DIPLOMA

IN

INSTRUMENTATION AND CONTROL ENGINEERING

SYLLABUS

H- SCHEME

WITH EFFECT FROM JUNE 2025

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

Table of Contents

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

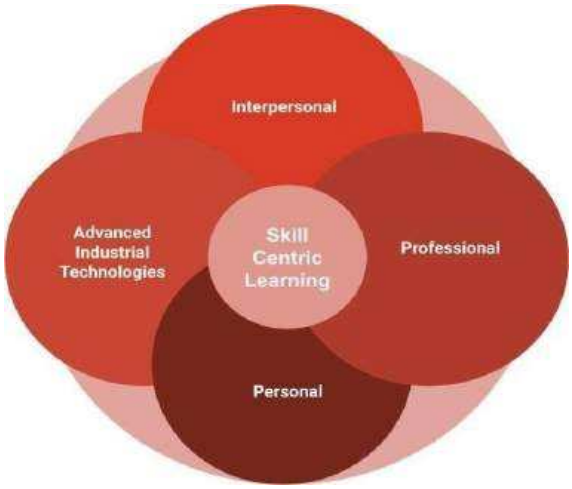
Today's world is rapidly changing and increasingly interconnected, and the future talent pipeline to be sourced from the campuses needs to adapt to changes that will keep accelerating in the future. The new diploma programme focuses on equipping learners with skills that will enable them to cope with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

GPi 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.

H Scheme
Program Structure

Diploma in Instrumentation and Control Engineering

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Diploma Graduates of Instrumentation and Control Engineering after 3 years of graduation will

- pursue higher education and/or engage in continuous upgradation of their professional skills.
- succeed in their professional career in Instrumentation and Control Engineering and allied disciplines as an employee/entrepreneur.
- demonstrate leadership capability and social responsibility.

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: Apply knowledge of sensor technologies, signal conditioning and calibration techniques to design, test and maintain instrumentation systems for industrial and laboratory applications.

PSO2: Develop and maintain automation systems using PID controllers, Program Logic Controllers, Human Machine Interface, microcontrollers and Industrial communication protocols.

Credit Distribution:

Semester	No of Courses	Periods	Credits
Semester I	8	640	20
Semester II	8	640	20
Semester III	7	640	21
Semester IV	7	640	19
Semester V	8	640	22
Semester VI	3	640	18
Total			**120**

Semester III

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	ICH301	Sensors and Transducers	3-0-0	45	3	Theory
2	Program Core	Practicum	ICH302	Electronic Measurements and Instruments	3-0-2	75	4	Theory
3	Program Core	Practical	ICH371	Sensors and Transducers Practical	0-0-4	60	2	Practical
4	Program Core	Practicum	ICH372	Circuit Theory and Machines	1-0-4	75	3	Practical
5	Program Core	Practicum	ICH373	Principles of Electronics Engineering	1-0-4	75	3	Practical
6	Program Core	Practicum	ICH374	Basics of C Programming	1-0-4	75	3	Practical
7	Open Elective	Advanced Skill Certification	ASH393	Advanced Skills Certification - 3	0-0-2	60	2	NA
8	Humanities & Social Science	Integrated Learning Experience		Growth Lab	-	30	0	NA
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		Shop Floor Immersion	-	15	0	-
12	Audit Course	Integrated Learning Experience		Student Led Initiative		15		
13	Audit Course	Integrated Learning Experience		Emerging Technology Seminars	-	8	0	-
14	Audit Course	Integrated Learning Experience		Health & Wellness	0-0-2	30	1	-
Library						**15**		
Test & Revisions						**30**		
Total						**640**	**21**	

