settings	2
8	Computer System	Minimum i3 processor, 4GB RAM, Windows/Linux, internet access for device interfacing	10 (1 per batch)
9	Internet Connection	Minimum 10 Mbps (LAN/Wi-Fi)	1 (shared lab connection)
10	Software Required	Proteus	

ECH582	CONSUMER ELECTRONICS	L	T	P	C
Practicum		1	0	4	3

UNIT I	AUDIO SYSTEMS	
Microphones and Loudspeakers: Carbon, Moving coil, Wireless microphone, Permanent Magnet Loudspeakers and Multi-speaker systems. **Recording Systems:** Digital Recording, Optical Recording **Reproducing systems:** Monophonic, Stereophonic, Surround System		3
UNIT II	**VIDEO SYSTEMS**	
Introduction to Video Signal Processing: Scanning Principles, Aspect Ratio, Resolution and Flicker. Attributes of Colour, Luminance and Chrominance Signal. **TV standards:** National Television Standards Committee (NTSC), Phase Alternating Line (PAL), Sequential Color and Memory (SECAM) System **TV Displays:** Liquid crystal display (LCD), light-emitting diode (LED) display		3
UNIT III	**DIGITAL TRANSMISSION SYSTEMS**	
Telecommunication System: Closed- circuit television (CCTV). **Satellite System:** Direct-To-Home (DTH), Satellite Navigation- GPS Receiver. **Fiber Optic System:** Usage of Fiber in Telephone Network, Fiber to the Home (FTTH).		3
UNIT IV	**CONSUMER APPLIANCES**	
Microwave Oven: Magnetron, Working principle of Microwave Oven. **Washing Machine:** Controller for Washing Machine, Washing Cycle, Hardware and Software Development, Fuzzy Logic Washing Machines.		3
Unit V	**MODERN CONSUMER ELECTRONICS**	
Scanner and Readers: Bar coding principle, Bar-Code Scanner and Decoder, RFID Tags and Readers, Quick Response (QR) code technology. **Wearables:** Smart Watch/Fit bands, Hearing Aids, AR/VR Headsets.		3

Ex. No	Name of the Experiment	
1.	To plot the directional response of a Microphone.	60
2.	To plot the directional response of a Loudspeaker.	
3.	Trouble shooting of CD/DVD Player	
4.	Installation of Dish Antenna for best reception	
5.	Installation of CCTV system	
6.	To study the various parameters in the Smartphone and Tablet.	
7.	Explore digital cameras settings	
8.	To Simulate Temperature Control System using Proteus.	
9.	Installation of LCD/LED Projector & verify the functionalities.	
10.	To Simulate circuit for A/C Motor Control using Proteus .	
	TOTAL	**75**

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

Textbooks:

1. S.P.Bali, Consumer Electronics, 1st edition, Pearson Education, 2007
2. B.R. Gupta and V. Singhal, Consumer Electronics, 6th edition, S. K. Kataria& Sons, 2013
3. R.G. Gupta, Audio video systems,2nd edition, Tata McGraw Hill, 2017

Web-based/Online Resources:

- https://www.explainthatstuff.com/articles_gadgets.html
- https://www.electronicsandyou.com/consumer-electronics-definition- list-of-companies.html
- https://spectrum.ieee.org/topic/consumer-electronics/

ELECTIVE 1:

ECH583	POWER ELECTRONIC DEVICES	L	T	P	C
Practicum		1	0	4	3

Introduction:

This course introduces the principles and practical uses of power semiconductor devices and circuits in the control and conversion of electric power. Students will explore devices such as SCR, MOSFET, and IGBT, and learn how they are used in converters, inverters, choppers, and triggering circuits. Emphasis is placed on understanding real-world applications in power control systems.

Course Objectives:

1. To introduce the working principles, characteristics, and applications of power semiconductor devices such as SCR, MOSFET, IGBT, and GTO used in industrial power control.
2. To provide knowledge on SCR triggering methods, commutation techniques, and converter circuits with practical exposure to waveform analysis and circuit behavior.
3. To develop the ability to design, construct, and test DC choppers and inverter circuits using engineering tools and simulation platforms.
4. To sensitize students to the societal, ethical, and environmental aspects of power electronics applications, fostering teamwork and lifelong learning in emerging technologies.

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the fundamental principles of power electronic devices and circuits.	---
CO1	Apply the fundamental concepts of power electronic devices to obtain the desired characteristics and performance parameters.	PO1
CO2	Analyze power electronic devices and circuits to meet specific power control and switching requirements.	PO2
CO3	Design power electronic devices and circuits for real-time applications such as motor control and power conversion.	PO3
CO4	Conduct experiments on power electronic devices and circuits (SCR characteristics, commutation circuits, chopper, inverter circuits) using lab equipment and demonstrate practical	PO4

	understanding.	
CO5	Make an oral presentation and prepare technical reports on power electronic devices and their applications demonstrating communication and teamwork skills	PO6, PO7

Pre-requisites:

- Basics of electrical and electronics engineering
- Semiconductor device principles and applications
- Circuit theory fundamentals

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	3	-	-
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	-	-	-	-			
CO4	-	-	-	2	-	-	-			
CO5	-	-	-	-	-	1	2			
CAM	3	2	2	2	-	1	2			

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

Instructional Strategy

- Use visual aids like diagrams, animations, and real-life examples to explain power devices (MOSFET, IGBT, SCR, GTO) and their applications.
- Solve real-world problems by analyzing SCR triggering, commutation circuits, and converters using theoretical and practical approaches.
- Engage students in designing and testing DC chopper and inverter circuits using simulation tools and physical experiments for hands-on learning.
- Facilitate discussions on the societal, environmental, and ethical implications of power electronics, while promoting teamwork and lifelong learning skills.

Apparatus Required (For one Batch)

S. No	Name of the Equipment / Component	Specification / Range	Quantity Required
1	SCR (Silicon Controlled Rectifier)	TYN612 / BT151	20
2	TRIAC	BTA16 / BT136	10
3	MOSFET	IRF540 / IRFZ44N	10
4	IGBT	IRG4PC50U	10
5	Resistors, Capacitors, Inductors	Various values as per circuit design	20 each
6	Diodes and Bridge Rectifiers	IN4007, Bridge Modules	20 each
7	Breadboards / PCB Boards	General-purpose type	10
8	Regulated Power Supplies	0–30V DC, 2A or above	10
9	Cathode Ray Oscilloscope / Digital Storage Oscilloscope	Dual channel, 20 MHz or above	2
10	Function Generator	1 Hz to 1 MHz range	2
11	Multimeters	Digital type	10
12	LEDs and Battery	White LEDs, Rechargeable battery (6V/12V), charging circuit	2 kits
13	Lamp Dimmer Components	Lamp holder, 230V bulb, TRIAC circuit components	2 setups
14	Load (Bulbs, DC motors, etc.)	12V DC motors, 230V bulbs for load testing	As needed
15	Single-Phase Inverter Kit / Components	Transformer, MOSFET/IGBT-based inverter circuit	2 kits
16	Connecting Wires and Patch Cords	Standard insulated flexible wire	Sufficient stock

ECH583	POWER ELECTRONIC DEVICES	L	T	P	C
Practicum		1	0	4	3

Unit I	POWER TRANSISTOR DEVICES	
Power Metal Oxide Semiconductor Field Effect Transistor (MOSFET)-Insulated Gate Bipolar Transistor (IGBT), Gate turn off thyristor (GTO) -Symbol, Principle of Working, Voltage-Current (V-I) Characteristics, and its applications.		3
Unit II	**SCR TRIGGERING AND COMMUTATION CIRCUITS**	
Triggering of SCR - Gate Triggering – Types –Concepts of DC Triggering, AC Triggering–Synchronized UJT Triggering (Ramp Triggering) Circuit and Waveform. Commutation of SCR- Natural and forced commutation		3
Unit III	**CONVERTERS**	
Converters: Single phase bridge half-controlled and full controlled converters with R, RL and freewheel diode- effect of source inductance and overlap angle - Three phase semi and full converters with resistive load		3
Unit IV	**CHOPPERS**	
CHOPPERS: Definition– Principle of DC Chopper Operation – Principle and Choppers: Principle of chopper operation- DC choppers: stepdown choppers- step up chopper - AC chopper		3
Unit V	**INVERTERS**	
Single phase half bridge & full bridge inverter - Mcmurray inverter circuit -output voltage control in inverter - method of obtaining sine wave output from an inverter		3

Ex. No	Name of the Experiment
1.	Verify the V-I Characteristics of SCR and Plot the graph.
2.	Construct and test commutation circuits of SCR
3.	Construct and test the performance of a full wave rectifier using SCR
4.	Emergency light system using SCR

5.	Lamp dimmer circuit using TRIAC.	60
6.	Construct and test a chopper circuit	
7.	Construct and Test the Single-Phase Inverter using MOSFET/IGBT.	
8.	Simulation of Power electronic circuits using simulation software.	
	TOTAL	**75**

Textbooks:

1. Ned Mohan, Tore M. Undeland, Power electronics: converters, applications, and design', John Wiley &Sons.3 rd edition.
2. P. S. Bimbhra, "Power Electronics", Khanna Publishers, New Delhi.
3. Industrial Electronics and Control-SK Battacharya & SChattarjee
4. Industrial electronics-G.K. Mithal.

Reference Books:

1. Industrial Electronics-Thomas E. Kissell
2. Muhammad H. Rashid, "Power Electronics - circuits, devices and applications", Prentice Hall of India, 2nd edition.
3. Power Electronics – Devices, Converters and Applications", by Vedam Subramanyam Revised 2nd edition, New Age Publications

ELECTIVE 1:

ECH584	WIRELESS COMMUNICATION	L	T	P	C
Practicum		1	0	4	3

Introduction:

The Wireless Communication course provides a comprehensive understanding of modern wireless systems, covering cellular concepts, radio propagation, modulation, multiple access techniques, wireless networks, and diversity techniques. This course equips students with both conceptual knowledge and hands-on experience in modeling and simulating wireless communication systems using tools like Xcos and open- source platforms, thereby preparing them for careers in the wireless and mobile communication industry.

Course Objectives:

1. To provide a strong foundation in cellular communication principles, wireless standards, and radio propagation models essential for modern wireless communication systems.
2. To introduce students to various modulation and multiple access techniques along with challenges such as interference and fading in wireless environments.
3. To develop skills in modeling and simulating wireless communication systems using open-source tools such as Xcos for practical learning.
4. To foster innovation and continuous learning in designing energy-efficient and future-ready wireless systems with exposure to technologies like 5G, MIMO, and smart antennas.

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the basic concepts of Wireless Communication.	
CO1	Apply the fundamental concepts of Wireless communication techniques to obtain a desired parameter.	PO1
CO2	Analyze wireless communication systems to meet specific requirements in mobile networks and wireless sensor applications.	PO2
CO3	Design modulation, multiple access, and diversity techniques in wireless communication for real-time applications such as cellular networks.	PO3

CO4	Conduct experiments for modeling wireless channels, modulation schemes, and equalization techniques using simulation tools (Xcos).	PO4
CO5	Present oral presentations and assignments on the application of wireless communication concepts, demonstrating effective communication skills.	PO6, PO7

Pre-requisites:

Basic knowledge of Analog and Digital Communication

Mapping of COs to Pos

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	3	-
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	-	-	-	-			
CO4	-	-	-	2	-	-	-			
CO5	-	-	-	-	-	1	2			
CAM	3	2	2	2	-	1	2			

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

Instructional Strategies

- **Engage and Motivate:** Start with interactive lectures to introduce the fundamental concepts of wireless communication, using real-world examples to engage students.
- **Theory to Practice:** Encourage students to bridge theoretical knowledge with practical experiments, simulating wireless communication systems through hands-on activities and open-source software like Xcos.
- **Simulation-Based Learning:** Focus on modeling and simulation exercises to visualize and understand wireless channel characteristics, modulation techniques, and network models, reinforcing theoretical concepts.
- **Collaborative Learning**: Foster teamwork by assigning group projects where students design and simulate wireless systems, promoting collaboration and peer learning.

Apparatus Required (For one Batch)

S. No	Name of the Equipment / Component	Specification / Range	Quantity Required
1	Computer System with Simulation Tools	Minimum i3 processor, 4GB RAM, Windows/Linux OS, Xcos/Scilab installed	10 (1 per batch)
2	Scilab with Xcos Software/any other simulation tool	Latest stable version with communication toolbox	Installed on all systems
3	Internet Connection	Minimum 10 Mbps LAN/Wi-Fi	1 (shared lab connection)
4	Projector / Smart Board (for demonstration)	HDMI/VGA compatible	1
5	Bluetooth-enabled Devices (Laptops/Mobiles/Tablets)	With Bluetooth 4.0 or above support	2 pairs (4 devices)
6	File Sharing Applications	Bluetooth file transfer tools, e.g., built-in OS utilities or open-source software	Installed or accessible
7	QPSK / MSK Modulation Software Tools	Scilab/Xcos or other open-source tools capable of QPSK/MSK simulation	Installed on all systems
8	Wireless Communication Simulation Toolbox	Open-source toolboxes/libraries for channel modeling and equalization	Installed on all systems

ECH584	WIRELESS COMMUNICATION	L	T	P	C
Practicum		1	0	4	3

Unit I	CELLULAR CONCEPT	
Cellular concepts-Mobile Station (MS) - Base Station (BS) - Mobile Switching Centre (MSC) - Frequency Reuse– Interference(Names Only)- Improving coverage & capacity in cellular systems(Names Only) - Cellular systems and standards – GSM, 4G (LTE), 5G (Basic concepts only)		3
Unit II	**MOBILE RADIO PROPAGATION**	
Introduction to radio wave propagation (scattering, reflection, diffraction), free space propagation model- two rays Rayleigh model, small scale fading, multipath fading		3
Unit III	**MODULATION ANDMULTIPLE ACCESS TECHNIQUES**	
Modulation - QPSK, MSK, GMSK, QAM, OFDM (Concepts only) - Multiple access - FDMA, TDMA, SDMA, OFDMA (concepts only) – CDMA (concepts only)		3
Unit IV	**WIRELESS NETWORKS**	
Wireless Local Area Networks (WLANs): IEEE 802.11 Standards -Wireless Personal Area Networks (WPANs): Bluetooth and Zigbee – Wireless Sensor Networks (WSNs) - Wireless Adhoc Networks		3
Unit V	**EQUALIZATION AND DIVERSITY TECHNIQUES**	
Basics of equalization and its types, diversity techniques & its types – MIMO – Smart antenna		3
Ex. No	**Name of the Experiment**	
1.	Performance measurement of signal adjacent channel leakage ratio using Xcos/ any simulation tool.	60
2.	Channel model simulation using Xcos/ any simulation tool.	
3.	Modeling and simulation of TDMA using any open-source software like Xcos/ any simulation tool.	
4.	Experiment with pairing devices, transferring files, and understanding the security features of Bluetooth.	
5.	Modulation of QPSK	

6.	Modulation of MSK	
7.	Wireless channel equalization of Zero forcing Equalizer using Xcos/ any simulation tool	
	TOTAL	**75**

ECH571	IMPLEMENTATION OF AI USING PYTHON	L	T	P	C
Practicum		1	0	4	3

Introduction:

This course provides hands-on exposure to Artificial Intelligence (AI) concepts using Python. It introduces students to the fundamentals of AI, problem-solving techniques, machine learning, natural language processing, and real-world applications such as chatbots and autonomous systems. The course emphasizes practical implementation through coding and experimentation with AI models.

Course Objectives (COs):

1. To introduce students to the fundamentals of Artificial Intelligence and the structure of intelligent systems, providing a strong foundation in core concepts like intelligent agents, environments, and basic Python programming for AI development.
2. To equip students with problem-solving techniques using AI algorithms and strategies, including search techniques (like Breadth-First Search), game-playing strategies (Minimax and Alpha-Beta pruning), and logic-based approaches.
3. To develop understanding of machine learning and deep learning concepts, focusing on learning algorithms such as Find-S, neural networks, and their implementation using Python libraries to solve classification and prediction tasks.
4. To enable students to apply AI techniques to real-world applications, such as building chatbots, performing natural language processing (NLP), image classification using CNNs, and developing interactive GUIs using tools like Tkinter.

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome mapping
	Describe and explain the basic concepts of AI implementation using Python.	---
CO1	Apply the fundamental concepts of artificial intelligence and Python programming to solve computational problems.	PO1
CO2	Analyze AI techniques such as search algorithms, machine learning models and natural language processing using Python to arrive at a suitable conclusion.	PO2
CO3	Develop Python code using libraries and tools such as TensorFlow/ Keras to create AI-based solutions for real-world applications.	P3, PO4

CO4	Conduct experiments using Python and prepare reports in Implementation of AI using Python demonstrating practical skills, effective communication and teamwork.	PO4, PO6, PO7

Pre-requisites:

Students should have basic knowledge of:

- Python programming fundamentals
- Logical and mathematical reasoning

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	3
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	-	-	-	-			
CO4	-	-	-	2	-	1	2			
CAM	3	2	2	2	-	1	2			

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

Instructional Strategies

➤ Introduce AI and Python concepts using real-life examples and interactive coding sessions.

➤ Conduct hands-on lab experiments involving search algorithms, neural networks, and text processing tools.

➤ Encourage mini projects like chatbot development and data extraction for better understanding of applications.

➤ Promote independent learning using AI tools and libraries (e.g., TensorFlow, NLTK) to simulate lifelong learning.

Apparatus Required (For one Batch)

S. No	Name of the Equipment / Component	Specification / Range	Quantity Required
1	Computer System with Python Installed	Minimum i3 processor, 4GB RAM, Windows/Linux OS, Python 3.8 or above	10
2	Python Programming Environment	Python 3.8+, with IDLE / Anaconda / Jupyter Notebook	Installed on all systems
3	Internet Connection	Minimum 10 Mbps (LAN/Wi-Fi) for installing libraries and accessing datasets	1 (shared lab connection)
4	Required Python Libraries	numpy, pandas, scikit-learn, nltk, tkinter, matplotlib, tensorflow, keras	Installed on all systems
5	CIFAR-10 Dataset (for CNN training)	Standard image dataset (downloaded from Keras Datasets or online sources)	Available on all systems
6	SQLite/MySQL Server or Database File	For database connectivity experiment	Installed on 2 systems
7	Text Files / Sample Data	For file handling and NLP experiments	Stored on all systems

ECH571	IMPLEMENTATION OF AI USING PYTHON	L	T	P	C
Practicum		1	0	4	3

Unit I	FUNDAMENTAL OF AI & PYTHON BASICS	
Introduction to AI - Structure of AI - Intelligent Agents & Environments **Python**: Introduction-Basic Syntax: Data Types-Variables-Operators- Input/output- Flow of Control (Modules, Branching): If-If-else-Nested if-else-Looping: For – While - Nested loops – Pass - Strings -Comparison of List, Dictionary & Tuples- OOPs concept.		3
Ex. No	**Name of the Experiment**	
1.	Write a program using python to get a number from user and display whether it is even or odd.	12
2.	Write a program to extract the data from database using python	

Unit II	PROBLEM SOLVING BY SEARCH	
Searching for solution- Uninformed Search-Breadth first search- Heuristic & Meta-Heuristics-Alphabet pruning.		3
Ex. No	**Name of the Experiment**	
3.	Implement uninformed search technique “Breadth first search” using python	12
4.	Write a Program to implement Tic- Tag- Toe Game Playing using Algorithms: Minimax and Alpha Beta Pruning	

Unit III	LEARNING	
Learning -the brain and the neuron - Machine Learning-subset of AI-Types (names only) - supervised learning Deep learning: subset of ML – differences and overlaps of AI, ML and DL		3
Ex. No	**Name of the Experiment**	
5.	Implement Find S algorithm using python	12
6.	Build and Train a Convolutional Neural Network for Classifying Images in the CIFAR-10 Dataset.	

Unit IV	NATURAL LANGUAGE PROCESSING	
Basics of text processing-Tokenization-Word type- Morphology- Lemmatization-Morphemes-Stemming- - Parts of speech tagging		3
Ex. No	**Name of the Experiment**	
7.	Implement a python program that performs tokenization on the input text.	12
8.	Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.	

Unit V	APPLICATIONS OF ARTIFICIAL INTELLIGENCE	
Education – Healthcare – Transportation – Robotics - Data Analysis - Autonomous Vehicle – Agriculture – Gaming		3
Ex. No	**Name of the Experiment**	
9.	Generate speedometer using TK dial using python	12
10.	Construct a chatbot using python programming.	
	TOTAL	75

Textbooks:

1. Stuart J. Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rdedition, Prentice Hall Series, 2010
2. Rupinder Singh, Introduction to Artificial Intelligence,1st edition, Notion Press, 2021
3. T.R. Sharika and P.S. Archana, Introduction to Artificial Intelligence, 1stedition, Sharika T R Publisher, 2023

ELECTIVE 2:

ECH585	EMBEDDED SYSTEMS WITH RASPBERRY Pi PICO LAB	L	T	P	C
Practical		0	0	4	2

Introduction:

The course focuses on practical implementation and hands-on experience with embedded systems using the Raspberry Pi PICO microcontroller. It covers Python programming, interfacing various peripherals with the microcontroller, and solving real-world problems using embedded solutions. The course includes a series of experiments that introduce students to the fundamental concepts of embedded systems design, sensor interfacing, and automation.

Course Objectives:

1. **To provide hands-on experience in Python programming and microcontroller-based development** using the Raspberry Pi PICO, emphasizing real-world applications through sensor and actuator interfacing.
2. **To introduce students to essential embedded system concepts**, such as digital input/output control, ADC, PWM, interrupts, and serial communication protocols like I2C, enabling students to build interactive hardware solutions.
3. **To develop skills in designing, coding, and debugging embedded applications**, including systems like traffic light controllers, temperature monitors, and motor controllers that solve practical engineering problems.
4. **To foster creativity, sustainability awareness, and teamwork through mini-projects and cloud- based IoT applications**, encouraging students to develop embedded systems with social and environmental impact.

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the basic concepts of embedded systems programming using Raspberry Pi PICO and Python language.	---
CO1	Apply knowledge of embedded systems to interface sensors, actuators and displays with Raspberry Pi PICO to obtain desired system behavior and parameters.	PO1
CO2	Analyse embedded system programs and hardware interfacing to identify issues and arrive at a conclusion for system performance improvement.	PO2
CO3	Develop Python code to interface sensors, actuators, and displays with Raspberry Pi PICO and analyse the system to meet specific	PO4

	performance requirements.	
CO4	Make a mini project or presentation demonstrating embedded system programming, sensor interfacing using Raspberry Pi PICO and Python with simulation tools exhibiting teamwork skills.	PO5, PO6, PO7

Pre-requisites:

- Basic knowledge of Python programming.
- Understanding of electronic components such as LEDs, sensors, motors, and displays.

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	3
CO2	-	2	-	-	-	-	-			
CO3	-	-	-	3	-	-	-			
CO4	-	-	-	-	1	1	2			
CAM	3	2	-	3	1	1	2			

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

Instructional Strategies:

- **Engage and Motivate**: Introduce basic programming concepts using Python and demonstrate their applications with practical interfacing tasks.
- **Hands-On Learning**: Conduct experiments that allow students to interface different components like LEDs, sensors, and motors, thereby reinforcing theoretical concepts with practical knowledge.
- **Project-Based Approach**: Guide students through designing simple embedded projects such as traffic light systems and temperature measurement tools to improve problem-solving and creative thinking.
- **Collaborative Learning**: Encourage group work on certain experiments to foster teamwork and peer-to-peer learning.