Semester IV

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	ICH401	Industrial Instrumentation	3-0-0	45	3	Theory
2	Program Core	Practicum	ICH402	Control Engineering	2-0-2	60	3	Theory
3	Program Core	Practical	ICH471	Industrial Instrumentation Practical	0-0-4	60	2	Practical
4	Program Core	Practical	ICH472	P&ID using CAD Practical	0-0-4	60	2	Practical
5	Program Core	Practicum	ICH473	Analog and Digital Electronics	1-0-4	75	3	Practical
6	Program Core	Practicum	ICH474	8051 Microcontroller	1-0-4	75	3	Practical
7	Open Elective	Advanced Skill Certification	ASH494	Advanced Skills Certification - 4	0-0-2	60	2	NA
8	Audit Course	Integrated Learning Experience		I&E/ Club Activity/ Community Initiatives	-	15	0	-
9	Audit Course	Integrated Learning Experience		Shop floor Immersion	-	15	0	-
10	Audit Course	Integrated Learning Experience		Student-Led Initiative	-	24	0	-
11	Audit Course	Integrated Learning Experience		Emerging Technology Seminars	-	16	0	-
12	Audit Course	Integrated Learning Experience		Health & Wellness	0-0-2	30	1	-
13	Audit Course	Integrated Learning Experience		Special Interest Groups (Placement Training)	-	30	0	-
Library						**15**		
Test & Revisions						**60**		
Total						**640**	**19**	

Semester V

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	ICH501	Process Control Instrumentation	5-0-0	75	5	Theory
2	Program Elective	Theory	ICH58X	Elective-1	4-0-0	60	4	Theory
3	Program Core	Practical	ICH571	Process Control Instrumentation Practical	0-0-4	60	2	Practical
4	Program Core	Practicum	ICH572	PLC Programming	1-0-4	75	3	Practical
5	Program Elective	Practical	ICH58X	Elective-2	0-0-4	60	2	Practical
6	Humanities & Social Science	Practicum	ICH573	Innovation & Startup	1-0-2	45	2	Project
7	Project/Internship	Project/Internship	ICH574	Industrial Training* [Summer Vacation - 90 Hours]	-	-	2	Project
8	Open Elective	Advanced Skill Certification	ASH595	Advanced Skills Certification - 5	0-0-2	60	2	NA
9	Audit Course	Integrated Learning Experience		Induction program III	-	40	0	-
10	Audit Course	Integrated Learning Experien		Student-Led Initiative	-	30	0	-
11	Audit Course	Integrated Learning Experience		Health & Wellness	-	30	0	-
12	Audit Course	Integrated Learning Experience		Special Interest Groups (Placement Training)	-	45	0	-
Library						15		
Test & Revisions						45		
Total						640	**22**	

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*

Semester VI

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Open Elective	Theory	ICH68X	Elective 3 (Pathways)	3-0-0	45	3	Theory
2	Open Elective	Theory	ICH68X	Elective-4 (Specialization)	3-0-0	45	3	Theory
3	Project / Internship	Project / Internship	ICH67X	Internship / Fellowship / In-house Project	-	550	12	Project
Total						**640**	**18**	
3	Project / Internship	Project / Internship	ICH671	Internship	**-**	550	12	Project
3	Project / Internship	Project / Internship	ICH672	Fellowship	**-**	550	12	Project
3	Project / Internship	Project / Internship	ICH673	In-house Project	**-**	550	12	Project

Elective 1

#	Course Category	Course Type	Code	Course Title
1	Program Elective	Theory	ICH581	Mechanical Measurements and Instrumentation
2	Program Elective	Theory	ICH582	Embedded System Design with ARDUINO
3	Program Elective	Theory	ICH583	Industrial Power Electronics
4	Program Elective	Theory	ICH584	Analytical Instrumentation

Elective 2

#	Course Category	Course Type	Code	Course Title
1	Program Elective	Practical	ICH585	Mechanical Measurements and Instrumentation Practical
2	Program Elective	Practical	ICH586	Embedded system Design with ARDUINO Practical
3	Program Elective	Practical	ICH587	Industrial Power Electronics Practical
4	Program Elective	Practical	ICH588	Virtual Instruments and Measurements Practical

Elective 3 (Pathway)

#	Course Category	Course Type	Code	Course Title
1	Program Elective - Higher Education	Theory	ICH681	Advanced Engineering Mathematics
2	Program Elective - Entrepreneur	Theory	ICH682	Entrepreneurship
3	Program Elective - Technocrats	Theory	ICH683	Project Management
4	Program Elective - Technologist	Theory	ICH684	Medical Instrumentation
5	Program Elective - Technologist	Theory	ICH685	Industrial Automation and Drives
6	Program Elective - Technologist	Theory	ICH686	Computer Control of Process

Elective 4 (Specialization)

#	Course Category	Course Type	Code	Course Title
1	Program Special Course	Theory	ICH687	Power Plant Instrumentation
2	Program Special Course	Theory	ICH688	Industrial Process Control Instrumentation
3	Program Special Course	Theory	ICH689	Industrial Robotics

DISCIPLINE WISE TASK FORCE MEETING

Held on: 11.09.2024

PARTICIPANTS

External Experts	Internal Experts
1. **Dr. A. Ganesh Ram** Asst. Prof (Sr. Gr) Dept. of Instrumentation Engg., MIT Campus Anna University Chennai	1. **Mrs. G. A. Fatima Rani** HoD Dept. of Instrumentation Engineering., DDGPCW Tharamani Chennai
2. **Mr. N. Sowrirajan** Assistant Professor Dept. of EIE SRM Valliammai Engineering College Potheri	2. **Mr. R. Selvakumar** Lecture Dept. of Instrumentation Engineering., DDGPCW Tharamani Chennai
3. **Ms. K. Prithya** Instrumentation Designer JGC India Private limited Perungudi Chennai	3. **Mr. N. Senthil Kumar** Lecturer Dept. of Instrumentation Engineering., DDGPC Tharamani, Chennai
4. **Ms. P. Dharini** Designer offshore Wood India Engineering & projects Private limited Tharamani, Chennai	4. **Dr. N.N. Praboo** Lecturer Dept. of Instrumentation Engineering., DDGPCW Tharamani, Chennai
5. **Mr. D. Venkatesan** Manager-Sales VI Microsystems Pvt. Ltd No.75, Electronics Estate Perungudi, Chennai	5. **Dr. L. Thillai Rani** Lecturer Dept. of Instrumentation Engineering., DDGPCW Tharamani, Chennai
6. **Mr. R. Sabari Dhasan** Senior Business Development Engineer Axis Global Automation Group of Companies Chennai	6. **Mr. M. Sankar** Lecturer Dept. of Instrumentation Engineering., DDGPCW Tharamani, Chennai

APEX BODY MEETING

Held on: 07.01.2025

PARTICIPANTS

External Experts	Internal Experts
1. **Dr. R. P. Kumudini Devi** Professor Dept. of Electrical and Electronics Engineering College of Engineering, Guindy Anna University, Chennai	1. **Mrs. G. A. Fatima Rani** HoD Dept. of Instrumentation Engineering., DDGPCW Tharamani, Chennai
2. **Dr. N. Pappa** Professor Dept. of Instrumentation Engineering M.I.T Campus Chromepet Chennai – 600 044	2. **Mrs. K. R. Maladevi** Lecturer Dept. of Instrumentation Engineering. DDGPCW Tharamani, Chennai
3. **Mrs. S. Malarvizhi** Instrumentation designer J Ray Mcdermott Engineering Services DLF Downtown CSIR Road, Tharamani Chennai	3. **Mr. R. Selvakumar** Lecturer Dept. of Instrumentation Engineering., DDGPCW Tharamani, Chennai
4. **Selvi. S. Pavithra** Vendor staff ICICI bank Teynampet Branch Chennai – 600 018	4. **Mr. N. Senthil Kumar** Lecturer Dept. of Instrumentation Engineering., DDGPCW Tharamani, Chennai
	5. **Dr. N.N. Praboo** Lecturer Dept. of Instrumentation Engineering., DDGPCW Tharamani, Chennai
	6. **Dr. L. Thillai Rani** Lecturer Dept. of Instrumentation Engineering., DDGPCW Tharamani, Chennai
	7. **Mr. M. Sankar** Lecturer Dept. of Instrumentation Engineering., DDGPCW Tharamani, Chennai