Apparatus Required (For one Batch)

S. No	Name of the Equipment / Component	Specification / Range	Quantity Required
1	Raspberry Pi Pico Microcontroller Boards	RP2040, Dual-core ARM Cortex-M0+, 264KB RAM, 2MB Flash	10
2	Computer Systems	i3 or above, 4GB RAM, Windows/Linux OS, Thonny IDE installed	10
3	Micro USB Cables	For programming Raspberry Pi Pico	10
4	Breadboards	Medium size	10
5	LEDs (Red, Yellow, Green)	5mm or 3mm	30+
6	Resistors	220Ω, 1kΩ, 10kΩ	Assorted boxes
7	Push Buttons	Tactile switches	20+
8	Relay Modules	5V, Single channel	2
9	Buzzer Modules	Piezo or active buzzers	2
10	Potentiometers	10kΩ	5
11	Ultrasonic Sensor Modules	HC-SR04	2
12	Temperature Sensor	LM35 / TMP36 / DS18B20	2
13	Stepper Motor + Driver Module	28BYJ-48 + ULN2803 or ULN2003 driver	2 sets
14	Light Dependent Resistor (LDR)	Photoresistor	2
15	7-Segment Display (Common Cathode or Anode)	Single-digit and dual-digit	5 each
16	I2C Module for 7-Segment / LCD	PCF8574 or equivalent	2
17	LCD Display (16x2)	With and without I2C interface	2
18	Jumper Wires (Male-Male, Male-Female)	Standard colours and lengths	100+
19	USB Power Supply or Power Banks	5V regulated	2

ECH585	EMBEDDED SYSTEMS WITH RASPBERRY Pi PICO LAB	L	T	P	C
Practical		0	0	4	2

Ex. No	Name of the Experiment	Hours
	PART I	**60**
1.	Familiarisation with Python: Programs related to input, output, if … else, for loop and while loop. (Not for exam purpose)	
	PART II	
1.	(a) Interface an LED to Raspberry Pi PICO microcontroller and write a python program to blink it every 1 second. (b) Interface a buzzer to Raspberry Pi PICO microcontroller and write a python program to beep it every 1 second. (c) Implement a traffic light control system by interfacing three LEDs with Raspberry Pi PICO microcontroller.	
2	Interface a relay to Raspberry Pi PICO microcontroller and write a python program to switch on and switch off a bulb every 1 second.	
3	Interface an LED and a push button with internal pullup to Raspberry Pi PICO microcontroller and write a python program to switch on the LED if the switch is ON and switch off the LED if the switch is OFF.	
4	Interface an LED and a push button with internal pullup to Raspberry Pi PICO microcontroller and write a python program to make the LED glow for three seconds and then switch it OFF when the switch is pressed and released. When the switch is not pressed, the LED should blink every 0.5s. Use interrupted concept.	
5	Interface an ultrasonic sensor to Raspberry Pi PICO microcontroller and write a python program to compute the distance of an obstacle and display it in serial monitor.	
6	Interface a potentiometer to Raspberry Pi PICO microcontroller and write a python program to print the potentiometer value.Use ADC concept.	
7	Interface a temperature sensor to Raspberry Pi PICO microcontroller and write a python program to print the temperature. Use ADC concept.	
8	Interface an LED to Raspberry Pi PICO microcontroller and write a python program to increase the brightness of the LED using PWM concept.	
9	Interface a stepper motor with Raspberry Pi PICO microcontroller and write a python program to rotate in clockwise direction in steps. Use	

	ULN2803 driver module.	
10	Interface an LDR to Raspberry Pi PICO microcontroller and write a python program to switch on the LED if the environment is dark and switch off the LED if the environment is dark.	
11	Interface a seven-segment display to Raspberry Pi PICO microcontroller and write a python program to display from 0to F using the concept of arrays.	
12	Interface two seven segment display to Raspberry Pi PICO microcontroller and write a python program to display from00 to 99. Interface seven segment displays using I2C protocol.	
13	Interface an LCD to Raspberry Pi PICO microcontroller and write a python program to display “HELLO WORLD” in the first line and to display from 0 to 9 in the second line with a time gap of 1s between each digit.	
14	Interface two seven segment display to Raspberry Pi PICO microcontroller and write a python program to display from00 to 99. Interface seven segment displays using I2C protocol.	
15	Interface a seven-segment display to Raspberry Pi PICO microcontroller and write a python program to display from 0 to F. Use memory addressing.	
	TOTAL	**60**

DIY: Implement the programs 1-10 in wokwi simulator.

1. Create an account in any IoT cloud. Interface a temperature sensor to Raspberry Pi PICO Microcontroller. Write a python program to send temperature values to the Cloud.

DIY Programs:

2. Write a python program to blink Raspberry Pi PICO's internal LED every 1 second.
3. Interface an LED to Raspberry Pi PICO microcontroller and write a python program to blink it every second for 20 times and then stop.
4. Interface two LEDs to Raspberry Pi PICO microcontroller and write a python program to blink the two LEDs such that when one LED is ON, the other is OFF and vice versa.
5. Use two LEDs. The first LED connected to GP 2 and second LED connected to GP 3. Both LEDs have a delay of 1ms. The sequence should be as follows:

D1: ON D2: OFF	D1: OFF D2: ON	D1: ON D2: ON	D1: OFF D2: OFF

6. Interface a push button to Raspberry Pi PICO microcontroller and write a python program to read the state of the switch and display it in the serial monitor. [Use internal pull up resistor]
7. Interface a push button to Raspberry Pi PICO microcontroller and write a python program to read the state of the switch and display it in the serial monitor. [Use internal pull-down resistor]
8. Interface a push button to Raspberry Pi PICO microcontroller and write a python program to read the state of the switch and display it in the serial monitor. [Connect external pull up resistor]
9. Interface a push button to Raspberry Pi PICO microcontroller and write a python program to read the state of the switch and display it in the serial monitor. [Connect external pull down resistor]
10. Interface a motor to Raspberry Pi PICO microcontroller and write a python program to switch on the motor for 5 seconds and then switch it off. Use ULN2803 IC.
11. Interface a stepper motor and a switch with Raspberry Pi PICO microcontroller and write a python program to rotate in clockwise direction in steps and rotate in anticlockwise direction in steps based on the state of the switch.
12. Interface an LED to Raspberry Pi PICO microcontroller and write a python program to blink it every second. Use timer module
13. Assume you are travelling by bike. The potentiometer knob is the accelerator (throttle). If the value is less than 30000, speed is normal. Green LED is on.

    If the value is greater than 30000,

    speed is high. Red LED is on. If the

button is pressed, the Buzzer is ON.

14. Interface a servo motor and potentiometer to Raspberry Pi PICO microcontroller and write a python program to rotate the servo motor based on the potentiometer value using PWM concept.
15. Interface a temperature sensor to Raspberry Pi PICO microcontroller and write a python program to print the temperature. Use ADC concept.

    if temp < 20^0, Green Led is on

    if temp > 20^0

    and < 25^0 Blue

    Led is on if

    temp > 25^0, Red

    Led is on
16. Interface two switches and one led to Raspberry Pi PICO microcontroller and write a python program for the following condition:

    If switch 1 is

    pressed,

    LED is on.

    If switch 2

    is pressed,

    LED is off.
17. Interface a push button to Raspberry Pi PICO microcontroller and write a python program to display in the

    serial monitor the number of times the push button is pressed.
18. Interface two push button to Raspberry Pi PICO microcontroller and write a python program for the following condition:

    When switch 1 is pressed, the counter keeps incrementing. Counter is a variable. Display it on a monitor. When switch 2 is pressed, the counter keeps decrementing.
19. Interface a humidity and temperature sensor (DHT22) to Raspberry Pi PICO microcontroller and write a python program to print humidity and temperature.
20. Interface an LED to Raspberry Pi PICO microcontroller and write a python program to increase the brightness of the LED and then decrease the brightness using PWM concept.
21. Interface a seven-segment display and a switch to Raspberry Pi PICO microcontroller and write

a python program to display from 0 to F when switch is pressed and to display from F to 0 when switch is not pressed using the concept of arrays.

22. Interface an LCD to Raspberry Pi PICO microcontroller and write a python program to display "HELLOWORLD" in the first line and to display "WELOCME TO RASP PI PICO" in the second line.
23. Interface a temperature sensor and an LCD to Raspberry Pi PICO microcontroller and write a python program to print the temperature in the LCD.
24. Interface an ultrasonic sensor and an LCD to Raspberry Pi PICO microcontroller and write a python program to compute the distance of an obstacle and display it in LCD.
25. Interface an ultrasonic sensor and an LCD to Raspberry Pi PICO microcontroller and write a python program to compute the distance of an obstacle and display it in LCD. Use functions.
26. Write a Python program to find the address of LCD display unit which has I2C interface:
27. Interface an OLED to Raspberry Pi PICO microcontroller and write a python program to display "HELLO WORLD" in the first line and to display "WELOCME TO RASP PI PICO" in the second line. OLED is accessed using I2C protocol.
28. Interface two seven segment display and a potentiometer to Raspberry Pi PICO microcontroller and write a python program to display the potentiometer value in the seven-segment display. Interface seven segment display using I2C.

DIY Projects:

1. Raspberry Pico Based Home Automation system
2. Development of Temperature monitoring and control systems
3. Automatic Irrigation System using Embedded controller
4. Automatic Traffic light control systems using Microcontroller
5. Energy Monitoring and control systems
6. Automatic water Tank level control system using ultrasonic sensor
7. Automatic Door Opening Based on Motion / IR Sensor
8. Health care Monitoring system using Bluetooth technology
9. Wireless Based Robot Controlling systems
10. Pulse Width Modulation based Motor Speed control systems
11. RFID Based Security System
12. Design and development of Mobile phone Charger

13. Human Counting based Auditorium Automation system
14. Weather Monitoring systems
15. Mobile App Based Device control system using IoT
16. To Development of Real time Logic Gate Trainer kit
17. Emergency Alarm System using IoT

ELECTIVE 2:

ECH586	PLC and ROBOTICS Lab	L	T	P	C
Practical		0	0	4	2

Introduction

This practical course focuses on implementing automation systems using PLCs and robotics. Students will learn ladder logic programming for industrial applications and simulate robotic movements for tasks such as motion control, object manipulation, and wireless communication. The course bridges automation theory with real-time implementation.

Course Objectives (COs):

1. **To introduce the fundamentals of Programmable Logic Controllers (PLCs) and develop students' skills in designing basic automation logic** using ladder programming techniques for real- world industrial control tasks.
2. **To provide practical exposure to automation systems using timers, counters, and control logic**, enabling students to implement applications like DOL starters, conveyor systems, traffic lights, and lift controls.
3. **To familiarize students with robotic programming and simulation environments**, allowing them to develop and test robotic behaviors such as movement control, object handling, and sensor-based decision-making.
4. **To promote innovation, collaboration, and safe engineering practices** through mini projects involving wireless communication (e.g., Zigbee), object/color detection, and integrated automation systems.

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the basic concepts of PLC programming and robotic control systems.	---
CO1	Apply knowledge of PLC and Robotics to develop and test logic gates, timers, counters, and automated control applications to obtain a desired parameter.	PO1
CO2	Analyze PLC programs and robotic controls to identify errors and arrive at conclusions to meet desired system performance.	PO2
CO3	Design and compute PLC ladder logic and robotic motion control programs for industrial automation and wireless communication.	PO3

CO4	Conduct experiments on PLC programming, robotic simulation and system integration using simulation tools.	PO4, PO6, PO7

Pre-requisites

Students should have a basic understanding of:

- Logic gates and digital electronics
- Electrical machines (motors, relays)
- Basics of programming logic and microcontrollers
- Sensors and actuators in automation

Mapping of COs to Pos

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	3
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	-	-	-	-			
CO4	-	-	-	2	-	1	2			
CAM	3	2	2	2	-	1	2			

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

Instructional Strategy

- **Introduce basic logic design and PLC environment** using hands-on examples like logic gates and simple timers/counters.
- **Utilize simulation tools** (like Factory I/O or Tinker CAD for logic gates, Robo DK/Proteus for robots) to implement and test ladder logic and robotic controls.
- **Assign practical problem-solving tasks** (e.g., lift/traffic light control, conveyor system) that mimic industry scenarios for logic development and testing.

Apparatus Required (For one Batch)

S. No	Name of the Equipment / Component	Specification / Range	Quantity Required
1	Programmable Logic Controller (PLC)	Delta / Siemens / Allen-Bradley, minimum 8 input & 6 output, with software	10
2	Computer Systems	i3 or above, 4GB RAM, Windows OS, PLC programming software installed	10
3	Simulation Software for Robotics	RoboAnalyzer / VPL / Proteus or equivalent	10
4	PLC Trainer Kits	With input/output modules and real-time interface	5
5	Relay Modules	5V or 12V relay boards	5
6	Timer Modules / Programming Software Support	Software-configurable timers (in PLC)	—
7	Counter Modules / Software Support	Up counter simulation in PLC	—
8	DOL Starter Panel	For motor control experiment	1
9	Conveyor Belt Model	Small-scale demo model	1
10	Lift Model	2-floor or 3-floor demo model	1
11	Traffic Light Model	Red, Yellow, Green LED-based model	1
12	Buzzer Module	5V / 12V Buzzer compatible with PLC and robot	2
13	Wheeled Robot Kit (Basic)	2WD or 4WD chassis with motor driver, programmable	5
14	Color Sensor Module	TCS3200 or equivalent	2
15	Robotic Arm Kit / Servo Motors	For object picking simulation	2
16	Zigbee Module (Wireless Communication)	XBee Series 2 or equivalent	2 pairs
17	Power Supply Units	12V DC, regulated	5

18	Jumper Wires & Cables	Male-female and male-male jumper wires	100+
19	Breadboards & Solderless Kits	Medium size	10

ECH586	PLC and ROBOTICS Lab	L	T	P	C
Practical		0	0	4	2

Ex. No	Name of the Experiment	Hours
1	Design and test the AND, OR and NOT logic gates using plc ladder programming.	4
2	Design and test the NAND, NOR, EXOR and EXNOR logic gates using plc ladder programming.	4
3	Write and implementation of simple ladder logic program using on delay timer	4
4	Write and implementation of simple ladder logic program using up counter.	4
5	Write and implementation of DOL starter using PLC	4
6	Write and implementation of conveyor control using PLC	4
7	Write and implementation of lift control using PLC	4
8	Write and implementation of traffic light control using PLC	4
9	Develop a program to interface a buzzer with a robot	4
10	Program and simulate a robot to perform forward and backward motion control	4
11	Program and simulate a robot to perform left and right motion control	4
12	Program and simulate a line follower robot	4
13	Program and simulate a robot to pick up an object and place it in a different location	4
14	Program and simulate a robot to identify different colors.	4
15	Design and implement a robotic system for two robots that use Zigbee communication for wireless control	4
	TOTAL	**60**

ELECTIVE 2:

ECH587	VERY LARGE-SCALE INTEGRATION LAB	L	T	P	C
Practical		0	0	4	2

Introduction:

The **Very Large-Scale Integration (VLSI) Practical** course aims to provide students with hands-on experience in the design and simulation of digital circuits. The course covers the application of Verilog for designing basic and complex digital systems, using tools like Xilinx ISE and FPGA kits. Students will work with combinational and sequential circuits, including logic gates, adders, multiplexers, flip-flops, and counters.

Course Objectives (COs):

1. **To introduce students to Verilog HDL and simulation tools** (such as Xilinx ISE) for designing and analyzing basic logic circuits, enabling foundational skills in digital design.
2. **To develop the ability to design and implement combinational and sequential circuits**, including adders, multiplexers, flip-flops, and counters, for practical and academic applications.
3. **To equip students with the skills to simulate, debug, and validate digital circuits** using software tools and FPGA kits, emphasizing hands-on learning and real-time implementation.
4. **To foster problem-solving, optimization, and teamwork through mini-projects**, where students develop and test advanced digital components like shift registers, decoders, and counters for real- world use cases

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the basic concepts of very large-scale integration systems and HDL-based circuit design.	---
CO1	Apply knowledge of VLSI systems to write and simulate Verilog code for combinational, sequential, and arithmetic circuits to obtain desired logic functionality.	PO1
CO2	Analyse VLSI circuit behavior and simulation results to identify logic or functional errors and arrive at a suitable conclusion.	PO2
CO3	Design and compute digital logic circuits and system modules using Verilog and implement them on FPGA kits.	PO3

CO4	Conduct experiments in Very Large-Scale Integration using simulation tools such as Xilinx ISE or ModelSim along with FPGA kits demonstrating collaborative and teamwork skills.	PO4,PO6,PO7

Pre-requisites:

Basic knowledge of digital logic gates and Boolean

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	3	-	-
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	-	-	-	-			
CO4	-	-	-	2	-	1	2			
CAM	3	2	2	2	-	1	2			

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

Instructional Strategy:

- **Engagement and Motivation:** Begin the course with an interactive demonstration of digital circuit design tools, such as Xilinx ISE and FPGA kits, to motivate students and show the relevance of VLSI in modern electronics.
- **Real-World Examples:** Illustrate practical applications of digital circuits in VLSI, such as in microprocessors, memory devices, and embedded systems, to show the importance of the concepts learned.
- **Continuous Assessment:** Regular quizzes, assignments, and practical tests will be conducted to assess students' understanding of both theoretical concepts and their ability to apply them in practical scenarios.
- **Collaborative Learning:** Encourage teamwork during practical sessions where students can discuss and resolve issues collectively, simulating real-world collaborative work environments in VLSI design.

Apparatus Required (For one Batch)

S. No	Name of the Equipment / Component	Specification / Range	Quantity Required
1	Computer Systems	Minimum i3 processor, 4GB RAM, Windows 10/Linux, with Verilog/VHDL software installed	10
2	Xilinx ISE / Vivado / Quartus Software	Verilog HDL support, synthesis and simulation features	10 licenses (installed)
3	FPGA Development Boards	Spartan 6 / Spartan 7 / Cyclone IV / DE0 / equivalent, with USB programming cable	10
4	USB JTAG Programmer	Compatible with FPGA boards	5
5	Logic Trainer Kit (optional for basic gate demo)	Includes switches, LEDs, logic ICs	2
6	Breadboards & Connecting Wires	For minor circuit testing	10 sets
7	LEDs, Push Buttons, Resistors	Through-hole components for FPGA kit I/O testing	Sufficient stock
8	CRO / DSO (for waveform observation, optional)	Minimum 20 MHz bandwidth	2
9	Power Supply Units	5V/3.3V DC regulated, compatible with FPGA kits	5
10	Internet Access	For software updates and online documentation	1 (lab-wide Wi-Fi or LAN)

ECH587	VERY LARGE-SCALE INTEGRATION LAB	L	T	P	C
Practical		0	0	4	2

Ex. No	Name of the Experiment	Hours
	I. BASIC LOGIC GATES	
1	Familiarization with Xilinx ISE (or) similar software. Develop code for logic gates. Simulate the code in the software (OR, AND NOT & NAND)	4
	II. COMBINATIONAL CIRCUITS	
2	Simulation of Verilog code for (i) Half adder (ii) Full Adder	4
3	Simulation of Verilog code for (i) Half Subtractor (ii) Full Subtractor	4
4	Simulation of Verilog code for 4-bit Parallel Adder.	4
5	Simulation of Verilog code for 4to1 MUX and implementation in FPGA Kit.	4
6	Simulation of Verilog code for 1to4 DEMUX and implementation in FPGA Kit.	4
7	Simulation of Verilog code for 3 to 8 Decoder and implement it in FPGA Kit.	4
8	Simulation of Verilog code for 4 to2 Encoder and implement it in FPGA Kit.	4
9	Simulation of Verilog code for Comparator (1-bit) and implement it in FPGA Kit	4
	III. SEQUENTIAL CIRCUITS	
10	Write Verilog code for JK flip flop and implement it in FPGA kit.	4
11	Write Verilog code for D and T flip flop and implement it in FPGA kit.	4
	IV. REGISTERS & COUNTERS	
12	Write Verilog code for 3-bit Shift Register and implement it in FPGA kit. (SISO)	4
13	Write Verilog code for 3-bit Shift Register and implement it in FPGA kit. (PIPO)	4
14	Write Verilog code for Decade counter and implement it in FPGA kit.	4
15	Write Verilog code for 3-bit down counter and implement it in FPGA kit.	4
	TOTAL	**60**

ECH572	COMPUTER NETWORKING LAB	L	T	P	C
Practical		0	0	2	1

Introduction:

This practical course offers hands-on experience with essential computer hardware and networking elements. Students learn to install, configure, and troubleshoot components like RAM, HDDs, printers, and networking devices. Through guided experimentation and simulation software, they gain skills in building and managing basic computer systems and networks in a real-world or virtual environment.

Course Objective:

To enable students to:

- Identify and handle various hardware components in a PC
- Install and configure peripheral and display devices
- Design and simulate computer networks using modern tools
- Develop foundational skills in system setup, troubleshooting, and communication within teams

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the basic concepts of computer networking systems	---
CO1	Apply knowledge of computer networking systems to set up LAN configurations, connect devices, and configure peripherals to obtain desired parameters	PO1
CO2	Analyse computer networking systems to identify connectivity or configuration issues and arrive at a suitable conclusion.	PO2
CO3	Design and compute experimental setups and solutions for network layouts, device integration and hardware configuration.	PO3
CO4	Conduct experiments demonstrating computer networking setup, device installation and system integration using lab tools and teamwork skills.	PO4, PO6, PO7

Pre-requisites:

- Basic understanding of computer architecture
- Knowledge of digital electronics fundamentals

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	3
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	-	-	-	-			
CO4	-	-	-	2	-	1	2			
CAM	3	2	2	2	-	1	2			

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

Instructional Strategies:

- **Demonstration-based teaching**: Helps students understand the procedures for assembling and configuring hardware
- **Hands-on lab sessions**: Provides individual practice for students to apply hardware and network setup skills
- **Problem-solving sessions**: Engage students in analyzing and solving real-world hardware and network issues, enhancing diagnostic and analytical skills
- **Use of simulation tools (e.g., Cisco Packet Tracer)**: Facilitates network design and testing
- **Peer learning and group-based experiments**: Fosters collaboration and communication

Apparatus Required (For one Batch)

S. No	Name of the Equipment / Component	Specification / Range	Quantity Required
1	Desktop Computers	Minimum i3 processor, 4GB RAM, HDD/SSD, Windows/Linux OS	10
2	Laptop (for comparison study with desktop motherboard)	Any standard laptop with accessible system info	1
3	Desktop Motherboard Samples	ATX / microATX with CPU socket and components visible	2
4	RAM Modules	DDR3 / DDR4 RAM (4GB or 8GB)	4
5	SATA Hard Disk Drives	500GB or 1TB	2
6	Internal HDD Mounting Kits	SATA data and power cables, mounting brackets	2
7	Laser Printer	Duplex printing support	2
8	Projector	HDMI / VGA compatible	1
9	VGA/HDMI Cables	Standard length	2
10	Networking Software (e.g., Cisco Packet Tracer, NetSim)	Installed on each system	10 licenses (or open-source)
11	Network Switches	8-port or 16-port unmanaged	2
12	Routers	Basic Wi-Fi / Ethernet router	2
13	LAN Cables (Cat5e/Cat6)	Factory made or user-crimped	10+
14	RJ45 Connectors	For LAN cable crimping	50
15	Crimping Tools	With cable tester	5
16	LAN-enabled Printer	Network connectivity via LAN/WiFi	1
17	Network-enabled PCs	Ethernet port or Wi-Fi supported PCs for printer and LAN activities	10

ECH572	COMPUTER NETWORKING LAB	L	T	P	C
Practical		0	0	2	1

Ex. No	Name of the Experiment	Hours
	Study experiment: To study the typical architecture of a Laptop Motherboard vs Desktop Motherboard Suggested Link: Practical-3: Specify The Difference Between Desktop Motherboard, Laptop and Server Method | PDF | Electronics | Electrical Engineering	
1	To expand the given RAM capacity of a PC using additional RAM slots. To identify and connect a SATA Hard Disk Drive To mount and connect an additional Hard Disk Drive and expand the storage capacity.	5
2	To Install and Configure a Laser printer and print a sample document on both sides of paper.	4
3	To Install and Configure a projector to a system with the help of VGA /HDMI cable and project a given media from a PC onto a screen.	4
COMPUTER NETWORKING:		
4	Construct a LAN with two PCs and a router using any networking software. Assign IP addresses and send data from one PC to another.	5
5	Construct a LAN with two switches and 4 PCs and a router using Cisco Packet tracer application or any other software. Assigning IP addresses and send data from one PC to another.	4
6	Crimp a cable to use as a LAN cable using Crimping tool	4
7	Connect a printer to a LAN and print a file from any PC connected to the LAN.	4
	TOTAL	**30**

ECH573	COMMUNICATION SYSTEMS LAB	L	T	P	C
Practical		0	0	2	1

Introduction:

The Communication Systems Lab provides hands-on experience with various communication technologies such as antennas, optical fibers, microwave systems, and satellite communication. Students will conduct experiments to design and simulate communication systems, measure parameters like VSWR, impedance, and fiber numerical aperture, and work with transmission and reception setups. The course develops practical skills in communication technologies, measurement techniques, and system analysis.

Course Objective:

The objective of this lab is to provide students with practical exposure to communication systems through experiments involving antennas, optical fibers, microwave systems, and satellite links. The lab aims to develop technical skills in system design, performance evaluation, and measurement of key parameters.