ICH301	Sensors and Transducers	L	T	P	C
Theory		3	0	0	3

Introduction

Sensors and transducers is a prominent course to make the students aware about the importance of measurement in control system design and development. This course is intended to develop the basic understanding as well as the competency to use, install and test various sensors and transducers used for measuring non-electrical quantities like displacement, temperature, pressure, flow, level etc. Sensors and Transducers are used in almost every industry and also in everyday life.

Course Objectives:

The objective of this course is to enable the students to

- Explain about various sensors used in industries to sense the physical parameters
- Explain the various Resistive type Transducers being used in industries
- Explain the various Inductive type Transducers being used in industries
- Explain the various capacitive type Transducers being used in industries
- Explain the various signal conditioning circuits to be interfaced with transducers to get useful output

Course Outcomes:

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

CO1: apply the knowledge of the various sensors being used to measure industrial process parameters

CO2: analyze the working principle of different types of Resistive, Inductive and Capacitive transducers being used to measure various process parameters

CO3: design various signal conditioning circuits with sensors and transducers to get desired output

Pre-requisites

Basic knowledge of Electrical, Electronics and Instrumentation

ICH301	Sensors and Transducers	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3							3	
CO2		3			2			2	
CO3			3		2				3

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

Instructional Strategy

- It is advised that teachers have to use different teaching methods to stimulate the interest of students in learning.
- To help students to learn different types of sensors and transducers. Teachers should use PPT presentation to show video of application of the various types of sensors and transducers. Also, should explain examples from daily life, realistic situations, and real-world engineering and technological applications.
- Students may be shown all the available sensors in the lab. The demonstration can make the subject exciting and foster in the students a scientific mind set. Student activities should be planned on all the topics.
- Demonstration method may be used with step-by-step procedure to show the working of different types of sensors and transducers.
- Teachers are advised to follow inductive strategy to help the students to know the working principle of special sensors.
- Do not let students work on an activity or an experiment with the expected outcome, rather allow students to be honest about whatever the results of the experiment are. If the results are different from the expectations, students should do an analysis where could be the source of error, if any.

ICH301	Sensors and Transducers	L	T	P	C
Theory		3	0	0	3

Assessment Methodology:

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 sem	Subject/General		
Total				40 Marks

ICH301	Sensors and Transducers	L	T	P	C
Theory		3	0	0	3

Unit I	SENSORS	
Definition – Types of Sensors - Mechanical sensor: Mechanical Springs and its types - Pressure sensor: Bourdon tube and its types - Measurement of Pressure with Bourdon tube and LVDT – Diaphragm – Bellows - Application of Bimetallic strip - Hydro Pneumatic Device - Float – working principle - Special sensors: Working principle of Proximity sensor - Magnetic Sensor – LDR		9
Unit II	**RESISTIVE TRANSDUCER**	
Transducer – Definition – Sensing and Transduction -Classification-Primary and Secondary transducer - Active and Passive transducer- Analog and Digital transducer - Inverse transducer - Examples		2
Resistive Transducer: Potentiometer- Translational-Rotational – Strain gauge- Types of Strain gauges-Wire wound (Bonded and Un bonded) - Foil type - semiconductor strain gauges - Load cell- Thermocouple – Resistance Temperature Detector (RTD) - Thermistor - characteristics – Applications.		7
Unit III	**INDUCTIVE TRANSDUCERS**	
Self-Inductance Type Transducer and its types – Variable Reluctance type transducer – Differential output- Mutual Inductance type - LVDT- Construction - Working –Characteristics- Advantage – Disadvantage- RVDT-working principle - Hall Effect Transducer		9
Unit IV	**CAPACITIVE TRANSDUCERS**	
Capacitive Transducers: Principle of operation – change in area type- change in distance type – change in dielectric constant –Capacitance type level measurement - Advantage - Disadvantage - Application.		5
Piezo Electric Transducers: Principle of operation – Modes of operation – Properties of Piezo electric crystal-Equivalent circuit – Applications.		4

ICH301	Sensors and Transducers	L	T	P	C
Theory		3	0	0	3

Unit V	SIGNAL CONDITIONING CIRCUITS	
Signal conditioning: DC signal conditioning system – AC signal conditioning system – Wheat Stone bridge - Null type bridge- Deflection type Bridge. Op_Amp based circuits: Buffer amplifier - Charge Amplifier- Instrumentation amplifier – Active filters : Low pass- High pass - Band pass - Band stop – (0 - 10V) to (4-20mA) translation circuit		4 5
TOTAL HOURS		**45**

Suggested List of Students Activity (Ungraded):

- Check the web portal to study different types of sensors and transducers.
- Periodical quizzes should be conducted on a weekly/fortnightly basis to reinforce the different types of sensors and their working principles.
- Students might be asked to see the demonstration video of various sensors and transducer

Text Books for Reference:

1. A.K.Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation,19th Edition, Dhanpatrai & sons, Educational and technical publishers, Delhi,2014
2. Patranabis, "Sensors and Transducers" 2ndEdition, Prentice Hall of India Pvt. Ltd., New Delhi, 2010
3. R.K.Jain, Mechanical and Industrial Measurements, 3rd Edition, Khanna Publishers, New Delhi,2015

Web Reference: (Click Ctrl + link to view the web page)

Lecture notes

1. https://byjusexamprep.com/gate-ece/sensors-transducers
2. https://www.egr.msu.edu/classes/ece445/mason/Files/4-Sensors_ch2.pdf
3. https://calicut-university.teachics.org/study-materials/a12-sensors-and-transducers/

Video Lectures

1. https://youtu.be/vGlBlsTwCfA
2. https://youtu.be/hv-aBonZMRQ
3. https://youtu.be/1uPTyjxZzyo

ICH302	Electronic Measurements and Instruments	L	T	P	C
Practicum		3	0	2	4

Introduction:

The course "Electronic Measurements and Instruments" is a pivotal course for Instrumentation & Control Engineering. This course deals with the methods of measuring basic electrical parameters such as voltage, current, power, energy, frequency, resistance, inductance and capacitance. Principle of operation and constructional details, working of various instruments are dealt with this course.

Course Objectives:

At the end of the course, the students would be able to

- Explain Measuring Instruments to measure Voltage, Current, Resistance, and Energy
- Explain to use Bridge circuits to measure unknown Resistance, Inductance and Capacitance
- Explain the Measuring instrument to display, measure and analyze the waveforms
- Explain the various test instruments used in the Industry /Laboratory to test and record the values of the parameters
- Explain the Various Digital Instruments to measure the Frequency, Period, Voltage, Resistance etc.

Course Outcomes:

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

CO1: articulate the construction and working of various instruments to measure current and voltage.

CO2: design the bridge circuit to measure Resistance, Inductance and Capacitance.

CO3: categorize the analog and digital instruments for different applications.

CO4: calibrate the given ammeter and voltmeter.

CO5: make use of CRO and digital multimeter.

Pre-requisites:

Basic Electronics

ICH302	Electronic Measurements and Instruments	L	T	P	C
Practicum		3	0	2	4

CO/PO Mapping

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

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

Instructional Strategy

- Teachers have to use different teaching method for easy to learn of students.
- To help the students to learn different types of instruments and their measurements.
- To Give Demo to the students by teachers using various multimedia applications.