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the basic concepts of communication system	---
CO1	Apply knowledge of communication systems to set up antenna radiation patterns, transmission systems, and optical fiber links to obtain desired parameters.	PO1
CO2	Analyse communication systems to identify issues and arrive at a suitable conclusion.	PO2
CO3	Design and compute experimental setups and solutions for antenna design, optical communication, satellite systems and microwave signal generation.	PO3
CO4	Conduct experiments demonstrating communication system setup, measurement, and analysis using lab tools and teamwork skills.	PO4, PO6, PO7

.

Pre-requisites:

Basic knowledge of communication systems and network protocols

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	3
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	-	-	-	-			
CO4	-	-	-	2	-	1	2			
CAM	3	2	2	2	-	1	2			

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

Instructional Strategies:

- **Demonstration-based teaching**: Introduce each experiment with a live demonstration, providing students with visual and practical understanding of communication systems.
- **Hands-on lab sessions**: Allow students to perform individual experiments and measurements using communication system components such as antennas, optical fibers, and microwave signal generators.
- **Collaborative group work**: Encourage teamwork through group-based experiments where students share tasks and analyze results together.
- **Continuous assessment**: Regular assessments, lab reports will help monitor student progress and understanding throughout the course.

Apparatus Required (For one Batch)

S. No	Name of the Equipment / Component	Specification / Range	Quantity Required
1	HFSS / Antenna Simulation Software	High Frequency Structure Simulator (HFSS) or equivalent software for Yagi-Uda antenna radiation pattern analysis	10 Licenses
2	Optical Fiber Analog & Digital Link Setup	Transmitter and receiver module with LED/Laser source and photodetector	2 Sets
3	Optical Fiber Cables	Step-index / graded-index multimode or single-mode, suitable length	10+ meters
4	Numerical Aperture Measurement Kit	Laser source, screen, fiber mount, and setup for NA measurement	2 Kits
5	Satellite Link Budget Simulation Software	Open-source or licensed satellite communication simulation tools	10 Licenses
6	DTH Setup	DTH dish antenna with receiver and signal meter	1 Full Setup
7	Transmission Line Trainer Kit	With adjustable line lengths, SWR meter, VSWR bridge	2 Kits
8	Reflex Klystron Microwave Bench Setup	Reflex klystron oscillator with frequency meter and power meter	1 Setup
9	Waveguides and Accessories	WR-90 or suitable size with connectors and tuning screws	1 Set
10	Power Meter and Frequency Counter	Suitable for microwave frequencies (e.g., 8–12 GHz)	1 Each
11	Oscilloscope	Digital/Analog, ≥ 20 MHz bandwidth	2 Units
12	Multimeter	Digital type	5 Units
13	Computers with simulation tools (HFSS, MATLAB/Simulink, etc.)	Installed with antenna and satellite communication modules	10 Systems

ECH573	COMMUNICATION SYSTEMS LAB	L	T	P	C
Practical		0	0	2	1

Ex. No	Name of the Experiment	Hours
	Communication systems:	
1	Antenna Radiation Pattern Measurement (using Antenna Trainer Kit or HFSS Simulation) (Design a Yagi-Uda antenna for a particular frequency)	4
2	Transmission and reception using optical fiber. Fiber Optic Analog and Digital Link Setup	4
3	Numerical aperture measurement of optical fiber.	4
4	Simulation of Satellite Link Budget Simulation of Satellite Communication Link using Software	4
5	DTH setup	4
6	VSWR and Characteristic Impedance Measurement using Transmission Line Trainer	5
7	Generation of Microwave Signal using Reflex Klystron Oscillator and Measurement of Frequency and Power	5
	TOTAL	**30**

ECH574	INNOVATION & STARTUP	L	T	P	C
Practicum		1	0	2	2

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 upon which they can build their skills in Innovation and Start-ups. This course can bridge the gap between theory and practice. It allows students to apply the knowledge they have acquired in a real-world context, thereby enhancing their understanding and retention of the above concept. This experimental learning approach not only fosters a deeper level of engagement but also trains students with practical skills necessary to navigate the complexities of the business world. This also empowers students to become an Innovator or Entrepreneur. This syllabus will explore the different facets of innovation, including its importance, types and strategies for fostering a culture of innovation within organizations.

Course Objectives:

The objective of this course is to enable the student to

- To understand the concept of Innovation and Start-ups.
- To acquire knowledge of Prototype development, IPR, Patents and Copyrights.
- To have practical experience in preparing Business plan for Start-ups.
- To visit the existing nearby industry to prepare a project report about the present challenges of that industry.
- To know the different funding supports available from Government and Non-Government schemes for Start-ups.

Course Outcomes:

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

CO	Course Outcome	Program Outcome Mapping
CO1	Apply the concepts of innovation, creativity, and entrepreneurship in the context of startups and emerging businesses.	PO1
CO2	Analyze the role of incubation centers, IPR, patents, and prototype development in supporting innovation.	PO2
CO3	Identify suitable funding schemes and outline the key components of a startup business plan.	PO4
CO4	Prepare a report and deliver a presentation on selected innovation and entrepreneurship-related topics. Visit and study a nearby industry or startup and compile a structured project report covering its key operations.	PO1, PO6, PO7

Pre-requisites:

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

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	3
CO2	-	2	-	-	-	-	-			
CO3	-	-	-	-	-	-	-			
CO4	1	-	-	2	-	1	2			
CAM	3	2	2	2	-	1	2			

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

ECH574	INNOVATION & STARTUP	L	T	P	C
Practicum		1	0	2	2

Unit I	INTRODUCTION TO INNOVATION	
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.		9
Unit II	**INCUBATION CLUBS, IPR, PATENTS AND COPYRIGHTS**	
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.		9
Unit III	**GOVERNMENT AND NON-GOVERNMENT FUNDING SCHEMES FOR START-UPS**	
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.		9
Unit IV	**TOPICS FOR PRESENTATION**	
All the students must select a minimum of 2 topics from the list given below. They are expected to collect the resources with the help of faculty assigned to them to prepare PPTs for presentation Idea Generation Innovation Management Product Development Business Model Innovation Organizational Culture and Change Management Leadership and Innovation Barriers to Innovation Innovation Marketing E-Commerce success stories (anyone) Role of Start-ups in Higher Education Professional Networking in Building Brands How to start a start-up in India		9
Unit V	**EXPOSURE TO INDUSTRY**	
All the students should visit and study the nearby industries, incubation centers, 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.		**9**
	TOTAL	**45**

VI Semester

S. No	Course Code	Course Title	Mode	End - exam	Credits	Hours per week	Total hours
1	*ECH68X	ELECTIVE III	THEORY	Theory	3	3-0-0	45
2	*ECH68X	ELECTIVE IV	PRACTICAL	Practical	2	0-0-4	60
3	ECH67X	PROJECT/INTERNSHIP	PROJECT	Project	10	0-0-20	300 / 450
				TOTAL	**15**		**405 / 555**

ELECTIVE III

*ECH681	Advanced Engineering Mathematics
*ECH682	Machine Learning and Deep Learning
*ECH683	Unmanned Aerial Vehicle / Automated Vehicle
*ECH684	Biomedical Instrumentation
*ECH685	E-Vehicle
*ECH686	Data Communication and Networking
*ECH687	$ Online Elective Course

$Online Elective Courses with the same credit available in AICTE / SWAYAM and reputed Institutions with proper evaluation system and certification can be considered after proper approval from the Chairman, Board of Examinations.

ELECTIVE IV

*ECH688	Multimedia / App designing Lab
*ECH689	PCB Design and Assembly Lab
*ECH68A	Industrial IoT Lab
*ECH68B	Virtual Instrumentation Lab
*ECH68C	Paper Presentation through conference/ Journal or other equivalent system

Course Title	Code	Course Title	L-T-P	Period	Credit	End Exam
Project / Internship	ECH671	In-house Project	0-0-20	450	10	Project
	ECH672	Industrial Training/Internship	0-0-20	300	10	Project
	ECH673	Fellowship	0-0-20	300	10	Project

ELECTIVE III : THEORY

ECH681	ADVANCED ENGINEERING MATHEMATICS	L	T	P	C
THEORY		3	0	0	3

Introduction

This course provides advanced mathematical techniques essential for engineering applications. Topics include Eigenvalues and Eigenvectors, Vector Calculus, Fourier Transform, Laplace Transform, and Probability Theory.

Course Objectives

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

- Understand and apply concepts of Eigenvalues, Eigenvectors, Vector Calculus, Fourier and Laplace Transforms, and Probability Theory.
- Solve complex engineering problems using appropriate mathematical tools.
- Appreciate the role of advanced mathematics in the analysis and modelling of engineering systems.

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the fundamental concepts and principles of Engineering Mathematics.	---
CO1	Apply the fundamental concepts of eigenvalues, eigenvectors, vector calculus, transforms and probability to solve engineering problems.	PO1
CO2	Analyze mathematical problems using appropriate concepts and techniques to interpret results and arrive at a suitable solution in engineering contexts.	PO2
CO3	Present an assignment or a short talk on real-life use of mathematics in engineering.	PO6, PO7

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	-			
CO3	-	-	-	-	-	1	2			
CAM	3	2	-	-	-	1	2			

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

Pre-requisites

Basic Engineering Mathematics / High School Mathematics

Instructional Strategy:

- Interactive Sessions: Encourage student participation through Q&A and group discussions.
- Real-life Applications: Relate mathematical concepts to engineering problems.
- Weekly Practice Problems: Assign numerical problems for each topic to reinforce learning.
- Group Activities: Promote teamwork by solving complex problems in groups.
- Short Presentations: Allow students to present solutions or explain concepts to peers.
- Assessment: Conduct regular class tests, quizzes, and assignments for continuous evaluation.

ECH681	ADVANCED ENGINEERING MATHEMATICS	L	T	P	C
THEORY		3	0	0	3

Unit I	**EIGEN VALUES AND EIGEN VECTORS :**	
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	**VECTOR CALCULUS :**	
Scalar field and Vector field – Vector differential operator – Gradient of a scalar field – Directional derivative – Divergence and curl of a vector field (excluding properties) – Solenoidal and irrotational vector fields – Simple problems.		9
Unit III	**FOURIER TRANSFORM**	
Mathematical definition of Fourier transform - Properties of Fourier Transforms – Linearity – Scaling – Shifting – Fourier Transform of standard signals – sine, cosine, exponential , impulse functions –Simple problems		9
Unit IV	**LAPLACE TRANSFORMS:**	
Definition of Laplace transform – Laplace transforms of standard functions –Inverse Laplace transforms –Method of partial fractions - Solving first order and second order ordinary differential equation – Simple problems.		9
Unit V	**PROBABILITY THEORY**	
Definition – Classification of probability – Conditional probability – Baye's theorem – Discrete and Continuous random variable – Mean, Variance – Standard deviation – Binomial distribution		9
	TOTAL	**45**

Suggested List of Students Activity

- Demonstrate the applications of Eigen-Values in stability analysis, decouple of three-phase systems and vibration analysis.
- Demonstrate maxima and minima of two variable functions using GeoGebra graphing calculator.
- Demonstrate solenoidal vector field and irrotational vector field using engineering applications.
- Demonstrate the applications of differential equations in solving engineering problems.
- Presentation /Seminars by students.
- Quizzes.

Text Books

1. John Bird, Higher Engineering Mathematics, 9th edition, Routledge,2021
2. B.S.Grewal, Higher Engineering Mathematics, 42nd edition, Khanna Publishers, 2012
3. P.Durai pandian and Kayalal Pachaiyappa, Vector Analysis, 1st edition, S. Chand and Company Limited, 2017

Web-based/Online Resources

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

ELECTIVE III : THEORY

ECH682	MACHINE LEARNING AND DEEP LEARNING	L	T	P	C
THEORY		3	0	0	3

Introduction:

This course offers foundational and advanced concepts in Machine Learning (ML) and Deep Learning (DL), covering algorithms, neural networks, and recent architectures. It emphasizes problem-solving, model evaluation, and real-world applications.

Course Objectives

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

- Understand the key concepts and types of Machine Learning, including supervised, unsupervised, semi-supervised, and reinforcement learning.
- Apply classification, regression, and clustering techniques to solve real-world problems.
- Analyze neural networks and dimensionality reduction techniques to optimize model performance.
- Explore deep learning architectures such as CNNs, RNNs, and autoencoders with practical applications.
- Examine recent advancements and trends in deep learning and their practical implications in industry.

Course Outcomes

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

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the fundamental concepts and principles of machine learning and deep learning.	
CO1	Apply the fundamental concepts of machine learning, Deep learning including neural network and clustering for specific domain.	PO1
CO2	Analyze the concepts and techniques of machine learning and deep learning to establish meaningful conclusions for solving real-world problems.	PO2
CO3	Design and develop machine learning and deep learning models using appropriate algorithms and architectures to address real-world scenarios.	PO3
CO4	Prepare and deliver an assignment or presentation on recent advancements in machine learning related to environmental sustainability.	PO6, PO7

Mapping of COs to PO\s:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	3
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	-	-	-	-			
CO4	-	-	-	-		2	1			
CAM	3	2	2	-	-	2	1			

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

Instructional Strategy

- Engage and Motivate: Begin with interactive sessions to introduce AI/ML relevance across industries.
- Real-World Applications: Use case studies from healthcare, finance, agriculture, and robotics.
- Problem-Based Approach: Encourage students to solve real-world problems using classification, regression, and image recognition tasks.
- Simulation and Practical Exposure: Introduce datasets and simulation tools to visualize learning performance and model behaviour.
- Critical Analysis: Foster discussions around performance metrics, overfitting/underfitting, and model optimization strategies.

ECH682	MACHINE LEARNING AND DEEP LEARNING	L	T	P	C
THEORY		3	0	0	3

Unit I	**INTRODUCTION TO MACHINE LEARNING**	
Introduction- Types of Machine Learning: Supervised, Unsupervised, semi- supervised learning and Reinforcement Learning-Training, Testing, and Validation in ML – Epochs-Performance Measures in Machine Learning (definitions only): Accuracy, Precision, Recall, F1 Score-Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis		9
Unit II	**SUPERVISED LEARNING- CLASSIFICATION AND REGRESSION AND UNSUPERVISED LEARNING- CLUSTERING**	
Concepts of Supervised Learning: Labelled Data and Decision Boundary- Classification Algorithm: K-Nearest Neighbor, Support Vector Machine- Regression Algorithms- Linear Regression, Ridge Regression. Concept of unsupervised learning- clustering algorithms- K-Means clustering and hierarchical clustering.		9
Unit III	**NEURAL NETWORK AND DIMENSIONALITY REDUCTION**	
Neural network: The brain and neuron-Single layer Perceptron, multilayer perceptron network-forward propagation- backward propagation- activation function- loss function (concepts only) Dimension reduction - Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA)		9
Unit IV	**INTRODUCTION TO DEEP LEARNING**	
Transfer learning (concepts) - Introduction to Deep Learning, Convolutional Neural Networks (CNN), Vanishing and Exploding Gradients in Deep Neural Networks, AlexNet, VGGNet and ResNet.		9
Unit V	**RECENT TRENDS IN DEEP LEARNING**	
Concepts and block diagrams: Generative Adversarial Networks (GAN), Auto Encoders, Recurrent Neural Networks and U-Net, Applications		9
	TOTAL	**45**

Text books:

1. E. Alpaydin, Introduction to Machine Learning, 3rd Edition, Prentice Hall (India) 2015.
2. S. O. Haykin, Neural Networks and Learning Machines, 3rd Edition, Pearson Education (India), 2016.
3. Stephen Marsland ―Machine Learning – An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
4. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016
5. Michael A. Nielsen, Neural Networks and Deep Learning , Determination Press, 2015

Reference Books:

1. Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data‖, First Edition, Cambridge University Press, 2012.
2. Ethem Alpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)‖, Third Edition, MIT Press, 2014
3. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013

ELECTIVE III : THEORY

ECH683	UNMANNED AERIAL VEHICLE / AUTOMATED VEHICLE	L	T	P	C
Theory		3	0	0	3

Introduction

This course provides comprehensive knowledge on Unmanned Aerial Vehicles (UAVs), focusing on their design, operation, and applications. It emphasizes the technical and societal aspects of UAV technology, equipping students with essential skills in system integration, control mechanisms, and application-based analysis, preparing them for real-world challenges in UAV technology.

Course Objectives

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

- Understand the history, importance, classification, and societal impact of UAVs.
- Analyze sensor systems, control mechanisms, and power supply configurations for UAVs.
- Evaluate communication payloads, telemetry systems, and cargo drone applications in logistics.
- Explore aerial photography methodologies, geometric considerations, and their use in supply chains.
- Examine UAV systems development, regulations, and autonomous vehicle integration.

Course Outcomes

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

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the fundamental concepts and principles of Unmanned Aerial Vehicles and Automated Vehicles.	---
CO1	Apply the basic knowledge of UAV and automated vehicle system including components, sensors, and control mechanisms to specific technical contexts.	PO1
CO2	Analyze the subsystems, sensor systems, and control technologies used in UAVs and automated vehicles to draw appropriate conclusions for specific applications.	PO2
CO3	Design and develop basic UAV or autonomous vehicle models or subsystems by selecting suitable components and control strategies for real-life scenarios.	PO3
CO4	Prepare and deliver an assignment or presentation on recent advancements in UAV or automated vehicle technologies.	PO6, PO7

Mapping of COs to POs

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	3
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	-	-	-	-			
CO4	-	-	-	-	-	2	1			
CAM	3	2	2	-	-	2	1			

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

Instructional Strategy

- Engage and Motivate: Actively involve students in discussions about UAVs to boost interest and confidence in learning.
- Real-World Applications: Highlight relatable examples, such as UAV use in agriculture and logistics, to bridge theory and practice.
- Interactive Learning: Conduct hands-on activities and demonstrations to enhance understanding.
- Critical Analysis: Promote discussion on system performance, identifying errors, and optimizing UAV configurations.

ECH683	UNMANNED AERIAL VEHICLE AND AUTOMATED VEHICLE	L	T	P	C
Theory		3	0	0	3

Unit I	INTRODUCTION TO UAV	
Overview and background - History of UAV –Importance of UAV - classification: difference between fixed-wing, rotary-wing, hybrid – societal impact and future outlook-Difference between Helicopter and Gyrocopter- Unmanned Aerial System (UAS) components-UAV Applications (concept only)		9
Unit II	**SENSOR SYSTEMS AND CONTROL MECHANISMS FOR UAV**	
Real time Embedded processors for UAVs – sensors: Basic concepts of LIDAR, Sensors(Basic Concepts only):Stereo sensor, GPR sensor, Camera Sensor- servos-accelerometer – gyros: Inertial Measurement Unit -actuators		9
Unit III	**COMMUNICATION PAYLOADS AND CONTROL**	
Payloads: Payload types: Dispensable Payload-Non-Dispensable Payload- Weapon Payloads, (Concepts only)-PID feedback and Control Mechanism-Telemetry(Basic)-Autopilot		9
Unit IV	**AERIAL PHOTOGRAPHY: METHODOLOGIES AND GEOMETRIC CONSIDERATIONS**	
Overview of Aerial Photographs - Uses and Advantage of Aerial Photography - Types of Aerial Photography: Geometry of an Aerial Photograph-Difference between a Map and an Aerial Photograph-Drones in Supply Chain.		9
Unit V	**DEVELOPMENT OF UAV SYSTEMS**	
Mini, Micro and Nano UAVs **Application of UAV:** Agriculture- Health Monitoring. Regulation Including Green Zone, Yellow Zone, & Red Zone for UAVs(Basic concepts only) **Overview of Autonomous Vehicles**- Importance and significance of driverless technology in transportation **-**Types of sensors used in autonomous vehicle (Types names Only)		9
	TOTAL	**45**

Textbook References:

1. Reg Austin "Unmanned Aircraft Systems UAV design, development and deployment", Wiley, 2010.
2. Paul G Fahlstrom, Thomas J Gleason, "Introduction to UAV Systems", UAV Systems, Inc, 1998
3. Dr. Armand J. Chaput, "Design of Unmanned Air Vehicle Systems", Lockheed Martin Aeronautics Company, 2001
4. Kimon P. Valavanis, "Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy", Springer, 2007
5. Robert C. Nelson, Flight Stability and Automatic Control, McGraw-Hill, Inc, 1998
6. Autonomous Vehicles: Opportunities, Strategies, and Disruptions by James M. McKinsey & Company
7. Driverless Cars: The Road to the Future by John D. Garrison

ELECTIVE III : THEORY

ECH684	Biomedical Instrumentation	L	T	P	C
Theory		3	0	0	3

Introduction:

This course provides foundational and applied knowledge in biomedical instrumentation. It focuses on physiological systems, medical diagnostic and therapeutic equipment, modern imaging techniques, and patient safety. Students will learn how biomedical signals are measured, monitored, and interpreted, preparing them for applications in clinical, hospital, and research settings.

Course Objectives

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

- Understand human physiological systems and their electrical signal characteristics.
- Analyze biomedical sensors, electrodes, and signal conditioning systems.
- Explore diagnostic, monitoring, and therapeutic instruments used in healthcare.
- Gain insights into modern medical imaging systems and their clinical applications.
- Examine biotelemetry systems and patient safety mechanisms in medical environments.

Course Outcomes

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

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the fundamental concepts and principles of Biomedical Instrumentation	---
CO1	Apply the fundamental concepts of human physiology and biomedical instrumentation including sensors and transducers to obtain the desired parameter.	PO1
CO2	Analyze the concepts and techniques of biomedical instruments to establish meaningful conclusions for patient monitoring applications.	PO2
CO3	Design and develop biomedical instrumentation systems using suitable sensors and basic electronic circuits to address clinical applications.	PO3
CO4	Prepare and deliver an assignment or presentation on recent advancements in biomedical instrumentation related to patient care and safety.	PO6, PO7

Pre-requisite:

Basic knowledge of human physiology and instrumentation.

Mapping of COs to POs

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	3	-	-
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	-	-	-	-			
CO4	-	-	-	-	-	2	1			
CAM	3	2	2	-	-	2	1			

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

Instructional Strategy

- Engage and Motivate: Begin with real-life applications of biomedical instruments in hospitals to spark curiosity.
- System-Based Learning: Teach each system (e.g., cardiovascular, respiratory) with related instrumentation for contextual understanding.
- Visual Aids and Block Diagrams: Use clear block diagrams to explain system functionality and signal pathways.
- Ethical and Safety Awareness: Discuss patient safety, standards, and ethics in the use of biomedical equipment.

ECH684	Biomedical Instrumentation	L	T	P	C
Theory		3	0	0	3

Unit I	Introduction to Human Physiology & Biomedical Instrumentation	
Bio–potential and their generation (resting and action potential)- Block Diagram of the cardiovascular system - Block Diagram of the respiratory system - Block Diagram of the urinary system. **Electrodes:** Micro, Skin-Surface and Needle electrodes- Biomedical sensors and transducers – Biomedical signal conditioning and amplification.		9
Unit II	**Diagnostic & Monitoring Instruments**	
Cardiac Monitoring: Block diagram of Electrocardiograph(ECG) Machine – Brain Monitoring: Block diagram of Electroencephalograph (EEG)machine – Muscle Activity Monitoring: Block diagram of Electromyograph (EMG) machine – Blood Pressure monitoring: Sphygmomanometer- SpO2 Monitoring: Block diagram of Pulse oximeter-Basic concepts on Electro retinography (ERG), Audiometry		9
Unit III	**Therapeutic Instruments**	
Introduction to Electrotherapy devices – Implantable Cardioverter Devices: Pacemakers – Implantable Cardiac Defibrillators (ICD) - Therapy Devices: Dialysis machines (Haemo dialysis and Peritoneal Dialysis)- Respiratory Therapy Devices: Ventilators – Heart Lung Machine (Cardio Pulmonary Bypass Machine)		9
Unit IV	**Modern Imaging Techniques**	
Imaging techniques classification -concept and applications- Ultrasonic Imaging Techniques- X-ray Machine- Computerized Tomography (CT) - Positron Emission Tomography (PET)		9
Unit V	**Biotelemetry and Patient Safety**	
Biotelemetry: Block diagram of a typical Biotelemetry System - Single Channel Telemetry technique - Multi Channel Telemetry technique - Continuous Monitoring- Telemedicine: Definition and applications **Patient safety:** Physiological effects of electric current – Micro and Macro shock-Methods of Accident Prevention- Grounding		9
	TOTAL	**45**

Text Books

1. R.S. Khandpur, Hand book of Biomedical Instrumentation, 3rd edition, McGraw Hill Education, 2014
2. M. Arumugam, BioMedical Instrumentation, Anuradha Publications, 2017
3. Lesile Cromwell,Fred J.Weibell and Erich A. Pfeiffer, Bio medical InstrumentationandMeasurement,2nd edition, Prentice-Hall of India, 2008

ELECTIVE III : THEORY

ECH685	E-VEHICLE	L	T	P	C
Theory		3	0	0	3

Introduction:

This course provides a comprehensive understanding of Electric Vehicles (EVs), focusing on their components, architectures, and the underlying technologies. It equips students with the knowledge to analyze EV systems, their environmental impact, and innovative trends in the field. Practical insights into EV charging, battery management, and policy frameworks prepare students for a career in modern transportation engineering.