ICH302	Electronic Measurements and Instruments	L	T	P	C
Practicum		3	0	2	4

Assessment Methodology:

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	2 Periods	All Experiments	60 Marks	10 Marks
(OR) CAT 3	1 Period	UNIT V And Activity	15 Marks Theory ->10 Marks Activity ->5 Marks	
Total				40 Marks

SCHEME OF EVALUATION – CAT 3

Sl.No.	Description	Marks
A	Block Diagram / Circuit Diagram	20
B	Procedure for Experimenting / Demonstrating	05
C	Performing Experiment / Demonstration	15
D	Procedure/ Observing Readings/Calculations	10
E	Record	10
Total		60

ICH302	Electronic Measurements and Instruments	L	T	P	C
Practicum		3	0	2	4

Unit I	Measuring Instruments	
Construction - working – Torque equation of Permanent magnet Moving coil instrument - Attraction and Repulsion type Moving iron instrument –Ammeter - Extending the range – simple problem - Multi range ammeter – Voltmeter - Extending the range - simple problem - Multi range voltmeter - Full wave rectifier type ac volt meter.		9
Ex.No.1: Extend the range of given Moving Coil Ammeter (0 – 10 mA) into (0 - 100 mA) Ex.No.2: Extend the range of given Moving Coil Voltmeter (0 – 1 V) into (0 – 10 V)		6
Unit II	**DC and AC bridges**	
DC Bridge - Construction, working, derivation of balance equation and application of measurement of resistance by Wheatstone bridge – Kelvin double bridge - AC Bridge – Balance equation of AC bridge in polar and rectangular form - Maxwell's Bridge – Hay's bridge - Measurement of unknown capacitance by Schering bridge.		9
Ex.No.3: Measure the unknown Resistance using Wheatstone Bridge Ex.No.4: Measure the unknown capacitance using Schering Bridge		6
Unit III	**Test Instruments**	
Block diagram, working and applications of DC power supply–fixed and variable – Megger – working and applications - Instrument transformer – Current Transformer (CT) and Potential Transformer (PT) - Block diagram of oscilloscope – construction and working of CRT – applications of CRO.		9
Ex.No.5: Demonstration of internal components and circuit of DC power supply Ex.No.6: Measure the Magnitude and frequency of the sine wave in CRO		6
Unit IV	**Digital Instruments - I**	
Digital Vs Analog instruments – inverting and non-inverting Schmitt trigger circuit - Digital frequency meter – block diagram - circuit diagram for Frequency measurement – Period measurement - Simple problems - Digital tachometer – Digital storage oscilloscope - Mixed storage oscilloscope -Applications.		9
Ex.No.7: Construct Non-Inverting Schmitt trigger circuit using Operational Amplifier IC741 and observe the output waveform in Digital storage CRO. Ex.No.8: Measure the speed using tachometer		6

ICH302	Electronic Measurements and Instruments	L	T	P	C
Practicum		3	0	2	4

Unit V	Digital Instruments - II	
Digital voltmeter - Linear ramp type voltmeter – Digital ramp type voltmeter – successive approximation type volt meter - Dual slope voltmeter - Digital Multimeter– auto ranging – auto zeroing – auto polarity – Function generator - Block diagram – working principle.		9
Ex.No.9: Demonstration of Function generator and observe the generated sinusoidal, triangular and pulse waveform in CRO Ex.No.10: Measure AC voltage, DC voltage, DC current, resistance value and check continuity using digital multimeter		6
TOTAL HOURS		75

Text Books for Reference:

- A Course in Electrical and electronic measurements and instrumentation by A. K. Sawhney, Dhanpat Rai & Sons. 1986
- Electronic Instrumentation and Measurements: David A. Bell
- Modern Electronics Instrumentation and Measurement Techniques by Albert D. Herfrick.