Course Objectives:

The objective of this course is to enable students to:

- Understand the principles, components, and environmental advantages of Electric Vehicles (EVs).
- Explore various types of EVs, including BEVs, HEVs, PHEVs, and FCEVs, along with their functionalities.
- Analyze EV architecture, focusing on powertrains, battery management systems (BMS), and charging technologies.
- Learn about EV motors and battery technologies, emphasizing working principles and comparative analysis.
- Evaluate the societal and environmental impact of EVs and explore policy frameworks, global standards, and future trends.

Course Outcomes:

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

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the fundamental concepts and principles of Electric Vehicles	---
CO1	Apply the fundamental concepts of electric vehicle types, battery technologies and motor drives for specific EV domains.	PO1
CO2	Analyze the concepts and techniques of electric vehicle architectures and battery management systems to arrive at meaningful conclusions for EV operation.	PO2
CO3	Design and develop electric vehicle systems incorporating motor drives, battery technologies and charging methods to address EV applications.	PO3
CO4	Prepare and deliver an assignment or presentation on recent advancements and innovations in electric vehicle technology and smart charging infrastructure for sustainable cities.	PO5, PO6, PO7

Pre-requisites:

Basic knowledge of Electronics Engineering.

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	-	-	-	-			
CO4	-	-	-	-	-	2	1			
CAM	3	2	2	-	-	2	1			

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

Instructional Strategy

- Engage and Motivate: Use interactive teaching methods, including case studies and real-world EV applications, to inspire interest.
- Application-Oriented Learning: Conduct demonstrations and encourage hands-on activities related to EV components and systems.
- Interactive Learning: Incorporate group discussions, simulations, and problem-solving sessions to deepen understanding.
- Critical Thinking and Analysis: Foster analytical thinking by evaluating EV policies, standards, and their global impact.
- Practical Exposure: Utilize industry examples and case studies to prepare students for real-world challenges in EV engineering.

ECH685	E-VEHICLE	L	T	P	C
Theory		3	0	0	3

Unit I	Introduction to Electric Vehicles	
	Overview of Electric Vehicles (EVs)-Definition of Electric Vehicles-Environmental impact of conventional vehicle - Comparison between conventional vehicles and BEVs. **Conventional drive train system**: – Rear Wheel, Front Wheel, and All wheel - Parts of Drive train system (concepts only) **Components of an Electric Vehicle:** Battery Pack, Electric Motor, Power electronics and controllers-Charging port.	9

Unit II	Types Of E -Vehicle	
	Battery Electric Vehicles (BEVs): Block diagram and working principle of BEVs **Hybrid Electric Vehicles (HEVs):** Block diagram and working principle of HEVs-Role of regenerative braking in energy recovery **Plug-in Hybrid Electric Vehicles (PHEVs):** Block diagram and working principle of PHEVs- Differences between PHEVs and HEVs **Fuel Cell Electric Vehicles (FCEVs):** Block diagram and working principle of FCEVs (hydrogen fuel cell technology). **Comparison between BEV, HEV, PHEV& FCEV**	9

Unit III	Electric Vehicle Architecture	
	Powertrain Architecture: Types of EV powertrains-Series, parallel, and series-parallel hybrid configurations. **Battery Management Systems (BMS):** Functions of BMS: monitoring, protection, balancing. **Charging Systems:** Types of charging: slow charging, fast charging, and ultra-fast charging (Concept only)-Wireless charging systems, Battery Charging techniques - Constant current and Constant voltage-V2V charging.	9

Unit IV	Electric Vehicle Motors and Battery Technologies	
	V Motor Drives: Types of EV motors - DC motor drives– Permanent Magnetic Brush Less DC Motor Drives (BLDC) –Principles, Construction and Working – Merits and Demerits of DC motor drive, BLDC motor drive. **Battery Technologies in Electric Vehicles:** Types-Lead Acid Batteries and its working principle, Nickel Based Batteries and its working principle and Lithium Based Batteries and its working principle.	9

Unit V	EV Impact and Innovation Framework	
Effects and Impacts: Effects and Impacts of EV – Need of EV Policy – Advantage of EV Eco system – Scope and Applicability of EV Policy – ARAI Standards for Electric Vehicle – AIS 038, AIS 039 &AIS 123 - Global Impact-Future Trends and Innovations in EV Technology **Case Study: Implementing Smart EV Charging Infrastructure in a Smart City**		9
	TOTAL	**45**

Suggested List of Students Activity

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

Text Books

1. Jack Erjavec and Jeff Arias, Hybrid, Electric and Fuel Cell Vehicles, 2nd edition, Cengage Learning, 2012
2. MehrdadEhsani, YiminGao, sebastien E. Gay and Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, 3rd edition, CRC Press, 2018
3. Tom Denton and Hayley Pells, Electric and Hybrid Vehicles, 3rd edition, Routledge, 2024
4. Modern Electric, Hybrid Electric and Fuel Cell Vehicles, Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, Ali Emadi, CR Press, London, New York.
5. Comparison of Electric and Conventional Vehicles in Indian Market: Total Cost of Ownership, Consumer Preference and Best Segment for Electric Vehicle (IJSR), Akshat Bansal, Akriti Agarwal

ELECTIVE III : THEORY

ECH686	Data Communication and Networking	L	T	P	C
Theory		3	0	0	3

Introduction:

This course teaches the techniques essential for engineering robust networks. Topics include data communication and networking principles, Transmission Control Protocol/Internet Protocol (TCP/IP), naming and addressing (Domain Name System), data error detection and correction concepts, transport layer and application layer services. It also introduces the concept of network security.

Course Objectives :

1. **To introduce the fundamental principles of data communication and networking**, including data representation, transmission methods, network types, and network architecture models like OSI and TCP/IP.
2. **To develop an understanding of physical layer technologies**, focusing on transmission media, multiplexing techniques, and network switching methods used in communication systems.
3. **To provide in-depth knowledge of data link and network layer functionalities**, such as framing, error and flow control protocols, logical addressing (IPv4/IPv6), and basic networking devices.

Course Outcomes:

After successful completion of this course, students should be able to:

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the fundamental concepts and principles of data communication and networking	---
CO1	Apply the fundamental concepts of data communication, network topologies, layered models and transmission media for specific networking domains.	PO1
CO2	Analyze the concepts and techniques of data communication and networking to arrive at meaningful conclusions for reliable data transfer.	PO2
CO3	Design and develop networking solutions using the concepts of data communication and networking to address real-world communication problems.	PO3
CO4	Prepare and deliver an assignment or presentation on recent advancements in network security for secure communication.	PO6, PO7

Pre-requisites:

Basics of Networking.

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	3	-
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	-	-	-	-			
CO4	-	-	-	-	-	2	1			
CAM	3	2	2	-	-	2	1			

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

Instructional Strategy

- Real life examples/demonstrations may aid in the effective learning retention of the students.
- Demonstrations using animations or any other instructional media can make the subject exciting and foster a scientific temper among the students.
- A theory-demonstrate-practice-activity strategy may be used to ensurethat learning is outcome-based and employability-based.

ECH686	Data Communication and Networking	L	T	P	C
Theory		3	0	0	3

Unit I	FUNDAMENTALS OF DATA COMMUNICATION	
	Data Communication: Definition of Data and Data communication, Components of Data Communication, Data Representation (Text, Image, Numbers, Audio, Video), Data Flow (Simplex, Half Duplex, Full Duplex) **Network:** Network Criteria: Performance (Throughput and Delay), Reliability, Security - Types of Network Connections (Point-to-Point and Multipoint) - Network Topologies: Star, Bus, Ring, Mesh - Network Categories (LAN, MAN, WAN) and Interconnection of networks **Network Architecture:** Layered Approach: ISO-OSI Model & TCP/IP Model – functions of each layer	9

Unit II	PHYSICAL LAYER	
	Multiplexing: Definition of Multiplexing - Frequency Division Multiplexing (FDM), Wavelength Division Multiplexing (WDM), Synchronous Time-Division Multiplexing (TDM) **Transmission media:** Guided Media: Twisted pair – UTP and connectors(RJ-45 Male and Female connectors), STP cables, Coaxial cable and connectors (BNC connector), Fiber-optic cables, cable sizes and connectors (SC, MT-RJ, ST, LC, FC) - Performance, and applications of UTP, Coaxial and Fiber-Optic cables - Unguided Media (Wireless Media):Radio waves, Microwaves, Infrared and their applications **Switching:** Circuit-Switched Network, Packet Switched Network (Datagram approach), Virtual Circuit network	9

Unit III	DATA LINK LAYER	
	Framing of data: Definition, Types: Fixed Size and Variable Size framing– Flow and Error control **Flow Control:** Noiseless Channel: Definition, Stop and Wait protocol –Concepts and Flow Diagram - Noisy Channel: Definition, Stop-and-Wait ARQ protocol, Go-Back–N ARQ Protocol, Selective Repeat ARQ Protocol - Concepts and Flow Diagram only **Error Control:** Concepts of Error Detection and Error Correction – types of error detecting and error correcting codes (definition only)	9

Unit IV	NETWORK LAYER	
Network Devices: Hub, Switch, Router, Bridge, Gateway (definition only) **Logical addressing:** IP Addressing: Dot-Decimal Notation of IPv4 – Classful and Classless addressing – IPv4 datagram format - Basics of IPv6 - Need for transition from IPv4 to IPv6 – IPv6 datagram format - Subnetting (only definition and subnet masks for each IP class) – StaticIP and Dynamic IP: Definition and applications **Network Layer Protocols:** IGMP, ICMP, ARP, RARP (definitions and functions only)		9
Unit V	**TRANSPORT LAYER, APPLICATION LAYER AND NETWORK SECURITY**	
Transport Layer: Connection-oriented and Connectionless Services - TCP Features - TCP segment format - User datagram format (UDP packet) **Application Layer**: Concepts of DNS – SMTP – FTP - HTTP – WWW (World Wide Web) **Network Security:** Data Encryption and Decryption		9
	TOTAL	**45**

Suggested List of Students Activity

- Formative Assessment like interactive quizzes using Mentimeter etc.shall be conducted.
- Presentation/Seminars by students on any recent technological developments specific to the course.
- Group Discussions on latest trends in networking, cryptography, and hacking topics would intrigue the students to learn more.

Text Books

1. Behrouz A. Forouzan, Data Communication and Networking, 5th edition, Tata McGraw Hill, 2007
2. Andrew S. Tanenbaum, Computer Networks, 5th edition, Prentice-Hallof India, 2010
3. William Stallings, Data and Computer Communications, 8th edition, Pearson Education India, 2007

Suggested Online Resources

- https://nptel.ac.in/courses/106105082
- https://www.geeksforgeeks.org/data-communication-definition-components-types-channels/

ELECTIVE 4: PRACTICAL

ECH688	MULTIMEDIA / APP DESIGNING LAB	L	T	P	C
Practical		0	0	4	2

Introduction:

This course provides hands-on experience with multimedia and app designing tools and techniques. Students will learn how to create multimedia content using various software and develop Android applications. The course focuses on practical skills in multimedia creation, editing, and application development.

Course Objectives:

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

1. Understand the fundamentals of multimedia creation and editing.
2. Develop practical skills in creating interactive web pages and animations.
3. Learn the basics of Android app development and understand Android Studio.
4. Build and deploy simple Android applications using various Android components.

Course Outcomes:

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

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the basic concepts of multimedia, animation, video editing, and mobile app development.	
CO1	Apply multimedia and app development techniques to obtain a desired parameter.	PO1
CO2	Analyse multimedia elements and app components to evaluate their effectiveness and arrive at a conclusion.	PO2
CO3	Design multimedia content and Android applications to meet specific requirements through practical implementation.	PO3
CO4	Conduct experiments and demonstrate multimedia and app development concepts using appropriate engineering tools and software and exhibit teamwork skills.	PO4, PO6, PO7

Pre-requisite

Basic knowledge of computer programming, HTML and general multimedia concepts.

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	3
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	-	-	-	-			
CO4	-	-	-	3	-	1	2			
CAM	3	2	2	3	-	1	2			

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

Instructional Strategy

- Hands-on Sessions: Practical exercises with multimedia and app designing tools.
- Demonstrations: Showcasing installation, configuration, and project setup.
- Collaboration: Encouraging group work for building comprehensive multimedia and app projects.

Apparatus Required (For one Batch)

S. No	Name of the Equipment	Specification/ Range	Quantity Required
1	Computer System with multimedia and app development software	Minimum i3 processor, 4GB RAM, Windows 10/Linux, Internet access, HTML5 compatible browser, Android Studio, Multimedia Editing Tools (e.g., Photoshop, Audacity, OpenShot, GIMP, etc.)	10
2	Scanner	Flatbed Scanner – A4 size	2
3	Android Mobile Device (for app testing)	Android 8.0 or above	2
4	Webcam	USB Plug and Play	2
5	Audio Input/ Microphone	3.5mm jack or USB	2
6	Headphones/Audio Output Devices	Standard stereo headphones	2
7	Printer	Laser / Inkjet – Color	1
8	Internet Connection	Min. 10 Mbps (LAN/WiFi)	1 (for lab)
9	Projector (for demonstrations)	HDMI / VGA Compatible	1

ECH688	MULTIMEDIA / APP DESIGNING LAB	L	T	P	C
Practical		0	0	4	2

Ex . No	Name of the Experiment	Hours
	MULTIMEDIA	
1	Use HTML multimedia support to play different audio and video formats in a browser using a desktop and a mobile.	4
2	Import an image from the browser / Picture folder and place it on the workspace. Click and drag the image on the work space.	4
3	Using suitable software create a notebook wrapper / or invitation.	4
4	Use scanner to create two or more partial scanned images of large poster/photo. Create a panoramic view of multiple photos by stitching together them using any panorama software.	4
5	Use a video processing software to perform–Trim video clips, rotate video, merge video, split video, add titles, add special effects and edit video dimensions, bit rate, frame rate, sample rate, channel.	4
6	Create a 2D Animation using Motion Guide Layer and masking.	4
7	Create a moving cloud using any animation software.	4
8	Develop a web page which shows an Imation with sound effect using any professional HTML editor.	4
9	Use suitable software and perform a) compress / decompress audio/ video files. b) Convert audio/ video to different format.	4
10	Create a pencil sketch of a picture using suitable software.	4
	APP DESIGNING	
11	Installation of Android studio.	4
12	Development of Hello World Application	4
13	Create an application that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button	4
14	Create a screen that has input boxes for User Name, Password, Address, Gender (radio buttons for male and female), Age (numeric), Date of Birth (Date Picket), State (Spinner) and a Submit button. On clicking the submit button, print all the data below the submit button(use any layout)	4
15	Design an android application to create page using Intent and one Button and pass the Values from one Activity to second Activity	4
	TOTAL	**60**

Text Books

1. Ze-Nian Li and M.S. Drew, Fundamentals of Multimedia, 2nd edition,Pearson Education,2014
2. Tay Vaughan, Multimedia: Making It Work, 8th edition, TataMcGrawHill, 2017
3. Ralf Steinmetz and KlaraNahrstedt, Multimedia Computing,Communication and Applications, 1st edition, Pearson Education, 2012

Web-based/Online Resources

- https://spoken-tutorial.org/tutorial-search/?search_foss=Video+Editing+using+Blender&search_language=English
- https://www.tutorialspoint.com/

ELECTIVE 4: PRACTICAL

ECH689	PCB Design & Assembly LAB	L	T	P	C
PRACTICAL		0	0	4	2

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. Using a PCB has many advantages such as compact design, ease of testing and repair, low noise and interference, and improved reliability. 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. Large number of PCBs can be fabricated at the same time after the layout is designed once. With consumers pushing for slimmer and faster devices, and with industries seeking improved functionality, the PCB will continue to develop in the future.

Course Objectives:

The objective of this course is to enable the student to

- Understand the types of PCB and component data sheet.
- Know how to draw circuit schematics using EDA tools.
- Understand PCB layout and routing.
- Understand flow chart for PCB assembly process.
- Practice schematic PCB layout and transfer to copper clad board.

Course Outcomes:

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

CO	Course Outcome	Program Outcome Mapping
	Describe and explain the basic concepts of PCB design, electronic components and assembly techniques.	
CO1	Apply PCB design and assembly techniques to create functional electronic circuits and layouts.	PO1
CO2	Analyse circuit schematics, layout designs, and fabrication results to identify issues and arrive at a conclusion.	PO2
CO3	Design PCB layouts and electronic assemblies to meet specific circuit requirements.	PO3
CO4	Conduct experiments and demonstrate PCB design, routing, fabrication, and assembly using EDA tools and exhibit teamwork skills	PO4, PO6, PO7

Pre-requisites

Basic knowledge of Electronics Engineering and Circuit Design.

Mapping of Cos to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	3
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	-	-	-	-			
CO4	-	-	-	-	-	1	2			
CAM	3	2	2	-	-	1	2			

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

Instructional Strategy:

- Introduce **PCB Design Concepts** through hands-on sessions using **EDA software**.
- Conduct **live demonstrations** of PCB layout creation, schematic generation, and simulation.
- Facilitate **guided practice sessions** to ensure students grasp basic and advanced techniques.
- Engage students in **hands-on soldering and assembly** of analog and digital circuits to enhance practical skills.

Apparatus Required (For one Batch)(For 1 Batch)

S. No	Name of the Equipment / Tool	Specification / Range	Quantity Required
1	Computer System with EDA Software	Minimum i3 processor, 4GB RAM, Windows 10/Linux, with software like KiCad / Eagle / EasyEDA / Proteus	15
2	Soldering Station	Temperature-controlled soldering iron (up to 400°C)	15
3	Desoldering Pump	Manual spring-type	10
4	Breadboard	Standard 830 tie points	20
5	Multimeter	Digital, Auto-ranging	10
6	DC Regulated Power Supply	0 – 30V / 2A	10
7	Dual Trace CRO / DSO	30 MHz / 50 MHz	10
8	Function Generator	1 MHz	5
9	PCB Etching Tank & Accessories	Manual etching setup with gloves, trays, stirrer	2 sets
10	UV Exposure Box (for PCB design, if applicable)	With timer and UV tubes	1
11	PCB Drilling Machine	Manual / Mini electric drill	5
12	Copper Clad Boards	Standard size (6"x4", single & double-sided)	50 sheets
13	Solder Wire	Leaded / Lead-free (0.8 mm)	10 rolls
14	Soldering Flux	Paste / Liquid	5 bottles
15	Nose Plier, Cutter, Tweezers	ESD safe tools	10 sets
16	Components Kit	Diodes, Transistors, Resistors, Capacitors, LEDs, Connectors, ICs, LDR, DC Motor, etc.	As per experiment

ECH689	PCB Design and Assembly LAB	L	T	P	C
Practical		0	0	4	2

Ex. No	Name of the Experiment	Hours
	Familiarization of any Electronic design automation (EDA)software	
1	Solder an analog circuit (Half wave rectifier) in a PCB with plated holes	4
2	Solder the given common emitter amplifier circuit in a PCB with plated holes	4
3	Create a schematic, generate net list and simulate an RC coupled amplifier using any simulation tool.	4
4	Create a schematic, generate net list and simulate a High pass filter using any simulation tool.	4
5	Create a schematic, generate net list and simulate basic logic gates (AND, OR, NOT) using discrete components using any simulation tool.	4
6	Place the components of RC coupled amplifier and route the connections between the components manually and verify using design rule check using any simulation tool.	4
7	Place the components of RC coupled amplifier and route the connections between the components using auto routing option using any simulation tool.	4
8	Design a PCB layout for Astable Multivibrator circuit and verify using design rule check using any simulation tool.	4
9	Design a PCB layout for regulated power supply, verify using design rule check and generate Gerber file, BOM using any simulation tool.	4
10	Design a PCB layout for a light dependent resistor (LDR) based automatic light switch and verify using design rule check using any simulation tool.	4
11	Create symbols and foot print for IN4007diode, IC741 using any simulation tool.	4
12	Create symbols and footprint for BC107transistor, connector using any simulation tool.	4
13	Design a double-layer PCB for a simple DC motor driver circuit with variable speed control.	4
14	Fabricate a low pass filter circuit manually using copper clad sheet.	4
15	Fabricate and test a power supply circuit using copper clad sheet.	4
	TOTAL	**60**

Textbook

1. R.S. Khandpur, Printed Circuit Boards: Design – Fabrication, 1st edition, McGraw Hill Education, 2017
2. Clyde F. Coombs, Printed Circuits Handbook, 6th edition, McGraw Hill, 2008
3. S.D. Mehta, Electronic Product Design, 1st edition, S Chand & Company, 2011

Web-based/Online Resources

- http://www.wikihow.com/Create-Printed-Circuit- Boards
- http://reprap.org/wiki/MakePCBInstructions#Making PCBs yourself

ELECTIVE 4: PRACTICAL

ECH68A	Industrial IoT LAB	L	T	P	C
Practical		0	0	4	2

Introduction:

Industrial IoT (IIoT) is transforming the manufacturing and industrial sectors by integrating smart devices, sensors, and connectivity to automate processes and enhance efficiency. This course is designed to provide hands-on experience with Industrial IoT concepts using Raspberry Pi enabling students to build and implement real-time monitoring and control systems in an industrial environment.

Course Objectives:

1. To understand the fundamental concepts of IoT architecture and communication protocols.
2. To gain practical knowledge in setting up and configuring Raspberry Pi for IIoT applications.
3. To interface various sensors, actuators, and modules with Raspberry Pi for real-time monitoring and control.
4. To develop practical skills in creating smart automation systems using IoT devices.
5. To implement the real-time data monitoring techniques for industrial applications.

Course Outcomes:

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

CO	Course Outcome	Program Outcome Mapping
	Describe the basic concepts of Industrial IoT, devices, and protocols.	
CO1	Apply Industrial IoT and Python coding to set up devices and get required results.	PO1
CO2	Analyse sensor data and device actions to find patterns and make conclusions.	PO2
CO3	Develop Python code for IoT systems using Raspberry Pi and sensors to address specific application needs.	PO3
CO4	Conduct experiments using IoT tools and Python to build and test Industrial IoT applications and exhibit teamwork skills.	PO4, PO6, PO7

Pre-requisites

Basic knowledge of Electronics Engineering.

Mapping Cos to Pos :

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	3
CO2	-	2	-	-	-	-	-			
CO3	-	-	1	-	-	-	-			
CO4	-	-	-	3	-	1	2			
CAM	3	2	1	3	-	1	2			

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

Instructional Strategy:

1. Hands-on Practical Sessions:
    - Conduct experiments and practical sessions using Raspberry Pi .
    - Integrate sensors, actuators, and other peripherals to build real-time IoT applications.
2. Demonstration and Simulation:
    - Demonstrate basic configurations and setups, such as headless mode and VNC viewer.
    - Use simulation tools for understanding data flow and device connectivity.
    - Encourage teamwork to build comprehensive IIoT solutions.

Apparatus Required (For one Batch)

S. No	Name of the Equipment / Component	Specification / Range	Quantity Required
1	Raspberry Pi (Model 3B+ / 4)	64-bit Quad Core, 2GB/4GB RAM, microSD slot, GPIO header	10
2	microSD Cards with Raspbian OS	Minimum 16GB, preloaded with Raspberry Pi OS	10
3	HDMI Monitor	19" or higher	10
4	USB Keyboard and Mouse	Standard	10 sets
5	Power Supply Adapter for Raspberry Pi	5V / 3A	10

6	USB to TTL Cable / Serial Console Cable	For headless setup	5
7	Breadboard	Standard 830 tie-points	25
8	Connecting Wires / Jumper Wires	Male-Male, Male-Female	100 sets
9	LEDs	5mm, Red/Green/Yellow	50
10	Resistors	220Ω, 330Ω, 1kΩ, 10kΩ	Assorted kit
11	Push Buttons	Tactile switch type	10
12	20x4 LCD Display Module	I2C or Parallel interface	5
13	Servo Motor	SG90 or equivalent	5
14	Touch Sensor Module	TTP223 or similar	5
15	PIR Motion Sensor	HC-SR501 or equivalent	5
16	Temperature Sensor	LM35 / DHT11 / DS18B20	5
17	IR Sensor Module	For obstacle / finger detection	5
18	Ultrasonic Sensor	HC-SR04 or equivalent	5
19	Camera Module for Raspberry Pi	5MP / 8MP with ribbon cable	5
20	RFID Reader Module with Tags	RC522 or equivalent	5 sets
21	Relay Module	5V, 1/2 Channel	5
22	Buzzer	5V Active Buzzer	5
23	Arduino Uno Board	With USB cable	5

ECH68A	Industrial IoT LAB	L	T	P	C
Practical		0	0	4	2

Ex. No	Name of the Experiment	
	Introduction about IOT Architecture and IOT protocol.	
1.	Setting up the Raspberry pi in normal mode.	4
2.	Setting up the Raspberry pi in Headless setup.	4
3.	Controlling the Light Emitting Diode (LED) with a push button using Raspberry pi.	4
4.	Interfacing 20x4 LCD with Raspberry Pi 4 for Creating Custom Character and Scrolling Text	4
5.	Interfacing of Servo Motor with the Raspberry pi for smart Industrial Automation.	4
6.	Buzzer Alarm System for Security Using Touch Sensor and Raspberry Pi in IIOT.	4
7.	Real-Time Motion Monitoring with PIR Sensor and Raspberry Pi in Industrial IoT	4
8.	Interfacing of temperature sensor with Raspberry pi	4
9.	Sense a Finger When it is Placed on Board Using Raspberry pi and IR sensor.	4
10.	IoT-Based Distance Measurement System Using Ultrasonic Sensor and Raspberry Pi	4
11.	Interfacing camera module in industry / office for monitoring and security.	4
12.	Real-Time Employee Attendance Tracking with RFID in Industrial IoT	4
13.	Smart Industrial automation by controlling lights using Raspberry pi.	4
14.	Real-Time Data Visualization with Tkinter Dial on Raspberry Pi for IIoT Monitoring	4
15.	Interfacing Arduino with Raspberry pi	4
	TOTAL	**60**

Text Books

1. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, 1st edition, Apress, 2017
2. Sabina Jeschke, Christian Brecher, Houbing Song and Danda B. Rawat,Industrial Internet of Things: Cyber manufacturing Systems, 1st edition,Springer, 2017
3. S. Misra, C. Roy, and A. Mukherjee, Introduction to Industrial Internet of Things and Industry, 1st edition, Routlege Taylor & Francis, 2020

Web-based/Online Resources

- https://www.youtube.com/watch?v=LlhmzVL5bm8
- https://onlinecourses.nptel.ac.in/noc22_cs53

ELECTIVE 4: PRACTICAL

ECH68B	VIRTUAL INSTRUMENTATION LAB	L	T	P	C
Practical		0	0	4	2

Introduction:

Virtual Instrumentation (VI) is the use of software tools, such as LabVIEW, to perform measurement, data acquisition, and control in engineering and industrial applications. This course focuses on understanding and applying LabVIEW for various virtual instrumentation tasks. Students will develop skills in implementing basic signal processing techniques.

Course Objectives:

The objective of this course is to enable the student to

- Understand the basics of Virtual Instrumentation
- Know the basic of Modular Programming
- Understand the 2D and multidimensional arrays and structures
- Know the data acquisition
- Understand simple applications in VI.

Course Outcomes

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

CO	Course Outcome	Program Outcome Mapping
	Describe the basic concepts of virtual instrumentation and LabVIEW software.	
CO1	Apply LabVIEW software tools to develop virtual instruments for arithmetic and logical operations to obtain desired results.	PO1
CO2	Analyze signal processing techniques, such as filtering and FFT, in LabVIEW, and design programs using loops (for, while) to solve mathematical and array operations.	PO2
CO3	Design virtual instruments using LabVIEW to meet specific signal processing and measurement requirements.	PO3
CO4	Conduct experiments using LabVIEW software to simulate and implement virtual instrumentation concepts and demonstrate teamwork skills.	PO4, PO6,PO7

Pre-requisites:

Knowledge of Digital Electronics.

Mapping of COs to POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO		
								PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	3
CO2	-	2	-	-	-	-	-			
CO3	-	-	2	-	-	-	-			
CO4	-	-	-	2	-	1	2			
CAM	3	2	2	2	-	1	2			

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

Instructional Strategy:

- Hands-on Learning: Practical experiments using LabVIEW for signal processing and virtual instrumentation tasks.
- Demonstration: Instructors showcase real-world virtual instrumentation applications.
- Collaborative Learning: Group projects to develop teamwork and communication skills.
- Project-based Learning: Mini-projects integrating multiple VI techniques for comprehensive understanding

Apparatus Required (For one Batch)

S. No	Name of the Equipment / Tool	Specification / Range	Quantity Required
1	Computer System with LabVIEW Software	Minimum i3 processor, 4GB RAM, Windows 10, NI LabVIEW Installed	15
2	NI LabVIEW Software License	Latest version with support for Signal Processing & Math Script	15 licenses
3	Internet Connectivity	For software activation and updates	1 (Lab-wide)
4	Multimedia Projector (for demonstrations)	HDMI / VGA compatible	1
5	Speakers / Headphones (optional)	Standard	5

ECH68B	VIRTUAL INSTRUMENTATION LAB	L	T	P	C
Practical		0	0	4	2

Ex. No	Name of the Experiment	Hours
1	Introduction to Lab VIEW software (Study Experiment)	4
Using LABVIEW software/any simulation tool, realize the following		
2	Basic arithmetic operations (addition, subtraction, multiplication, division)	4
3	Boolean operations (AND, OR, NOT, XOR and NAND)	4
4	Sum of ‘n’ numbers using ‘for’ loop	4
5	Factorial of a given number using ‘for’ loop	4
6	Sum of n natural numbers using ‘while’ loop	4
7	Sorting even numbers using while loop in an array	4
8	Find the maximum and minimum in an array	4
9	Flat and stacked sequence	4
10	Create a sine wave using formula node.	4
11	Find the Convolution of two signals	4
12	Apply Median Filter technique for a given input signal	4
13	Apply filtering technique for a given input signal	4
14	Apply different windowing technique on the given input signal	4
15	Apply FFT on the given input signal	4
	TOTAL	**60**

Suggested List of Students Activity:

Apart from classroom and laboratory learning, Teachers should use the following strategies to achieve the various outcomes of the course.

- Different analyzing tools for virtual instrumentation may be discussed.
- Micro-projects may be given to group of students for hand-on experiences.

Text Books

1. G. Johnson, LabVIEW Graphical Programming, 4th edition, McGraw Hill,2006
2. L. Sokoloft, Basic Concepts of LabVIEW 4, Prentice Hall Inc., 1st edition, 2005
3. L.K. Wells and J.Travis, LabVIEW for Everyone: Graphical Programming Made Even Easier, 4th edition, Prentice Hall, 2005

Websites

- LabVIEW tutorial videos on NI http://www.ni.com/academic/students/learn-labview/
- LabVIEW Basics http://www.ni.com/white-paper/7466/en/
- LabVIEW VISA Overview http://www.ni.com/support/visa/vintro.pdf

ECH671	IN -HOUSE PROJECT	L	T	P	C
Project		0	0	20	10

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 Lab or in-house or a combination of any two for the partial fulfillment for the award of Diploma in Engineering.
- For the project works, the Department will constitute a three-member faculty committee to monitor the progress of the project and conduct reviews regularly.
- If the projects are done in-house, the students must obtain the Bonafide certificate for project work from the Project supervisor and Head of the Department, at the end of the semester. Students who have not obtained the Bonafide certificate are not permitted to appear for the Project Viva Voce examination.
- For the projects carried out in Industry, the students must submit a separate certificate from Industry apart from the regular Bonafide certificate mentioned above. For Industry related projects there must be one internal faculty advisor / Supervisor from Industry (External), this is in addition to the regular faculty supervision.
- The final examination for project work will be evaluated based on the final report submitted by the project group of **not exceeding four students**, and the viva voce by an external examiner.

Course Objectives

Academic project work plays a crucial role in the education of Diploma in Engineering students, as it helps them apply theoretical knowledge to practical situations and prepares them for real-world engineering challenges.

Integration of Knowledge: Consolidate and integrate theoretical knowledge acquired in coursework to solve practical engineering problems.
Skill Development: Enhance technical skills related to the specific field of engineering through hands-on experience and application.
Problem-Solving Abilities: Develop critical thinking and problem- solving abilities by addressing complex engineering issues within a defined scope.
Project Management: Gain experience in project planning, execution, and management, including setting objectives, timelines, and resource allocation.
Teamwork and Collaboration: Foster teamwork and collaboration by working in multidisciplinary teams to achieve project goals and objectives.

Course Outcomes:

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

CO	Course Outcome	Program Outcome Mapping
CO1	Apply the basic knowledge of electronics and communication to solve real life problems.	PO1
CO2	Ability to prepare the Gantt Chart for scheduling the project work and designate responsibility of every member in the team.	PO2
CO3	Ability to perform the budget analysis of the project through the utilization of resources	PO4
CO4	Create a project or presentation using simulation tools and demonstrate effective teamwork skills.	PO4, PO6, PO7

Important points to consider to select the In-house project

Selecting a project work in Diploma Engineering is a significant decision that can greatly influence your learning experience and future career prospects.

Choose a project that aligns with your career aspirations and interests within the field of engineering. Consider how the project can contribute to your professional development and future opportunities.

Ensure the project aligns with your coursework and specialization within the Diploma program. It should complement and build upon the knowledge and skills you have acquired in your studies.

Evaluate the scope of the project to ensure it is manageable within the given timeframe, resources, and constraints. Avoid projects that are overly ambitious or impractical to complete effectively.

Assess the availability of resources needed to conduct the project, such as equipment, materials, laboratory facilities, and access to relevant software or tools. Lack of resources can hinder project progress.

Select a project that genuinely interests and motivates you. A project that captures your curiosity and passion will keep you engaged and committed throughout the project duration.

Consider the availability and expertise of faculty advisors or industry mentors who can provide guidance and support throughout the project. Effective mentorship is crucial for success.

Clearly define the learning objectives and expected outcomes of the project. Ensure that the project will help you achieve specific learning goals related to technical skills, problem-solving, and professional development.

Look for opportunities to propose innovative solutions or explore new methodologies within your project. Projects that encourage creativity can set you apart and enhance your learning experience.

Consider ethical implications related to the project, such as safety protocols, environmental impact, and compliance with ethical guidelines in research and engineering practices.

Evaluate whether the project offers opportunities for collaboration with peers, experts from other disciplines, or industry partners. Interdisciplinary projects can broaden your perspective and enhance your teamwork skills.

Consider the potential impact of your project on society or the engineering community. Projects that address significant challenges or contribute to social good can be highly fulfilling and make a meaningful difference.

By carefully considering these points, Diploma Engineering students can make informed decisions when selecting project work that not only enhances their academic learning but also prepares them for successful careers in engineering.

Duties Responsibilities of the internal faculty advisor

Each group should have an internal faculty advisor assigned by the HOD/Principal.

The in-house project should be approved by the project monitoring committee constituted by the Chairman Board of Examinations.

The in-house project should be selected in the fifth semester itself. Each in-house project shall have a maximum of four students in the project group.

Provide comprehensive academic advising to help in the selection of appropriate in-house project that align with their interests and career goals.

Offer expertise and feedback to ensure rigorous methodology, innovative approaches, and meaningful contributions to the field.

Assist in developing technical and professional skills through hands-on projects, laboratory work, and practical applications of theoretical knowledge.

Provide personal mentorship, fostering a supportive relationship that encourages growth, resilience, and a positive academic experience.

Facilitate connections between students and industry professionals, alumni, and other relevant networks to enhance their professional opportunities and industry exposure.

Ensure students have access to necessary resources, including research materials, lab equipment, software, and academic literature.

Regularly monitor and evaluate the progress of the in-house project, providing

constructive feedback and guidance to help them stay on track and achieve their goals.

Instill and uphold high ethical and professional standards, encouraging students to practice integrity and responsibility in their work.

Assist in preparing progress reports, writing recommendation letters, and facilitating grant applications.

Organize and participate in workshops, seminars, and other educational events that enhance the learning experience and professional development.

Address any issues or conflicts that arise, providing mediation and support to ensure a positive and productive academic environment.

Instructions to the students

Regularly meet with your internal faculty advisor for guidance on academic progress, research projects, and career planning. Be proactive in seeking advice and support from your faculty advisor.

Use planners, calendars, and task management tools to keep track of assignments, project deadlines, and study schedules. Prioritize tasks to manage your time efficiently.

Take advantage of opportunities to participate in in-house projects and hands-on activities. These experiences are crucial for applying your theoretical knowledge and gaining practical skills.

Focus on improving essential professional skills such as communication, teamwork, problem-solving, and leadership. Participate in workshops and seminars that enhance these competencies.

Documents to be submitted by the student for an in-house project

Submit a printed report of your in-house project work along with the fabrication model / analysis report for the End Semester Examination.

Rubrics for In-House Project Work

Sl. No.	Topics	Description
1	Objectives	Clearly defined and specific objectives outlined. Objectives align with the project's scope and purpose.
2	Literature Review	Thorough review of relevant literature. Identification of gaps and justification for the project's contribution.

3	Research Design and Methodology	Clear explanation of the research design. Appropriateness and justification of chosen research methods.
4	Project Management	Adherence to project timeline and milestones. Effective organization and planning evident in the project execution.
5	Documentation	Comprehensive documentation of project details. Clarity and completeness in recording methods, results, and challenges.
6	Presentation Skills	Clear and articulate communication of project findings. Effective use of visuals, if applicable.
7	Analysis and Interpretation	In-depth analysis of data. Clear interpretation of results in the context of research questions.
8	Problem-Solving	Demonstrated ability to identify and address challenges encountered during the project. Innovative solutions considered where applicable.
9	Professionalism and Compliance	Adherence to ethical standards in research. Compliance with project guidelines and requirements.
10	Quality of Work	Overall quality and contribution of the project to the field. Demonstrated effort to produce high-quality work.

ECH672	INDUSTRIAL TRAINING	L	T	P	C
Project		0	0	20	10

Introduction

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

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

Objectives

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

Structure of the Training Program

- Orientation: Introduction to the company, its operations, and safety protocols.
- Project Assignment: Students are assigned specific projects or tasks relevant to their field of study.
- Supervision and Mentorship: Industry professional's guide and mentor students throughout the training.

- Skill Development Workshops: Sessions on technical skills, software tools, and industry best practices.
- Assessment and Feedback: Performance evaluations and constructive feedback to help students improve.

Benefits for Students

- Enhanced Employability: Practical experience makes students more attractive to potential employers.
- Confidence Building: Working in a real-world setting boosts confidence and professional demeanor.
- Clarified Career Goals: Exposure to various roles and responsibilities helps students define their career paths.

Course Outcomes:

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

CO	Course Outcome	Program Outcome Mapping
CO1	**Apply** engineering knowledge and technical skills in a real industrial environment.	PO1
CO2	**Analyze** industrial workflow, safety procedures, and professional practices through observation and experience.	PO2
CO3	**Design** proper documentation and prepare a detailed report based on the industrial training experience to meet specific circuit requirements.	PO3
CO4	Make a project using modern tools and industry trends to enhance professional growth.	PO4, PO6, PO7

Duties Responsibilities of the Faculty Mentor

One faculty mentor should be assigned for every 30 students by the HOD / Principal. Faculty mentors shall play a crucial role in overseeing and guiding students during their industrial training program in Diploma engineering.

Pre-Training Responsibilities:

1. Orientation and Preparation:
    - Conduct orientation sessions to familiarize students with the objectives, expectations, and guidelines of the industrial training program.
    - Assist students in understanding the importance of industrial training in

their academic and professional development.

2. Placement Coordination:
    - Collaborate with the placement cell or industry liaison office to secure suitable training placements for students that align with their academic specialization and career interests.
    - Facilitate communication between the institution and host organizations to ensure smooth coordination of training arrangements.
3. Training Plan Development:
    - Help students develop a detailed training plan outlining learning objectives, tasks, and expected outcomes for the training period.
    - Guide students in setting SMART (Specific, Measurable, Achievable, Relevant, Time-bound) goals for their training experience.

During Training Responsibilities:

4. Monitoring and Support:
    - Regularly monitor the progress of students during their industrial training. Maintain communication with both students

      and industry supervisors to track performance and address any issues that may arise.
    - Provide ongoing support and guidance to students, offering advice on technical challenges, professional conduct, and workplace etiquette.
5. Technical Guidance:
    - Offer technical guidance and mentorship related to the specific engineering discipline or specialization of the students. Help them apply theoretical knowledge to practical situations encountered in the industry.
6. Problem-Solving Assistance:
    - Assist students in overcoming obstacles or challenges encountered during their training. Encourage them to develop problem-solving skills and resilience in real-world engineering scenarios.
7. Feedback and Evaluation:
    - Provide constructive feedback on students' performance based on reports, assessments, and observations gathered from industry supervisors.
    - Evaluate students' achievements in relation to their training objectives and competencies developed during the program.

Post-Training Responsibilities:

8. Reflection and Debriefing:
    - Conduct debriefing sessions with students to reflect on their training experiences, discuss lessons learned, and identify areas for further improvement.
    - Help students articulate their learning outcomes and how these experiences contribute to their professional growth.
9. Documentation and Reporting:
    - Ensure comprehensive documentation of students' training activities, achievements, and feedback received from industry supervisors.
    - Prepare reports summarizing students' performance and submit these to relevant departments or committees for review and assessment.
10. Career Counseling:
    - Provide career guidance and counseling to students based on their industrial training experiences. Assist them in leveraging these experiences for future job applications or further academic pursuits.
11. Continuous Improvement:
    - Collaborate with industry partners to continuously improve the quality and relevance of the industrial training program.
    - Incorporate feedback from students and industry supervisors to enhance the effectiveness of future training placements.

By fulfilling these duties and responsibilities, faculty mentors contribute significantly to the overall educational experience and professional development of Diploma engineering students during their industrial training program.

Instructions to the students

Before Starting Industrial Training:

1. **Orientation and Preparation:**
    - Attend orientation sessions conducted by the institution or faculty mentors to understand the objectives, expectations, and guidelines of the industrial training program.
    - Familiarize yourself with the specific policies, procedures, and safety regulations of the host organization where you will be undergoing training.
2. Setting Goals:
    - Set clear and specific goals for your industrial training period. Define what

skills, knowledge, and experiences you aim to gain during this time.

- Discuss your goals with your faculty mentor and seek their guidance in developing a training plan that aligns with your career aspirations.

3. Professional Attire and Conduct:
    - Dress appropriately and professionally according to the standards of the industry and host organization.
    - Maintain a positive attitude, demonstrate punctuality, and adhere to workplace etiquette and norms.

During Industrial Training:

4. Learning and Engagement:
    - Actively engage in all assigned tasks and projects. Seek opportunities to learn new skills and technologies relevant to your field of study.
    - Take initiative in asking questions, seeking clarification, and participating in discussions with supervisors and colleagues.
5. Adaptability and Flexibility:
    - Adapt to the work environment and demonstrate flexibility in handling various responsibilities and challenges that arise during your training.
    - Be open to different roles and tasks assigned to you, as this will broaden your experience and skill set.
6. Professionalism and Communication:
    - Communicate effectively with supervisors, colleagues, and clients as required. Practice clear and concise verbal and written communication.
    - Demonstrate professionalism in all interactions, respecting confidentiality, and adhering to company policies and procedures.
7. Safety and Compliance:
    - Prioritize safety at all times. Familiarize yourself with safety protocols, procedures, and emergency exits in the workplace.
    - Follow all safety guidelines and regulations to ensure your well- being and that of others around you.

After Completing Industrial Training:

8. Reflection and Documentation:
    - Reflect on your training experience. Evaluate what you have learned, the challenges you faced, and how you have grown professionally.
    - Maintain a journal or log documenting your daily activities,

achievements, and lessons learned during the training period.

9. Feedback and Evaluation:
    - Seek feedback from your industry supervisor and faculty mentor on your performance and areas for improvement.
    - Use constructive feedback to enhance your skills and competencies for future career opportunities.
10. Career Planning:
    - Use your industrial training experience to inform your career planning and decision-making process.
    - Discuss your career goals and aspirations with your faculty mentor or career counselor for guidance on next steps after completing your diploma.

By following these instructions, Diploma engineering students can make the most of their industrial training experience, gain valuable insights into their chosen field, and prepare themselves effectively for future professional endeavors.

Attendance Certification

Every student has to get their attendance certified by the industrial supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and submit it to the institution faculty mentor.

Training Reports

The students have to prepare reports: The report in the form of a diary to be submitted to the concerned faculty mentor of the institution. This will be reviewed while awarding Internal assessment.

Industrial Training Diary

Students are required to maintain the record of day-to-day work done. Such a record is called Industrial training Diary. Students have to write this report regularly. All days for the week should be accounted for clearly giving attendance particulars (Presence, absence, Leave, Holidays etc.). The concern of the Industrial supervisor is to periodically check these progress reports.

In addition to the diary, students are required to submit a comprehensive report on training with details of the organization where the training was undergone after attestation by the supervisors. The comprehensive report should incorporate study of plant / product /process / construction along with intensive in-depth study on any one of the topics such as processes, methods, tooling, construction and Equipment, highlighting aspects of quality, productivity and system. The

comprehensive report should be completed in the last week of Industrial training. Any data, drawings etc. should be incorporated with the consent of the Organization.

Scheme of Evaluation

Internal Assessment

Students should be assessed for 40 Marks by industry supervisor and polytechnic 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		50

End Semester 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 Semester Examination.

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

Integrated Learning Experiences (ILE)

Standard Operating Procedures (SOPs)

S.No	Contents
1	Introduction
2	Health & Wellness
3	Growth Lab
4	Induction Program
5	Student Led Initiatives
6	Shop Floor Immersion
7	Emerging Technology Seminars
8	Special interest Groups & Club activities
9	Student Induction Program Cell

Introduction:

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. This new curriculum revamping (R2023) 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. From this perspective, a new structure called "Integrated Learning Experiences(ILE)" is introduced in the regulation 2023. This ILE 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.

		L	T	P	C**
AUDIT	**HEALTH & WELLNESS**	**0**	**0**	**2**	**1**

** Health & Wellness has one credit for the third semester only and it has no credits for other semesters.

Skill Areas:

Physical Fitness, Nutrition, Mental Health, Awareness on Drug addiction and its effects

Purpose:

The Health & Wellness course focuses on teaching the elements of physical, mental, emotional, social, intellectual, environmental well-being which are essential for overall development of an individual. The course also addresses the dangers of substance abuse and online risks to promote emotional and mental health.

Learning Outcomes:

Upon completion of the Health & Wellness course, students will be able to:

1. Demonstrate proficiency in sports training and physical fitness practices.
2. Improve their mental and emotional well-being, fostering a positive outlook on health and life.
3. Develop competence and commitment as professionals in the field of health and wellness.
4. Awareness on drug addiction and its ill effects

Focus:

During the conduct of the Health & Wellness course, the students will benefit from the following focus areas:

1. Stress Management.
2. Breaking Bad Habits.
3. Improving Interpersonal Relationships.
4. Building Physical Strength & Inner Strength.

Role of the Facilitator:

The faculty plays a crucial role in effectively engaging with students and guiding them towards achieving learning outcomes. Faculty participation involves the following areas:

1. **Mentorship & Motivation:** The Facilitator mentors students in wellness and self-discipline while inspiring a positive outlook on health. Faculty teach stress management, fitness, and daily well-being.
2. **Promoting a Safe and Inclusive Environment:** The facilitator ensures a safe, inclusive, and respectful learning environment for active student participation and benefit.
3. **Individualised Support and Monitoring Progress:** The facilitator plays a crucial role in providing personalized support, monitoring and guidance to students.

Guided Activities:

In this course, several general guided activities have been suggested to facilitate the achievement of desired learning outcomes. They are as follows:

1. Introduction to Holistic Well-being.
2. Holistic Wellness Program- Nurturing Body and Mind
3. Breaking Bad Habits Workshop.
4. Improving the elements of physical, emotional, social, intellectual, environmental and mental well-being.
5. Creating situational awareness, digital awareness.
6. Understanding substance abuse, consequences and the way out.

Period Distribution

The following are the guided activities suggested for this Audit course.

The Physical Director should plan the activities by the students.

Arrange the suitable Mentor / Guide for the wellness activities.

Additional activities and programs can be planned for Health and Wellness.

S.No	Guided Activities	Period
1	**Introduction to Holistic Well-being** 1. Introduce the core components of Health & Well-being namely Physical, mental and emotional well-being 2. Provide worksheets on all the four components individually and explain the interconnectedness to give an overall understanding.	
2	**Wellness Wheel Exercise (Overall Analysis)**	

	● Guide students to assess their well-being in various life dimensions through exercises on various aspects of well – being, and explain the benefits of applying wellness wheel. ● Introduce Tech Tools: ● Explore the use of technology to support well-being. ● Introduce students to apps for meditation, sleep tracking, or healthy recipe inspiration.	
3	**Breaking Bad Habits (Overall Analysis)** ● Open a discussion on bad habits and their harmful effects. ● Provide a worksheet to the students to identify their personal bad habits. ● Discuss the trigger, cause, consequence and solution with examples. ● Guide them to replace the bad habits with good ones through worksheets.	
4	**Physical Well-being** **1. Fitness** Introduce the different types of fitness activities such as basic exercises, cardiovascular exercises, strength training exercises, flexibility exercises, so on and so forth. (Include theoretical explanations and outdoor activity). **2. Nutrition** Facilitate students to reflect on their eating habits, their body type, and to test their knowledge on nutrition, its sources and the benefits. **3. Yoga & Meditation** Discuss the benefits of Yoga and Meditation for one's overall health. Demonstrate different yoga postures and their benefits on the body through visuals (pictures or videos)	

	4. Brain Health Discuss the importance of brain health for daily life. Habits that affect brain health (irregular sleep, eating, screen time). Habits that help for healthy brains (reading, proper sleep, exercises). Benefits of breathing exercises and meditation for healthy lungs. **5. Healthy Lungs** Discuss the importance of lung health for daily life. Habits that affect lung health (smoking, lack of exercises). Benefits of breathing exercises for healthy lungs. **6. Hygiene and Grooming** Discuss the importance of hygienic habits for good oral, vision, hearing and skin health. Discuss the positive effects of grooming on one's confidence level and professional growth. **<u>Suggested Activities (sample):</u>** **Nutrition:** Invite a nutritionist to talk among the students on the importance of nutrition to the body or show similar videos shared by experts on social media. Organize a 'Stove less/fireless cooking competition' for students where they are expected to prepare a nutritious dish and explain the nutritive values in parallel.	
5	**Emotional Well-being** **1. Stress Management** Trigger a conversation or provide self-reflective worksheets to identify the stress factors in daily life and their impact on students' performance. Introduce different relaxation techniques like deep breathing, progressive muscle relaxation, or guided imagery. (use audio recordings or visuals to guide them through these techniques). After practicing the techniques, have them reflect on how these methods can help manage stress in daily life. **2. Importance of saying 'NO'.**	

	Explain the students that saying 'NO' is important for their Physical and mental well-being, Academic Performance, Growth and Future, Confidence, Self-respect, Strong and Healthy Relationships, building reputation for self and their family (avoid earning a bad name). Factors that prevent them from saying 'NO'. How to practice saying 'NO''. **3. Body Positivity and self-acceptance** Discuss the following with the students. ● What is body positivity and self-acceptance? ● Why is it important? ● Be kind to yourself. ● Understand that everyone's unique. **<u>Suggested Activities(Sample):</u>** (Importance of saying 'NO') Provide worksheets to self-reflect on… …how they feel when others say 'no' to them …the situations where they should say 'no' Challenge students to write a song or rap about the importance of saying no and how to do it effectively. Students can perform their creations for the class.	
6	**Social Well-Being** **1. Practicing Gratitude** Discuss the importance of practicing gratitude for building relationships with family, friends, relatives, mentors and colleagues. Discuss how one can show gratitude through words and deeds. Explain how practicing gratitude can create 'ripple effect'. **2. Cultivating Kindness and Compassion** Define and differentiate between kindness and compassion. Explore practices that cultivate these positive emotions. Self-Compassion as the Foundation.	

	The power of small gestures. Understanding another's perspective. The fruits of compassion. **3. Practising Forgiveness** Discuss the concept of forgiveness and its benefits. Forgiveness: What is it? and What it isn't? Benefits of forgiveness. Finding forgiveness practices. **4. Celebrating Differences** Appreciate the value of individual differences and foster inclusivity. The World: A Tapestry of Differences (cultures, backgrounds, beliefs, abilities, and appearances). Finding strength in differences (diverse perspectives and experiences lead to better problem-solving and innovation). Celebrating differences, not ignoring them (respecting and appreciating the unique qualities). Activities for celebrating differences (share culture, learn about others, embrace new experiences). **5. Digital Detox** **Introduce the students to:** The concept of a digital detox and its benefits for social well-being. How to disconnect from devices more often to strengthen real-world connections. **<u>Suggested Activities (sample)</u>**: (Practicing Gratitude) Provide worksheets to choose the right ways to express gratitude. Celebrate 'gratitude day' in the college and encourage the students to honour the house keeping staff in some way to express gratitude for their service.	

7.	**Intellectual Well-being** **1. Being a lifelong Learner** Give students an understanding on: The relevance of intellectual well-being in this 21st century to meet the expectations in personal and professional well-being The Importance of enhancing problem-solving skills Cultivating habits to enhance the intellectual well-being (using the library extensively, participating in extra-curricular activities, reading newspaper etc.) **2. Digital Literacy Discuss:** The key aspects of digital literacy and its importance in today's world. It is more than just liking and sharing on social media. The four major components of digital literacy (critical thinking, communication, problem-solving, digital citizenship). Why is digital literacy important? Boosting one's digital skills. **3. Transfer of Learning** Connections between different subjects – How knowledge gained in one area can be applied to others. Suggested Activities(sample): Intellectual Well-being. Provide worksheets to students for teaching them how to boost intellectual well-being. Ask the students to identify a long-standing problem in their locality, and come up with a solution and present it in the classroom. Also organize an event like 'Idea Expo' to display the designs, ideas, and suggestions, to motivate the students to improve their intellectual well-being.	
8	**Environmental Well-being** **1.The Importance of initiating a change in the environment.** The session could be around: Defining Environmental well-being (physical, chemical, biological, social, and psychosocial factors) – People's behaviour, crime, pollution, political activities, infra-structure, family situation etc. Suggesting different ways of initiating changes in the environment (taking responsibility, creating awareness, volunteering,	

	approaching administration). **<u>Suggested Activities (sample)</u>**: Providing worksheets to self-reflect on how the environment affects their life, and the ways to initiate a change. Dedicate a bulletin board or wall space (or chart work) in the classroom for students to share their ideas for improving environmental well-being. Creating a volunteers' club in the college and carrying out monthly activities like campus cleaning, awareness campaigns against noise pollution, (loud speakers in public places), addressing anti-social behaviour on the campus or in their locality.	
9	**Mental Well-being** **1. Importance of self-reflection** **Discuss:** Steps involved in achieving mental well-being (self-reflection, self-awareness, applying actions, achieving mental well-being). Different ways to achieve mental well-being (finding purpose, coping with stress, moral compass, connecting for a common cause). The role of journaling in mental well-being. **2. Mindfulness and Meditation Practices** Benefits of practicing mindful habits and meditation for overall well-being. **1. Connecting with nature** Practising to be in the present moment **–** Nature walk, feeling the sun, listening to the natural sounds. Exploring with intention – Hiking, gardening to observe the nature. Reflecting on the emotions, and feeling kindled by nature. **2. Serving people** Identifying the needs of others. Helping others. Volunteering your time, skills and listening ear. Finding joy in giving. **3. Creative Expressions**	

	Indulging in writing poems, stories, music making/listening, creating visual arts to connect with inner selves. **<u>Suggested Activities(Sample):</u>** (Mindfulness and Meditation) – Conducting guided meditation every day for 10 minutes and directing the students to record the changes they observe.	
10	**Situational Awareness (Developing Life skills)** **1. Being street smart** **Discuss:** Who are street smarts? Why is it important to be street smart? Characteristics of a street smart person: Importance of acquiring life skills to become street smart – (General First-aid procedure, CPR Procedure, Handling emergency situations like fire, flood etc). **2. Digital Awareness** **Discuss:** Cyber Security Information Literacy Digital Privacy Fraud Detection **<u>Suggested Activities</u>** (sample): (Street Smart) Inviting professionals to demonstrate the CPR Procedure Conducting a quiz on Emergency Numbers	
11	**Understanding Addiction** **Plan this session around:** Identifying the environmental cues, triggers that lead to picking up this habit. Knowing the impact of substance abuse – Adverse health conditions, social isolation, ruined future, hidden financial loss and damaging the family reputation. Seeking help to get out of this addiction. **<u>Suggested Activities</u>**:	

	Provide Worksheets to check the students' level of understanding about substance addiction and their impacts. Share case studies with students from real-life. Play/share awareness videos on addiction/de-addiction, experts talk. *Conduct awareness programmes on Drugs and its ill effects. (Arrange Experts from the concerned government departments and NGOs working in drug addiction issues) and maintain the documents of the program.	

Closure:

Each student should submit a Handwritten Summary of their Learnings & Action Plan for the future.

Assessments:

- Use Self-reflective worksheets to assess their understanding.
- Submit the worksheets to internal audit/external audit.
- Every student's activities report should be documented and the same have to be assessed by the Physical Director with the mentor. The evaluation should be for 100 marks. No examination is required.

Scheme of Evaluation

Part	Description	Marks
A	Report	40
B	Attendance	20
C	Activities (Observation During Practice)	40
Total		100

References/Resource Materials:

The course acknowledges that individual needs for references and resources may vary. However, here are some general reference materials and resources that may be helpful:

1. **The Well-Being Wheel:**

2. **Facilities & Spaces:** Some activities may require access to specific facilities, resources or spaces. Students may need to coordinate with the college administration to reserve these as required.
3. **Online Resources:**
    1. United Nations Sustainable Development Goals - Goal 3 - Good Health & Well-Being: https://www.un.org/sustainabledevelopment/health/
    2. Mindfulness and Meditation: Stanford Health Library offers mindfulness and meditation resources: https://healthlibrary.stanford.edu/books-resources/mindfulness- meditation.html

3. Breaking Bad Habits: James Clear provides a guide on how to build good habits and break bad ones: https://jamesclear.com/habits
4. 6 Ways to Keep Your Brain Sharp https://www.lorman.com/blog/post/how-to-keep-your-brain-sharp
5. What Is Social Wellbeing? 12+ Activities for Social Wellness https://positivepsychology.com/social-wellbeing/
6. How Does Your Environment Affect Your Mental Health? https://www.verywellmind.com/how-your-environment-affects-your-mental-health-5093687
7. How to say no to others (and why you shouldn't feel guilty) https://www.betterup.com/blog/how-to-say-no

	Growth Lab
AUDIT	

Skill Areas:

Self-Discovery, Habit Formation, Mind-set Development.

Learning Outcomes:

The Growth Lab aims to provide students with various learning outcomes, including:

1. Develop personal ethics, a growth mind-set, and strong communication skills.
2. Practice effective time management, overcoming challenges, and teamwork.
3. Master academic skills like reading, writing, and goal setting.
4. Become job-ready through resume building, interviewing, and resource utilization.
5. Reflect on their growth journey and articulate its impact.

Focus:

While organizing and participating in the Growth Lab, students should focus on the following key areas:

1. **Mindful Habits:** Emphasize the importance of cultivating mindful habits in their daily lives. Encouraging students to be conscious of their actions, thoughts, and emotions can help them identify any negative patterns and replace them with positive and empowering habits.
2. **Self-reflection:** Students should engage in self-reflection to gain deeper insights into their own strengths, weaknesses, and areas for improvement. Taking the time to reflect on their experiences and learning helps in identifying personal growth opportunities.
3. **Goal Setting:** Students should set clear goals for their personal and professional development. Encourage students to set specific, measurable, achievable, relevant, and time-bound (SMART) goals.

Role of the Facilitator:

Department faculty shall play a crucial role in organizing the Growth Lab. Their responsibilities include:

1. **Facilitation:** Faculty lead and guide the students throughout the Growth Lab sessions. They provide instructions, facilitate discussions, and offer insights to foster a

stimulating learning environment. They ensure that the sessions are engaging, interactive, and conducive to student participation.

2. **Mentorship:** Facilitators should Provide clear explanations and guidance on the importance of cultivating mindful habits in their daily lives and engaging in self-reflection. Help students understand how these practices contribute to their personal growth and development.

Guided Activities:

The Growth Lab shall incorporate the following guided activities to support the development of students. Here are some examples of guided activities that could be included:

Period Distribution: Depends on the Curriculum Allocation

S.No	Guided Activities	Period
1	**Ethics and Values for Growth** **1. Avoiding Absenteeism** Discuss: Why regular attendance matters? Quick Quiz/Self-reflective worksheet on absenting for something other than being super sick. Brainstorm consequences of absenting often. (becomes a habit, affects productivity, lose inclusivity). How to avoid absenteeism – Initiate group discussion among students. Explain how the habit of absence often affects growth at the workplace. **2. The Importance of Obeying Rules** Talk about college rules and why they're important for students' success. Explain the benefits of following the rules (safe, respectful and productive environment). Consequences of breaking the rules (warnings to fines, academic sanctions, or even expulsion). Connect how the habit of disobeying the rules will affect growth in the workplace. **3. Identifying personal values**	

	Provide self-reflective worksheets to understand how students' get affected when others do not adhere to ethics and values. Help them identify their own ethics and values that they uphold. Explain how upholding ethics and values is important for professional success citing examples from real life. **<u>Suggested Activities (sample – Avoiding Absenteeism)</u>** Peer accountability partner – pair students up and have them check in with each other regularly to ensure both are attending class regularly. Provide statistics on the loss incurred by a company due to frequent absenteeism by employees. Ask students to prepare a comical skit on absenteeism and its consequences.	
2	**Identifying Strengths and Weaknesses** **1. Overcoming Self-doubt** Provide worksheets to check whether the students have felt unsure about doing something new. Briefly discuss self-doubt and how it can feel like a monster holding us back. Introduce strategies to overcome self-doubt - Train the students to say instead of "I can't," say "I'll try my best" or "I'm learning", focus on progress, and learn from mistakes. **2. Overcoming Procrastination** Ask students (worksheet/oral discussion) how they feel when they put off a task until the last minute. Brainstorm the consequences of procrastination (creates a cycle of avoidance and stress). Introduce strategies to overcome procrastination (Breaking down tasks and setting small goals, self-rewarding). **3. Overcoming Distractions** Help students identify the distractions (phones, social media, noise, conflicts with friends, hanging out with friends often, movies). Discuss the impacts of distractions on productivity and growth. Introduce strategies to fight the Distractions (introduce pomodoro	

	technique). **<u>Suggested Activities (sample –Over Coming Self-doubt)</u>** Present a challenge to the students, it could be anything from narrating a story, mimicking, singing, dancing, talking about their family. Encourage them to overcome their self-doubt and perform in front of their classmates. Finally ask them to express how they felt while performing.	
3	**Cultivating Growth Mind-set** **1. Cultivating Determination** Explain what determination is (hard work, not giving up, being ready to face challenges). Show videos/share stories of successful people who overcame challenges to achieve something big for them or the society. Define the ways to cultivate determination (setting SMART goals, learning from mistakes, celebrating every small win). **2. Cultivating Positive Habit Change** **Discuss:** Impact of habits on one's actions and decisions (triggers automatic responses, decision making). Impact on skills and abilities (practice makes progress). Impact on personal growth and well-being (confidence building, positive lifestyle). Impact on overall success (reaching goals, building discipline). Ways to switch to positive habits (use self-reflective worksheets to identify students' habits). **3. Time-management** Teach students the importance of prioritizing tasks for effective results. (important and urgent) Teach them prioritization matrix for organizing tasks, projects and ideas **<u>Suggested Activities (sample – Overcoming Procrastination)</u>** Host a procrastination-free week, ask students to team up and commit	

	to spending a week without procrastinating on any task or assignment. Announce a reward or incentive for the winning team. Also encourage them to share their feeling when they complete the tasks without procrastinating.	
4	**Improving the Basic Skills** **1. Reading, Writing and Speaking Practice** Train the students to read, write and speak fluently in English/Regional language. **2. Letter Writing Practice** Train the students in letter writing in English (leave letter, permission letter, apology letter) by providing them formats. **Suggested Activities (sample -speaking practice)** Create a WhatsApp group and share short animation English videos (maximum one minute long). Ask the students to listen to the dialogues, repeat it in their voice, record the same and send back. Observe their progress through the semester and reward them duly. **Letter Writing Practice** – set up a 'Mysterious Mailbox' in the classroom, encourage the students to write letters (leave letters, permission slips, apology letters), collect the letters and distribute them for others to analyse and give feedback.	
5	**Goal Setting and Mind Mapping** 1. Teach mind mapping & ask students to make mind maps for visualizing their personal goals. 2. Guide students in setting SMART goals for the semester. **Suggested Activities (sample)** Encourage students to take up at least one-value added course and receive certification per semester	
6	**Interpersonal Skills** Introduce the components of Interpersonal Skills such as: Communication Skills (verbal/non-verbal communication) Speaking, listening, body language. Problem-solving Skills (conflict resolution, negotiation, team work).	

	Team work. Flexibility. Patience. Educate students that how interpersonal skills help in building healthy relationships in personal and professional life. **<u>Suggested Activities (Sample)</u>** Organize a guest lecture on the importance of interpersonal skills by inviting a HR Personnel to educate the students (Especially communication skills)	
7	**Interview Skills** Introduce Resume Writing to students (conduct frequent resume writing drills through the semesters, and ask them to review the same to understand whether they have progressed in all areas). Train the students in self-introduction. Train the students in group discussions (Initiating a discussion, countering participants, using appropriate phrases to interrupt etc.). Introduce Interview ethics (body language, grooming, presentation). Cultivating the habit of researching (to know the profile of companies, their operating style, activity) **<u>Suggested Activities (sample)</u>** Conduct frequent mock interviews to train the students in the above interview skills. Stream videos of mock interviews.	
8	**Utilizing the Available Resources for Growth** Arrange a campus tour for the students to know the available facilities such as libraries, laboratories etc. Encourage the students to enrol in (online/offline) courses available in the college. Guide the students to use social media for their personal and professional growth (browsing for the latest trends in engineering and technology, following entrepreneurs on social media to understand	

	their journey, to check for institutions for higher studies etc). **Networking & Connecting** Help students connect with their alumni for guidance for their studies and career growth. Encourage students to follow entrepreneurs, eminent businessmen on a regular basis to stay updated and ask them to share the information in the class to inspire others. **<u>Suggested Activities (sample – Networking and connecting.</u>** Identify alumni who would be interested to contribute for the growth of the students and connect them with students for guidance in their studies and career growth.	
9	**Final Oral Presentation & Impact Assessment: *** 1. Give students an opportunity to present their semester's journey and the changes they have experienced. 2. Faculty shall compile a brief report assessing program impact based on student feedback.	

Closure: End of the semester a half-day session shall be given for the students to share their transformation and feedback can be collected about his self-reflection on the impact of the program. The faculty must submit a brief report by assessing every student's development on the impact of the program, comparing their initial state at the beginning of the semester with their progress at the end.	
Assessments: ● Use self-reflective worksheets to assess students' understanding. ● Subject the worksheets to internal/external audit.	

References / Resource Materials:

For the Growth Labs, the following references and resource materials may be utilized to support the learning and development of the students:

1. Facilities & Spaces: Growth labs may require access to specific facilities, resources or spaces. Faculty may need to coordinate with the college administration to reserve these as required.

Online Resources:

1. How to Begin Your Self-Discovery Journey: 16 Best Questions https://positivepsychology.com/self-discovery/
2. How to break a bad habit? https://www.health.harvard.edu/blog/how-to-break-a-bad-habit-202205022736
3. How To Mind Map Yourself For Growth? https://mindmapsunleashed.com/how-to-mind-map-yourself-for-growth
4. Interpersonal Communication and Its Importance at Work https://www.indeed.com/career-advice/career-development/importance-of-interpersonal-communication
5. Personal Responsibility: Embracing Accountability in Life https://www.graygroupintl.com/blog/personal-responsibility
6. The Power of Prioritization: Why You Need It in Your Life https://medium.com/@Jd-Lewis/the-power-of-prioritization-why-you-need-it-in-your- life-5fd49c7c2f6c#:~:text=Prioritization%20helps%20you%20make%20informed,achieve%20more%20in%20less%20time.
7. How To Write An IT Fresher Resume: A Step-By-Step Guide https://in.indeed.com/career-advice/resumes-cover-letters/how-to-write-it-fresher-resume
8. How to Overcome Self Doubt https://www.wikihow.health/Overcome-Self-Doubt
9. The Surprising Health Benefits of Bird-Watching https://www.nytimes.com/2022/12/10/well/move/bird-watching-health-benefits.html
10. Positive Daily Affirmations: Is There Science Behind It? https://positivepsychology.com/daily-affirmations/

-	Induction Program
AUDIT	

Induction Program - I (One Week) Should be scheduled at the First Week after reopening as per the schedule.

Induction Program - II (As per the curriculum) Should be scheduled in the beginning of the III Semester.

Induction Program - III (One Week) Should be scheduled at the beginning of the V Semester.

Skill Areas:

Interpersonal Skills, Academic Orientation, Technical Skills Development, Soft Skills and Communication, Study Skills and Time Management, Healthy and Safety Environmental Awareness, Ethics and Professionalism, awareness on drug addiction and its related physical and mental health issues, Career Guidance and Industry Interaction, Extracurricular Activities and Personal Development.

Purpose:

The transition from school to college life is one of the most challenging events in a student's life. The Induction Programme helps new students adjust, learn institutional values, build bonds, and explore the institutional policies, processes, practices, culture, universal human values, and get introduced to DOTE regulations, overview of the diploma programme, and prospective skill areas.

Learning Outcomes:

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

1. Feel comfortable in the new college environment.
2. Understand the curriculum, preparing for their academic journey comprehensively.
3. Get introduced to various committees recommended by AICTE
4. Experience diverse activities, promoting holistic development.
5. Connect with faculty, including the Principal, HoD, and department faculty.
6. Interact with industry professionals and alumni.
7. Learn about the resources needed for skill development.
8. Understand professional ethics and responsibilities in technical fields.
9. Aware of career opportunities and pathways in technical fields

10. Aware of student support services, including counselling and mentorship.
11. Train in effective communication, presentation skills, public speaking, teamwork and collaboration exercises.
12. Awareness of drug addiction and its related health issues.

Focus:

The induction program focuses on providing clarity and support for a successful academic journey and holistic development of students. Key areas include adjustment, comfort in the new environment, fostering institutional culture, building bonds, and promoting self-exploration. Some key focus areas include,

1. Credit System and GPA/CGPA Assessment.
2. Diverse Classes at the End.
3. Theory, Laboratory, and Practicum Sessions.
4. Assessment Methods.
5. Internship Opportunities.
6. Fast Track Courses.
7. Exposure to Extracurricular Activities.
8. Course Add/Drop.
9. Examination Withdrawal.
10. Role of a Mentor.
11. Choosing Pathways.
12. The importance of understanding the Universal Human Values.
13. Role of DOTE in diploma programme.
14. Role of AICTE in diploma programme and the various committees and their objectives recommended by Dote and AICTE.

Role of the Facilitator

The SIP committee comprises the Head of the Institute, Heads of various departments, Senior Faculty, Senior Students (Second and Final Year), and Alumni. Their roles are as follows:

1. **Head of the Institute:** Explains new regulations from DoTE, institute rules, and significant changes in the new regulations.
2. **Head of the Department:** Walks through department facilities, and discusses achievements of senior and alumni students, placement training and assistance, Entrepreneur development activities, higher education ideas.
3. **Senior Faculty**: Guides diploma students on post-program pathways with faculty

mentor assistance.

4. **Senior Students:** Introduce student clubs, and conduct department and lab tours.
5. **Alumni:** Share the growth opportunities available to diploma students, recent trends and placement opportunities in the relevant field, entrepreneurship ideas and the available resources for the same.

Guided Activities:

The SIP should have the below list of activities.

Period Distribution

Induction Program - I

S.No	Guided Activities	Period	Day
1	Registration, Formation of student classroom groups of respective programs & Formation of Student Representatives		
2	Presentation cum Interactive Session with Important Institution Functionaries like Head of Institute, Principal, HoDs, etc.		
3	Visit to departments & facilities of the Institution. Motivate students to utilize library, sports facilities, Institution Innovation Council's (IIC) opportunities, Entrepreneur Development Cell, Skill Development and Training facilities, Placement opportunities and other amenities		
4	Ice breaking activity for the new students & Self Introduction of some newly joined students		
5	Introduction to Various Clubs & Community Initiatives; A short session on the importance of joining such initiatives will be taken. The activities may include: Cultural Activities, Movie shows,		

	Sports Activities, Visits to museum, community centres, club relevant field visits. Quiz Literary Activities such as, Tamil/English debate, discourses etc..		
6	Introduction to Committees/Associations and their Functions. (Committees of High Importance) Vishaka Committee Anti-ragging Committee Grievance Redressal mechanism SC/ST Committee etc. **Other Preferred Committees/Associations** Alumni Association etc. Department Associations		
7	Interaction with Senior Students		
8	Interaction with Alumni Students		
9	Talks, Lectures or Workshops by Eminent People from varying domains - This may include hackathon, ideation camps, motivational talks, personality development, universal human values, career development, group activities, social awareness lectures etc		
10	Talk on Respective Program scheme of studies and details of courses, examination pattern, types of courses, credit system, assessment methods, examination withdrawal, internship, passing and eligibility criteria, attendance requirements and board exam guidelines by respective program coordinator Educate the students on the importance of preparing reports on internships attended during the programme		

11	Industrial Interaction; Local Industrial Visits or Interactions with Industry Experts invited to the Induction. Providing guidelines on following safety measures, undertaking from both students and parents, maintaining discipline during these activities		
12	• Awareness talks on "drugs and its ill effects" should be arranged. • College authorities has to explain the various mechanism to control the drug consuming and peddling drugs in their college premises		
	Induction Program - II The induction programme for the Second Year can be planned. (You may include the above mentioned activities) in addition to the following activities. Emphasis on the importance of improving the academic performance as the students are in their Second Year. Guide students for the Academic and Internship Programmes. Guide students on choosing the elective subjects. Guide students on ● Project Selection. ● Student Batch Identification. ● Financial Planning and Transparent Transaction. ● Synopsis Writing. ● Execution of the Project. ● Project Reviews and Presentation. ● Preparing Project Report. ● Project Assessment Pattern. ● Board Exam Evaluation Pattern. ● Dote Prescribed Norms for the Project. Awareness program of, ● Anti-ragging guidelines,		

• Internship policy guidelines & procedures • Grievance Redressal mechanism • Vishaka committee guidelines • Sexual Harassment of Women (Prevention, Prohibition and Redressal) • Awareness talks on "drugs and its ill effects" should be arranged. • College authorities has to explain the various mechanism to control the drug consuming and peddling drugs in their college premises **Induction Program - III**		
The induction programme for the Final Year. (You may include the above mentioned activities in addition to the following activities). As the focus and the weightage are mainly on project work, internship and fellowship: Impart in depth Knowledge on • In-house projects • Internship • Fellowship Instruct the Dos and Don'ts on the above. Guide students on the report preparation for the above. Explain the DOTE's Objective behind the periods allotted for the above. A Talk by training and placement cell; Career opportunities for students, placement activities in college; placement process which includes introduction to platforms that offer value-added courses such as: SWAYAM NPTEL, CIICP, TCS ION CAREER EDGE, Self-assessment Platform - Parakh Portal. Awareness Program on Competitive Exams such as TNPSC, SSC, JEEE. Introduction to AICTE internship programs.		

Awareness Program about the Non Resident Tamils Rehabilitation and Welfare. Experts from the Commissionerate of Rehabilitation and Welfare Non Resident Tamils can be called for this session. The following contents can be included. Understanding the different types of migration and employment opportunities. Learning about the legal requirements and documentation needed for migration. Exploring the cultural and social aspects of living and working in a foreign country. Identifying common challenges and risks associated with migration, such as exploitation, discrimination and human trafficking. Providing guidance on how to reach and evaluate potential employers and job offers. Educating students about their rights and responsibilities as migrant workers. Offering practical advice of financial management, healthcare, and personal safety while abroad. Highlighting the importance of maintaining communication with family and seeking support when needed. By incorporating this into the induction program, we can empower our youth with the knowledge and skills they need to make informed decisions and migration and protect themselves from potential risks.		

Recording the Activities

SIP is intended for ice-breaking and familiarization purposes; hence no student assessment is required. However, documenting visitors' and students' feedback is highly recommended. Also, submitting the prepared report for internal/external audit is encouraged.

For every induction programme conducted, a report may be prepared in the following format.

Preparing Invitation and Poster

Report

Programme:

Theme:

Duration:

Date/Time:

Resource Person (internal/External):

Objective:

Outcomes:

Photograph:

Feedback:

Collection of student feedback on induction program - Make a report of Induction program by collecting student feedback

References/Resource Materials:

Regulation 2023 (R-2023) SOP given by DoTE.

60 Awesome Icebreakers for Orientation and Beyond:

https://sapro.moderncampus.com/blog/60-awesome-icebreakers-for-orientation-and-beyond

AICTE INTERNSHIP POLICY GUIDELINES & PROCEDURES

http://www.aicte-india.org/sites/default/files/Aicte%20Internship%20Policy-%2002.04.2019.pdf

AICTE Link Safety of Students in and Outside of Technical Campus

https://www.aicte-india.org/downloads/AICTE_Circular.PDF

Grievance Redressal mechanism:

https://aicte-india.org/bureaus/grievance-redressal

https://www.aicte-india.org/sites/default/files/approval/2023-24/Appendix-6.pdf

Vishaka committee guidelines:

https://www.vishaka.org/#:~:text=Vishaka%20reinforces%20ICC%20formation%20with,Right%20Act%20of%201964%20compliance.

Anti-ragging guidelines: https://www.aicte-india.org/downloads/Antiragging.doc

GUIDELINES

Induction Program - I (One Week) Should be scheduled at the First Week after reopening as per the schedule.

Day 1: FN: Registration and Inaugural Session.

(Welcome and Brief about the college, and their academic program. Rules and Regulation guidelines, Orientation, Familiarization College, Dept./ Branch)

Day 1: AN: Familiarization about the Dept./ Branch. Day

2: FN: Literary activity

Day 2: AN: Proficiency Modules

Day 3: FN: Lectures & Workshops by Eminent People

Day 3: AN: Visits to the College Common areas, Respective Department facilities.

Day 4: FN: Extra-Curricular Activities in College, Awareness talk on Drug addiction and its ill effects

Day 4: AN: Mentor-mentee groups meet Day

5: FN: Interaction Session

Day 5: AN: Feedback and Report on the Program and Valedictory Session

Note: Inauguration and Valedictory can be conducted commonly; other sessions can be organised in the respective department.

Induction Program - II (As per the curriculum) Should be scheduled in the beginning of the III Semester.

Brief sessions about the importance of the Diploma Program, Growth and opportunity for higher education and employability.

Guidelines to select the Electives and Projects. Alumni, Industrial experts and Senior faculties can be engaged for this program.

Conduct Awareness programs on Drug addiction and its ill effects

Induction Program - III (One Week) Should be scheduled at the beginning of the V Semester.

Day 1: FN: In-house projects, Internship, Fellowship

Day 1: AN: Online Skill Courses

Day 2: FN: Employability Skills - I (Industry Awareness and Trends)

Day 2: AN: Employability Skills - II (Resume Building and Job Application Skills)

Day 3: FN: Employability Skills - III (Interview Preparation, Technical Skill Enhancement) Day

3: AN: Employability Skills - IV (Soft Skills and Communication)

Day 4: FN: Employability Skills - V (Entrepreneurship and Innovation) Day

4: AN: Employability Skills - VI (Career Counselling and Guidance)

Day 5: FN: College to Corporate (Ethics and Professionalism, Emotional Intelligence and

Stress Management)

Day 5: AN: Non Resident Tamils Rehabilitation and Welfare Program

	Student-Led Initiative
AUDIT	

Skill Areas:

Team Work, Presentation Skills, Communication.

Purpose:

The aim is to promote active participation and collaboration among students, allowing them to learn from each other. One such initiative is the student-led tech talk series, where students can share knowledge and explore new technologies. These initiatives also provide resources and support to help students achieve their personal and career goals with guidance from the educational institutions.

Learning Outcomes:

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

1. Collaborate and Communicate effectively
2. Develop interpersonal skills with self-confidence and resilience
3. Foster a culture of collaborative learning with peers by sharing knowledge effectively.

Focus:

When conducting a student-led initiative, there are several focus areas that students should keep in mind to ensure a successful and impactful endeavour. Here are some key areas to consider:

1. Teamwork
2. Planning and Execution
3. Personal Growth and Learning

Role of the Facilitator:

The role of a college faculty facilitator in student-led initiatives is crucial in providing guidance, support, and mentorship to the student participants. Here are some key aspects of the faculty facilitator's role:

1. **Mentorship and Coaching:** Faculty facilitators act as mentors, providing one-on-one or group coaching to students involved in the initiative. The faculty facilitator serves as an

advisor, offering expertise, knowledge, and feedback to guide students in the planning and implementation of their initiatives.

2. **Resource Support:** Faculty facilitators assist students in accessing resources necessary for the success of their initiatives. They can help students identify relevant research or technical expertise.

Guided Activities:

In a student-led initiative, various guided activities can be implemented. Here are some guided activities to be undertaken:

1. Identify Technology Areas/Themes
2. Team Formation for the Presentation
3. Oral Presentation Preparation
4. Oral Presentation
5. Feedback
6. One Page Report

Note: *The student teams are expected to conduct an Oral Presentation in a seminar format, which means they* ***don't*** *need to create presentation slides. Instead, they will present their content through verbal communication during the presentation.*

Period Distribution

S.No	Guided Activities	Period
1	Introduction and Briefing 1. Identification of 8-10 Emerging Trends/Technology by the faculty 2. Briefing of the 8-10 Emerging Trends/Technology to the students	
2	Team Formation for the Presentation 1. Team of 4 students are formed based on the topic that is selected 2. Faculty assigns the roles and responsibilities of each student in the team	

3	Oral Presentation Preparation 1. Students browse the topics or go to the library to learn the topics for the presentation 2. Students develop contents for the presentation 3. Faculty mentor the students to form a outline for the presentation in the following format a. Introduction b. Working Principle c. Advantages & Limitations d. Applications	
4	Oral Presentation 1. Students need to prepare & deliver the Oral presentation based on guidelines prescribed by the Faculty mentor 2. Deliver within the allotted time of 15 minutes 3. Include a Q&A Section covering a maximum of 3 minutes	
5	Feedback 1. Mentor gives the feedback to the student team about a. Presentation Contents b. Presentation Delivery/Quality c. Suggestions for improvisations for individual student	
6	One Page Report 1. Each Student submits a handwritten one-page summary of the oral presentation	

Rubrics for the Evaluation

Category		SCORE			
		5—Excellent	**3—Good**	**2—Fair**	**1—Needs Improvement**
A	**Quality of oral Presentation**	Well-structured Content and clear presentation; engages the audience with good preparation and confidence.	Sufficiently clear content and reasonably organized; presents with moderate confidence.	Somewhat clear with basic organization; needs improvement in coherence and confidence.	Unclear about topic and disorganized presentation; lacks coherence and preparation.
B	**Communication**	The delivery is confident, natural, and engaging. The student maintains excellent eye contact, gestures appropriately, and uses a clear and well-modulated voice.	The delivery is mostly confident and engaging but may have some minor areas for improvement in eye contact, gestures, or vocal delivery.	The delivery is somewhat engaging, but there are noticeable issues with eye contact, gestures, or vocal delivery.	The delivery is hesitant, and the student struggles with eye contact, gestures, or vocal delivery.
C	**Teamwork**	The team runs perfectly coordinated, with clear guidelines about each member's role. Each member has participated.	The team was mostly coordinated, but there were some moments of doubt and/or unbalance. A minority of the members of the group did not know what to do.	One or two members of the group have focused most of the presentation. The rest of the group did not have clear instructions about their role.	The team did not know when to speak, or what role they were having. Only one person leads the group.
	SCORE	(A+B+C)/15 Points			

Closure:

After finishing their student-led initiatives, each team member must write a one-page summary of the oral presentation by hand. This summary should include topics covered in the Oral presentation.

Assessments:

No formal assessments are required for the student-led initiatives since it's just a platform for peer-to-peer to exchange knowledge and skills.

References/Resource Materials:

Student-led initiatives may require a variety of resource materials to support their planning, implementation, and success. Here are some general requirements:

1. **Informational Resources:** These include textbooks, reference materials, and online information relevant to the topic or theme of the initiative.
2. **Facilities and Spaces:** Some initiatives may require access to specific facilities or spaces for presentations. This can include classrooms, laboratories, meeting rooms, performance spaces, exhibition halls, or outdoor areas.
3. **Online Resources:**
    1. How to Do a Presentation in Class? - https://www.wikihow.com/Do-a-Presentation-in-Class
    2. How to Give a Short Class Presentation Competently? - https://www.instructables.com/How-to-Give-a-Short-Class-Presentation-Competently/
    3. Best Practices for Oral Presentation: https://www.uow.edu.au/student/learning-co-op/assessments/presentations/
    4. How to keep up with the latest emerging trends? - https://pakwired.com/latest-technology-trends/
    5. Body Language Tips for Presentation - https://www.toastmasters.org/resources/public-speaking-tips/gestures-and-body-language

	SHOP FLOOR IMMERSION
AUDIT	

Skill Areas: 5S Methodology, LOTO, Six Sigma, ISO, SAP, Agile Methodology, etc…

Note: Any one industrial practices can be planned for every semester.

Purpose:

First semester, students will learn about the importance of '5S' through a shop floor workshop. '5S' helps reduce waste and improve productivity by organizing the workplace and using visual cues. It involves five steps: sort, set in order, shine, standardize, and sustain.

Learning Outcomes:

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

1. Creates an organised and clean environment in their lab/workshop
2. Acquire self-discipline as they need to maintain the standards
3. Identify and eliminate wastes
4. Creating a safe workplace by reducing accidents caused by external factors

Focus:

This course introduces the important concept of 5S, a fundamental skill used in various industries. It focuses on workplace organization and efficiency, which is essential for students entering the industry.

The 5S Methodology includes five steps:

- Sort: Remove unnecessary items to tidy up the space.
- Set In Order: Organize the work area with a place for everything.
- Shine: Clean and maintain the area to prevent dirt and grime.
- Standardize: Create written procedures to make new practices a norm.
- Sustain: Continuously commit to maintaining the organized and efficient workspace.

Additionally, safety is integrated throughout all the steps to improve workplace safety, not just efficiency.

Role of the Facilitator:

Faculty introduce the concepts of 5S to the students and assign a specific activity to each team of 4 students and guide them to implement 5S to a specific lab or workshop.

Guided Activities:

In the shop floor immersion course, few activities can be implemented to reach the desired course outcome. Here are some guided activities to be undertaken:

1. **Workshop (Learning Session):** The Faculty can take a session 5S Methodology covering the aspects of 5S like; What is 5S?, Why use 5S?, Advantages & Limitations, Case Studies, The 6th S - Safety.

2. **5S Implementation:** Students will implement 5S in a chosen lab. Faculty guides lab selection, assesses its state, gathers inventory, plans resources. After implementation, a post-assessment is done with faculty guidance.

Period Distribution

S.No	Guided Activities	Period
1	Workshop (Learning Session) 1. Faculty will conduct Session on 5S Methodology and its significance in the industry 2. Faculty need to conduct a Q&A Section to address questions, concerns & clarifications related to 5S	2
2	5S Implementation 1. Preparation: a. Faculty should identify lab/workshop needing 5S implementation b. Faculty will form a teams of 4 students	6

	2. Implementation a. Develop an implementation plan for 5S b. Document lab's current state by taking a photograph c. Proceed with the implementation of 5S by assigning specific jobs to the student teams.	

Closure:

The faculty in charge of the session is responsible for maintaining a one page record of the 5S implementation in the lab along with the "before" and "after" photographs.

Assessments:

No assessments are required for students. The facilitator monitors & guides the students to implement the practical implementation of 5S in the lab/workshop.

References/Resource Materials:

The references and resource materials required may differ depending on the department and type of lab 5S implementation is done. However, here are some general reference materials and resources that may be helpful:

1. **Facilities and Spaces:** 5S Implementation may require access to specific facilities or spaces. This can include access to workshops or labs.

2. **Online Resources:**
    1. What is 5S?: https://www.graphicproducts.com/articles/what-is-5s/
    2. 5S Guide: Improve efficiency with effective organisation: https://leanscape.io/what-is-5s-and-what-are-its-benefits/
    3. How to implement 5S in Workplace? https://www.simplilearn.com/implementing-5s-methodology-to-achieve-workplace-efficiency-article

Note: Every semester any one activity can be planned as above.

	Emerging Technology Seminars
AUDIT	

Skill Areas:

Knowledge Enhancement, Communication Skills, Confidence Building, Awareness of Trends.

Learning Outcomes:

1. Research Skills: Students learn how to gather information, analyze data, and present findings. This enhances their research abilities.
2. Presentation Skills: By delivering seminars, students improve their presentation techniques, including slide design, body language, and engaging with the audience.
3. Critical Thinking: Preparing for seminars encourages critical thinking. Students evaluate different perspectives, assess evidence, and form well-reasoned arguments.
4. Networking: Seminars provide opportunities to connect with industry professionals, guest speakers, and fellow students. Networking is crucial for future career prospects.
5. Time Management: Balancing seminar preparation with other academic tasks teaches students effective time management.

Role of the Facilitator:

The department faculty will be the facilitator. All the students will be given opportunity to prepare a seminar on the selected topic during the Library periods also. Each student should present on topic for about 10 minutes. The faculty in-charge should make the necessary facility for the presentation. The HOD is requested to deploy at least two staff members for the Assessment during the presentation.

Guided Activities:

Preparation

1. Select a Relevant Topic:
    - Choose an emerging technology that is relevant to the engineering field and has significant current and future impact.

- Ensure the topic is neither too broad nor too narrow, allowing you to cover it comprehensively within the given time.

2. Research Thoroughly:
   - Gather information from reputable sources such as academic journals, industry reports, and expert interviews.
   - Stay updated with the latest developments and advancements related to your chosen technology.
3. Define Objectives:
   - Clearly outline the learning objectives of your seminar. What should the audience learn or understand by the end of your presentation?
4. Structure Your Presentation:
   - Introduction: Introduce the topic and explain its importance.
   - Body: Discuss the key aspects of the technology, including its principles, applications, benefits, and challenges.
   - Conclusion: Summarize the main points and discuss future prospects.
5. Create Visual Aids:
   - Develop slides that are visually appealing and easy to understand.
   - Use diagrams, charts, images, and videos to illustrate complex concepts.
   - Keep text minimal on slides; use bullet points and short phrases.
6. Prepare Supporting Materials:
   - Provide handouts or digital resources for further reading.
   - Prepare a list of references and sources for credibility.

Presentation

1. Practice:
   - Rehearse your presentation multiple times.
   - Time yourself to ensure you stay within the allotted time.
   - Practice in front of friends or colleagues to get feedback.
2. Engage Your Audience:
   - Start with a compelling opening to grab attention.
   - Use questions and interactive elements to involve the audience.
   - Encourage participation and allow time for Q&A sessions.
3. Communication Skills:
   - Speak clearly and confidently.
   - Maintain eye contact with your audience.

- Use appropriate gestures and body language.

4. Use Technology Effectively:
   - Ensure your presentation equipment (laptop, projector, microphone) is set up and functioning properly.
   - Be familiar with the software you are using for your slides.
5. Handle Questions Gracefully:
   - Listen carefully to questions from the audience.
   - Answer clearly and concisely. If you don't know the answer, acknowledge it and offer to find out later.

Follow-Up

1. Feedback:
   - Collect feedback from your audience to understand what worked well and what can be improved.
   - Use this feedback to refine future presentations.
2. Provide Additional Resources:
   - Share your presentation slides and any additional resources with your audience.
   - Offer to answer further questions via email or a discussion forum.
3. Stay Updated:
   - Continue to follow developments in your chosen technology area.
   - Update your presentation and materials as new information becomes available.

Rubrics for the Evaluation:

1. **Content Quality (40%)**
   - Relevance: The topic is relevant to the field of engineering and is current.
   - Depth of Research: The presentation demonstrates thorough research with accurate and up-to-date information.
   - Clarity of Objectives: Clear objectives are defined and met during the presentation.
   - Comprehensiveness: The topic is covered comprehensively within the scope and time limits.
   - Accuracy: Technical details are correct and well-explained.

2. **Presentation Skills (30%)**
    - Clarity and Coherence: The presentation is clear, logically structured, and easy to follow.
    - Engagement: The presenter engages the audience and maintains interest throughout the presentation.
    - Communication: The presenter speaks clearly and confidently, using appropriate language and terminology.
    - Visual Aids: Slides and other visual aids are well-designed, relevant, and enhance the presentation.
3. **Delivery (20%)**
    - Confidence and Poise: The presenter appears confident and handles the presentation smoothly.
    - Body Language: Appropriate body language, gestures, and eye contact are used.
    - Time Management: The presentation is well-timed, adhering to the allotted duration.
    - Handling Questions: The presenter answers questions clearly and accurately, demonstrating a good understanding of the topic.
4. **Originality and Creativity (10%)**
    - Innovative Approach: The presentation includes original ideas or perspectives.
    - Creativity: The presenter uses creative methods to explain concepts and engage the audience.

Assessment Process

1. **Pre-Presentation Briefing:**
    - Provide students with the evaluation criteria and explain how they will be assessed.
    - Ensure students understand the importance of each criterion.
2. **During the Presentation:**
    - Use a standardized evaluation form to score each criterion. This ensures consistency and fairness.
    - Have multiple assessors, if possible, to provide a balanced evaluation. Assessors can be faculty members, industry experts, or peers.

3. **Post-Presentation Evaluation:**
    - Assessors should meet to discuss and finalize scores.
    - Provide detailed feedback to students, highlighting strengths and areas for improvement.

Assessments:

Sample Evaluation Form

Criteria	Weight	Score (1-10)	Comments
Content Quality	40%		
Relevance			
Depth of Research			
Clarity of Objectives			
Comprehensiveness			
Accuracy			
Presentation Skills	30%		
Clarity and Coherence			
Engagement			
Communication			
Visual Aids			
Delivery	20%		
Confidence and Poise			
Body Language			

Time Management			
Handling Questions			
Originality and Creativity	10%		
Innovative Approach			
Creativity			
Total Score	100%		

Feedback

1. Individual Feedback:
    - Provide each student with detailed feedback on their strengths and areas for improvement.
    - Use the comments section in the evaluation form to offer specific suggestions.
2. General Feedback:
    - Share common strengths and areas for improvement with the entire class to help all students learn and improve.
3. Follow-Up:
    - Offer opportunities for students to discuss their feedback with assessors.
    - Encourage students to apply feedback in future presentations and projects.

By following these guidelines, you can ensure a fair, transparent, and constructive evaluation process that helps students improve their seminar presentation skills.

-	**Special Interest Groups (Placement Training)**
AUDIT	

Note: Training related to enhance the employability skill can be conducted during this period.

	I&E / Club Activity / Community Initiatives
AUDIT	

Club Activity

Skill Areas: Collaboration, Ownership, Interpersonal Skills
Purpose: Club activities provide a platform for students with similar interests to engage, participate in events, workshops, and competitions. This fosters collaboration and skill development in various fields.
Learning Outcomes: At the end of the course, students will be able to: 1. Collaborate and work in interdisciplinary teams towards contributing effectively 2. Learn or enhance skills through workshops, competitions, and experiential learning.
Focus: During club activities students should prioritize key focus areas to enhance their learning and impact. Here are some focus areas to consider: 1. Collaboration & Communication 2. Identify strengths and weaknesses, and learn from experiences to foster personal growth
Role of the Facilitator: The faculty facilitator's role is crucial in guiding and supporting students in club activities. Key aspects of their role include:

1. **Mentorship and Guidance:** Faculty facilitators act as mentors, providing one-on-one or group guidance to students involved in the club.
2. **Creating a Supportive Learning Environment:** Facilitators will nurture a supportive, inclusive environment in the clubs where students freely express and learn collaboratively. They provide a platform for like-minded students to engage, collaborate, and participate.

Guided Activities:

For Club Activities, students can engage in learning and developing a new skill or enhancing their skill by involving & actively participating in one or more clubs of their interest. These clubs can be used as a platform for Personal growth.

They may include but are not limited to the following clubs: Tamil Mandram, Music, Dance, Math, Chess, Arts, Anti-drug, Photography, Sports, Astronomy, Science, Robotics, English, Theatre, NCC, NSS, Digital Media Club, Cooking, UN Sustainable Development Goal, YRC (Youth Red Cross), Olympiad clubs, etc. The Outcome can be achieved through conducting **Competitions and Challenges.**

Period Distribution

S.No	Guided Activities	Period
1	Enrolment to Clubs 1. Invite club representatives along with Faculty to give short presentations, and collect names of students who are interested to join 2. Students should list their top 3 preferred clubs based on their interests and submit to the respective club representative	
2	Exploring of Clubs 1. Ensure students understand their responsibilities as club members. 2. Emphasize the importance of commitment and regular participation. 3. Explore with club representatives about planning and hosting competitions, or events for the club.	

3	Learn & Exhibit 1. Encourage students to participate actively and showcase their skills. 2. The Faculty should provide a necessary platform to enhance students skills, learn new skills, and exhibit skill through various competitions, events or initiatives.	
4	Recognition 1. Acknowledge the efforts and contributions of individual members as well as the whole club	

Closure:

No formal documentation is needed for course completion, but students must participate in at least one or more of the clubs meeting the 30 Period Requirement.

Assessments:

No formal assessments are required for the Innovation and Entrepreneurship, Cub activities or Community Initiatives.

References/Resource Materials:

The references and resource materials required for club activities may vary based on the personal focus, goals, and also resources available at each college. However, here are some general reference materials and resources that may be helpful:

1. **Facilities and Spaces:** Some clubs may require access to specific facilities or spaces. This can include classrooms, laboratories, meeting rooms, performance spaces, exhibition halls, or outdoor areas.
2. **Coaching:** Students may require coaching from faculty members or professionals with relevant knowledge and experience related to the club.

3. Online Resources:

1. How to choose the Right Club for your personal growth?
   https://www.topuniversities.com/student-info/student-stories/5-common-mistakes-avoid-when-choosing-student-clubs
2. How to make your club great?
   https://www.pearson.com/ped-blogs/pearsonstudents/2021/04/11-tips-to-make-a-any-college-club-great.html

Note: Innovation & Entrepreneurship and Community Initiatives awareness program and activities can also be conducted.

STUDENT INDUCTION PROGRAM CELL (SIP CELL)

The Principal or HOD will be the Chairman of the Student Induction Program Cell.

SIP Cell (or Induction Unit) will be managed by the department faculty members with the help of student volunteers.

The SIP Cell will be responsible for planning, organization, coordination and reporting of the annual Student Induction Program with the help of other faculty members and student volunteers.

Students Counselling Service (SCS)

In order to provide advice or help to the students of the institute, Student Counselling Service (SCS) needs to be initiated. Team of SCS will assist and strengthen the students at the institute for enhancing their academic skills and career developments, as well as for their overall wellness.

Student Coordinators may be appointed with the guidance of a staff mentor.

1. Wellness Coordinator.
2. Skills Coordinator
3. Career Coordinator
4. Academic Coordinator etc…

OBJECTIVE:

The objective of the SIP cell is

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence.
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

OUTCOME:

At the end, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Note: ILE activity can be conducted and monitored by the SIP Cell.

INTERNAL ASSESMENT PATTERN

ASSESSMENT FOR PRACTICAL PAPERS					
TYPE OF ASSESSMENT	**DURATION**	**MARKS**	**CONVERTED TO**	**MARKS**	**REMARKS**
OBSERVATION	-	-	**20 MARKS**	**20**	-
RECORD	-	-	**20 MARKS**	**20**	-
TOTAL				**40**	

ASSESSMENT FOR PRACTICUM PAPERS WITH END EXAMINATION PRACTICAL				
Assessment	**Duration**	**Portions covered**	**Mark allocation**	**Reduced to**
CAT 1	2 Periods	UNITS I &II	30 Marks 1 Mark Questions (10) ->10Marks 10 Mark Questions (2out of 4) ->20 Marks	10 Marks
CAT 2	2 Periods	UNITS III & IV	30 Marks 1 Mark Questions (10) ->10Marks 10 Mark Questions (2out of 4) ->20 Marks	10 Marks
CAT 3 (PRACTICAL)	2 Periods	All Experiments	60 Marks	10 Marks
RECORD				10 Marks
Total				40 Marks

MODEL QUESTION PAPER

INSTRUCTIONS TO QUESTION PAPER SETTERS

I. PART – A Question Nos. 1 to 30 should cover all Units.
II. PART – B Questions 31 to 36 should cover all Units such that each unit should have minimum one question and no unit can have more than two questions. Part-B questions can have subdivisions (if needed).

QUESTION PAPER PATTERN

COURSE CODE: TIME : 2.5 Hours

COURSE NAME: MAX. MARKS:60

PART-A (30*1 = 30)

I. Multiple Choice Questions (10 x 1 = 10)

1.
2.
…
10.

II. True or False (10 x 1 = 10)

11.
12.
…
20.

III. A. Match the following (5 x 1 = 5)

	Column A	Column B
21.		
22.		
23.		
24.		
25.		

B. Image based Multiple Choice Questions (5 x 1 =5)

26.
27.
28.
29.
30.

(or)

III. **Match the following** **(10 x 1 = 10)**

	Column A	Column B
21.		
22.		
23.		
24.		
25.		
26.		
27.		
28.		
29.		
30.		

(or)

III. **Multiple Choice Questions** **(10 x 1 = 10)**

21.
22.
23.
…
30.

PART-B (3*10 = 30)
Answer any THREE questions
31.
32.
33.
34.
35.
36.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COMPARISON OF SYLLABUS

SEM	COURSE TITLE	EQUIVALENT CODE				
		H SCHEME	G SCHEME	2018-2021	2015-2018	2011-2014
III	Electronic Devices and Circuits	ECH301	ECG302	ECE 306	EC 306	EC 302
III	Digital Electronics	ECH302	ECG304	ECE 308	EC 308	EC 304
III	Electrical Circuits, Machines and E-vehicle	ECH371	ECG303	ECE 307	EC 307	EC 303
	Electrical Circuits C Instruments Lab		ECG372	ECE 375	EC 375	EC 372
III	C programming	ECH372	ECG403	ECE406	EC406	EC 503
	C Programming lab		ECG473	ECE476	EC476	EC 573
III	Electronic Devices and Circuits Lab	ECH373	ECG371	ECE 374	EC 374	EC 371
III	Digital Electronics Lab	ECH374	ECG373	ECE 376	EC 376	EC 373
IV	Analog Electronics	ECH401	ECG401	ECE404	EC404	EC 401
IV	Measurements and Instrumentation	ECH402				
V	Measurement Systems C Electric Vehicle Technology		ECG502	---		---
V	Measurement Systems C Electrical Machines		---	ECE508	EC508	EC 403
V	Measurement Systems C simulation Lab		ECG572	ECE575	EC575	EC 473
V	Embedded Systems Lab		ECG573	ECE678	EC678	EC 672
IV	Communication Engineering – I	ECH471	ECG402	ECE405	EC405	EC 501
	Communication Engineering – I Lab		ECG472	ECE475	EC475	EC 571
IV	8051 Microcontroller and Embedded Systems	ECH472	ECG503	ECE607	EC607	EC 602
V	Microcontroller and Interfacing		---	ECE509	EC509	EC 402
V	Microcontroller and Interfacing Lab		---	ECE576	EC576	EC 472
IV	Analog Electronics Lab	ECH473	ECG471	ECE474	EC474	EC471
IV	Arduino Programming, IoT with Mini-project	ECH474	---	---	---	---
V	Communication Systems	ECH501	ECG501	ECE507	EC507	EC 601
V	Industrial Electronics and Machine Electronics, PLC and Robotics	ECH502	ECG601	ECE 606	EC 606	EC 502
V	Implementation of AI using Python	ECH571	---	---	---	---
V	Computer Networking Lab	ECH572	ECG682	ECE 609	EC 609	EC 604
			ECG685	ECE 684	EC 684	EC 674

V	Communication Systems Lab	ECH573	ECG571	ECE574	EC574	EC 671
V	Innovation and startup	ECH574	ECG474	---	---	---
VI	Internet of Things		ECG602	---	---	---
VI	Industrial Electronics C Medical Electronics Lab		ECG671	ECE 677	EC 677	EC 572
VI	Internet of Things Lab		ECG672	---	---	---
VI	Internship or Industrial Training	ECH671				
VI	Fellowship	ECH672				
VI	In-house Project	ECH673	ECG673	ECE 679	EC 679	EC 676
	Very Large-Scale Integration Lab		ECG681	ECE 608	EC 608	EC 603
E	Digital Communication		---	ECE 512	EC 512	---
E	Consumer Electronics Lab		ECG686	---	---	---
E	Signals C Systems and Image Processing	*ECH581	---	---	---	---
E	Consumer Electronics	*ECH582	ECG683	---	---	---
E	Power Electronic Devices	*ECH583	---	---	---	---
E	Wireless Communication	*ECH584	ECG581	ECE 510	EC 510	EC 504
E	Embedded Systems with Raspberry Pi PICO Lab	*ECH585	---	---	---	---
E	PLC and Robotics Lab.	*ECH586	---	---	---	---
E	Very Large-Scale Integration Lab	*ECH587	ECG684	ECE 683	EC 683	EC 673
E	Computer Aided Design Simulation Lab	*ECH588	---	---	---	---
E	Advanced Engineering Mathematics	*ECH681	ECG301	ECE 305	EC 305	EC 301
E	Machine Learning and Deep Learning	*ECH682	---	---	---	---
E	Unmanned Aerial Vehicle / Automated Vehicle	*ECH683	---	---	---	---
E	Biomedical Instrumentation	*ECH684	ECG582	ECE 511	EC 511	EC 505
E	E-Vehicle	*ECH685	ECG583	---	---	---
E	Data communication and Networking	*ECH686	---	---	---	---
E	Multimedia / App designing Lab	*ECH688	---	---	---	---
E	PCB Design and Assembly Lab	*ECH689	---	---	---	---
E	Industrial IoT Lab	*ECH68A	---	---	---	---
E	Virtual Instrumentation Lab	*ECH68B	---	---	---	---
	Communication Skills-Practical		BEG177	BEE183	BE183	BE 183

DR. DHARMAMBAL GOVT POLYTECHNIC COLLEGE FOR WOMEN, THARAMANI, CHENNAI-113. DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING COMPARISION STATEMENT OF G SCHEME AND H SCHEME SYLLABUS					
S. N	**H SCHEME Subject**	**Addition**	**Deletion**	**Modification**	**UNIT**
1	**Electronic Devices and Circuits**	MEMS, Relay, SPDT switch	—	Passive components reordered	**I**
		Clipper, Clamper circuits	Gunn diode	Filters grouped with rectifiers	**II**
		—	Self-bias, Collector-bias	Only Voltage Divider bias retained	**III**
		—	MOSFET in enhancement mode	Only Depletion-mode MOSFET included	**IV**
		LCD, Optocoupler	LED, LDR	Grouping of optoelectronics clarified	**V**
2	**Digital Electronics**	Code conversion focus (hex/dec/binary)	—	—	**I**
		Digital comparator, 3-bit parity check	4-bit ALU	Logic blocks shown with truth tables	**II**
		Master-slave FF explanation	—	Registers (PISO, SIPO, etc.) added	**III**
		Ring & Johnson counters	—	RAM/ROM types visualized with block diagram	**IV**
		FPGA block, VHDL modeling styles	Full adder VHDL	VHDL split into Dataflow, Behavioral, Structural	**V**
3	**Electrical Circuits, Machines & E-Vehicle**	Voltage, Current, Power, Ohm's Law	—	—	**I**
		Thevenin, Norton, Superposition	—	—	**II**
		Series & Parallel resonance, Q factor	—	—	**III**
		DC/AC motor principles	—	—	**IV**
		EV Block diagram, Battery types	—	—	**V**
4	**C Programming**	Built-in char functions (isalpha, etc.), flowchart execution	—	Emphasis on syntax structure and flow	**I**
		Unconditional branching (goto, break, continue)	Advanced decision flow examples	Syntax-focused presentation	**II**

		String functions (gets, puts)	Array of strings operations	2D array limited to integer types	III
		Structure vs Array difference, pointer basics	Array of structures	Union concept newly added	IV
		Dynamic memory (malloc, calloc, realloc), recursion	Command line args	Function calling methods grouped	V
5	**Analog Electronics**	Cascade amplifier without RC coupling	—	Darlington and differential amplifier grouped	I
		Class C amplifier details	Transformer-coupled PA focus	Tuned amplifier shown with frequency response	II
		Barkhausen Criterion	—	Oscillators reorganized (Hartley, Colpitts, etc.)	III
		IC741 applications: comparator, integrator	Instrumentation amplifier	Op-Amp pins and ideal characteristics added	IV
		IC555 Multivibrators (Astable, Mono, Bi-stable)	Monostable not separate	DAC and ADC types grouped with application focus	V
6	**Measurements and Instrumentation**	Static & Dynamic characteristics	Galvanometer-related sections	PMMC/MI meter details restructured	I
		DSO, Digital Multimeter	Analog CRO block diagram	Digital instrument architecture clarified	II
		Load cell, strain gauge, RTD, thermistor	Complex calibration instruments	Measurement of temp/displacement grouped clearly	III
		Ultrasonic, IR, Smoke, Motion sensors	Loudspeaker technical blocks	Surround system moved to Consumer Electronics	IV
		Spectrum Analyzer, Frequency Synthesizer	Earth Tester	Generator types shown with block diagrams	V
7	**Communication Engineering I**	Classification of CT/DT signals	—	Filters LPF, HPF, BPF shown with frequency response	I
		DSB, SSB, VSB Types	PAL/NTSC decoding circuits	Modulation waveform analysis emphasized	II
		Noise triangle, pre-/de-emphasis	Phase modulation derivation	Angle modulation explained qualitatively	III

		PCM, FDM, TDM	Delta modulation	Sampling and multiplexing given with circuits	**IV**
		Line coding (RZ, NRZ, Manchester, etc.)	ASK/FSK equations	Digital modulation with block diagrams and waveforms	**V**
8	**8051 Microcontroller and Embedded Systems**	Microcontroller vs Microprocessor	—	Pin diagram and CPU architecture introduced	**I**
		Bit-level manipulation	Flags usage not emphasized	Instructions grouped into categories (logic, data, etc.)	**II**
		Timer/Counter modes and SFRs	Basic delay examples	Serial communication structure shown	**III**
		Stepper motor, LCD, DAC interfacing	—	Interrupt vectors and priority added	**IV**
		ARM LPC2148 intro, pipeline concept	—	Embedded system types listed with examples	**V**
9	**Communication Systems**	Microstrip patch and horn antennas	Loop antenna	Propagation types grouped, parameters added	**I**
		LTE, 5G, Cell splitting/sectoring	2G/3G tech removed	GSM block diagram included	**II**
		GPS, DTH, Transponders	TT&C detailed math	Satellite systems explained with block diagram	**III**
		LED/Laser source and detectors (PIN, APD)	Optical receiver circuits	Fiber types and losses added	**IV**
		Radar block diagram, frequency bands, Klystron, Magnetron	Radar range derivation	Waveguide components explained schematically	**V**
10	**Industrial Electronics and Medical Electronics, PLC and Robotics**	GTO, IGBT, Power MOSFET	SCR-only focus	V-I characteristics and switching details structured	**I**
		Chopper types (Step-up/down, AC chopper)	Complex converter derivations	Single-phase converter with freewheeling diode emphasized	**II**
		McMurray inverter, UPS (Online/Offline)	Linear regulator focus	SMPS block diagram added	**III**
		Ladder logic programming, Conveyor example	Hardwired control systems	PLC block diagram explained unit-wise	**IV**

		Pacemaker, EMG, ECG, Peritoneal Dialysis	Basic patient monitor examples	Medical equipment classified into diagnostic/therapeutic	**V**
11	**Signals & Systems & Image Processing**	Signal classification (CT/DT), Standard signals	—	—	**I**
		Fourier & Laplace transform with properties	—	—	**II**
		Image sampling/quantization, RGB/HSI color models	—	—	**III**
		Gray level transformations, Histogram Equalization	—	—	**IV**
		Image segmentation, JPEG, MPEG, Huffman coding	—	—	**V**
12	**Consumer Electronics**	Home Theatre Systems, Wireless microphone	Tape recorder	Speaker types reorganized (Woofer, Tweeter, etc.)	**I**
		OLED, LCD, LED, Display types	CRT, PAL/SECAM system circuits	TV signal processing simplified	**II**
		GPS, DTH, FTTH, CCTV	Analog satellite communication	Optical fiber usage in home systems highlighted	**III**
		Fuzzy Logic Washing Machine, Inverter AC	Rotary dial timers	Domestic appliances grouped under smart tech	**IV**
		QR Code, RFID, AR/VR, Smart Wearables	Bar code details only	Devices like Smart Watch, Digital Camera newly added	**V**
13	**Power Electronic Devices**	IGBT, GTO, Power MOSFET, V-I characteristics	—	—	**I**
		Single-phase converters with R, RL loads	—	—	**II**
		McMurray inverter, Voltage control in inverter	—	—	**III**

		Chopper types, AC/DC chopper drives	—	—	**IV**
		SMPS, Online/Offline UPS, Applications	—	—	**V**
14	**Wireless Communication**	Bluetooth, Wi-Fi, Mobile Radio, 4G-5G overview	—	—	**I**
		IoT technologies, NB-IoT, LoRa	—	—	**II**
		RFID, ZigBee, Wireless Sensor Networks	—	—	**III**
		GPS, Satellite Communication	—	—	**IV**
		Network security concepts, Mobile computing	—	—	**V**
15	**Implementation of AI using Python**	AI vs ML vs DL, Scope of AI, Tools overview	—	—	**I**
		Python IDE setup, Data Types, Numpy, Pandas	—	—	**II**
		Regression techniques, Supervised ML algorithms	—	—	**III**
		CNN, SVM, ANN, Activation functions	—	—	**IV**
		AI applications in daily life, project guidance	—	—	**V**
16	**Innovation & Startup**	Entrepreneurial mindset, Myths of Entrepreneurship	—	—	**I**
		Types of Startups, Startup Ecosystem, E-commerce models	—	—	**II**
		Startup India schemes, Incubation, Success stories	—	—	**III**
		Funding methods, Cash flow, Break-even analysis	—	—	**IV**
		Business plan development,	—	—	**V**

		Pitching, Social entrepreneurship			
17	**Advanced Engineering Mathematics**	Complex functions, Analytic functions	—	—	**I**
		Fourier transform and its properties	—	—	**II**
		Z-transform, Difference equations	—	—	**III**
		Probability Distributions (Binomial, Poisson, Normal)	—	—	**IV**
		Queuing Theory, Basics of simulation	—	—	**V**
18	**Machine Learning and Deep Learning**	Supervised, Unsupervised learning, Applications of ML	—	—	**I**
		Dataset handling, Feature engineering	—	—	**II**
		Algorithms: SVM, Decision Trees, KNN	—	—	**III**
		Deep Learning basics, ANN, CNN	—	—	**IV**
		DL use cases in ECE, project idea development	—	—	**V**
19	**Unmanned Aerial Vehicle and Automated Vehicle**	UAV basics, classification (Fixed wing, Quadcopter, etc.)	—	—	**I**
		Drone laws, safety regulations, applications	—	—	**II**
		Flight controller, sensors, navigation systems	—	—	**III**
		Automated vehicle architecture, control systems	—	—	**IV**
		Case studies on UAV & AV systems	—	—	**V**
20	**Biomedical Instrumentation**	Bio-potential sources, Electrode types	—	—	**I**
		ECG/EMG machines, Block diagrams of diagnostic equipment	—	—	**II**

		Therapeutic devices – pacemaker, defibrillator	—	—	**III**
		Dialysis machine, Operating principle	—	—	**IV**
		Heart-lung machine, use in surgeries	—	—	**V**
21	**E-Vehicle**	EV definition, components, environmental benefits	—	—	**I**
		Battery types, charging methods	—	—	**II**
		EV powertrain, regenerative braking	—	—	**III**
		Controllers and BLDC motor interface	—	—	**IV**
		Smart EV, BMS, IoT in EV systems	—	—	**V**
22	**Data Communication and Networking**	OSI/TCP-IP models, Layer functions	—	—	**I**
		IP addressing, IPv4 vs IPv6	—	—	**II**
		Network devices: router, switch, hub, bridge	—	—	**III**
		Guided/unguided media, fiber optic vs wireless	—	—	**IV**
		Network security basics, cyber threats	—	—	**V**

Dr. DHARMAMBAL GOVT POLYTECHNIC COLLEGE FOR WOMEN, THARAMANI, CHENNAI
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
COMPARISON STATEMENT OF H SCHEME AND DOTE R2023 SCHEME SYLLABUS

SEM	H SCHEME SUBJECTS	DOTE R2023 SCHEME SUBJECTS
III	- Electronic Devices and Circuits: Diodes, BJTs, FETs, Oscillators, SCR, UJT, etc. - Digital Electronics: Logic gates, Boolean algebra, flip-flops, counters, K-map - Electrical Circuits, Machines C E-Vehicle: Motors, transformers, EV basics - C Programming: Arrays, loops, functions, pointers - Labs: EDC Lab, Digital Lab, C Programming Lab - Skill Modules: Growth Lab, Advanced Skills Certification, Wellness	- Electronic Devices and Circuits: Same core topics (BJTs, FETs, Rectifiers, Amplifiers, Oscillators) - Digital Electronics: Same core topics + Memory, A/D C D/A converters - Electrical Circuits and Machines: Equivalent subject - Programming in C: Same fundamentals - Labs: EDC Practical, Digital Practical, C Programming - Additional Modules: Health C Wellness, Induction Program, Student-Led Initiative
IV	- Analog Electronics: BJTs, FETs, amplifiers, oscillators, thyristors - Measurements C Instrumentation: Measuring instruments, sensors - Communication Engineering – I: Modulation, demodulation, AM/FM basics - 8051 Microcontroller and Embedded Systems: Architecture, programming - Labs: Analog Lab, Embedded Lab, Communication Lab - Skill Modules: Arduino, IoT mini project, Advanced Skills Certification, Wellness	- Microcontroller: Same core topics (8051 architecture, programming) - Data Communication C Networking: Networking basics, protocols - Basics of Communication Engineering: Analog communication techniques - Measuring Instruments and Sensors: Equivalent subject - Labs: Microcontroller Practical, Communication Practical - Additional Modules: Health C Wellness, Induction Program, Club Activities
V	- Communication Systems: Modulation types, Transmitters, Receivers - Industrial Electronics and Medical Electronics, PLC C Robotics: Industrial electronics, automation, robotics - Elective I: Signals C Systems, Consumer Electronics, Wireless Comm., etc. - Elective II: VLSI, CAD, Raspberry Pi, PLC - AI using Python: Basic AI/ML concepts with Python - Labs: Communication Lab, Networking Lab - Skill Modules: Advanced Skills Certification, Innovation C Startup, Internship	- Advanced Communication Systems: Communication theory and modulation - Mobile Communication: Cellular systems, wireless technologies - Elective I: Digital Comm., Medical Instr., Signal C Image Processing, etc. - Elective II: Industrial IoT, VLSI using Verilog, Multimedia Systems, etc. - Embedded Systems: Embedded architecture and applications - Labs: Embedded Lab, Communication Lab - Additional Modules: Innovation C Startup, Summer Industrial Training, Health C Wellness

VI	- Elective III (Pathways): Advanced Mathematics, Machine Learning, Biomedical, UAVs, etc. - Elective IV (Specialization): PCB Design, Industrial IoT, Virtual Instrumentation, App Design - Internship / Fellowship / In-house Project Skill Exposure: Journal publication	- **Elective III (Pathways)**: Similar elective options (Advanced Math, Data Comm., ASIC, etc.) - **Elective IV (Specialization)**: Same/similar elective tracks (Power Devices, VR/AR, VLSI, etc.) - **Project / Internship**: Internship, Fellowship, or In-house Project