Web-based/Online Resources

1. https://www.tutorialspoint.com/electronic_measuring_instruments/measuring_instruments.html
2. https://circuitglobe.com/energy-meter.html
3. https://www.tutorialspoint.com/electronic_measuring_instruments/electronic_measuring_instruments_bridges.html
4. https://www.tutorialspoint.com/electronic_measuring_instruments/electronic_measuring_instruments_basics_of_oscilloscopes.html
5. https://www.electrical4u.com/digital-voltmeters-working-principle-of-digital-voltmeter/

ICH302	Electronic Measurements and Instruments	L	T	P	C
Practicum		3	0	2	4

Equipment Required:

S.No	Description	Range	Quantity Required
1	Ammeter	(0-10mA)	4
2	Voltmeter	(0-1V)	2
3	Bread board	-	5
4	Decade Resistance Box	Min: 10 Ohm Max: 100 K	2
5	Fixed Resistors	1 K, 10 K, 1.2 K, 2.2 K, 4.7K	2
6	Multimeter	-	
7	Function Generator	-	2
8	CRO	-	2
9	Digital storage oscilloscope	-	1
10	IC741	-	5
11	DC Regulated power supply	(0-30V)	5
12	Connecting wires	-	As reqd

ICH371	Sensors and Transducers Practical	L	T	P	C
Practical		0	0	4	2

Introduction:

Sensors and Transducers play a crucial role in various applications to convert physical quantities into measurable signals. This syllabus is to provide a skill oriented practical exposure in sensor technologies ensuring that students not only grasp the theoretical foundations but also acquire the skills necessary for successful completion of their own project works in various domains. The chosen sensors are relevant to a wide range of industries including automation, robotics, environmental monitoring and safety. This syllabus aims to prepare students for real-world applications of sensor technologies aligning with industry needs and trends.

Course Objectives:

The objective of this course is to enable the student to

- Perform Experiment on potentiometer and strain gauge
- Perform Experiment on LVDT and thermistor
- Perform Experiment on RTD and Thermocouple
- Perform Experiment on LDR and Load cell
- Perform Experiment on Hall effect sensor and Piezo-Electric Transducer and in Signal conditioning circuits

Course Outcomes:

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

CO1: apply various sensor modules in projects

CO2: categorize various sensors and transducers used to measure physical parameters such as displacement, temperature, force, pressure and light intensity

CO3: explain the function of special transducers

Prerequisite:

Sensors and Transducers Theory

ICH371	Sensors and Transducers Practical	L	T	P	C
Practical		0	0	4	2

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PS01	PSO2
CO1	3			3	3	3		3	
CO2		3		3	3	3			
CO3		3		3	3				

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

Assessment Methodology:

TYPE OF ASSESSMENT	DURATION (PERIODS)	MARKS	CONVERTED TO	MARKS	REMARKS
CAT I	2	50	10	10	50% of Exercises
CAT II	2	50	10	10	All Exercises
OBSERVATION				10	
RECORD				10	
	TOTAL			40	

SCHEME OF EVALUATION

CAT I AND CAT II EXAMINATION

PART	DESCRIPTION	MARKS
A	Drawing Circuit Diagram	20
B	Circuit Construction	15
C	Experimenting with Procedure	05
D	Readings Observed / Calculations / Graph	10
TOTAL		50

ICH371	Sensors and Transducers Practical	L	T	P	C
Practical		0	0	4	2

End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Experimental Setup Diagram	20
B	Experimenting with Procedure	15
4C	Readings Observed	10
D	Calculations / Graph	10
F	Viva voce	05
TOTAL		60

ICH371	Sensors and Transducers Practical	L	T	P	C
Practical		0	0	4	2

Ex.No.	Name of the Exercise	Hours
1	V-I characteristics of Potentiometer and observe its linearity	5
2	Characteristics of strain gauge	5
3	Characteristics of LVDT	5
4	Characteristics of Thermistor	5
5	Characteristics of Resistance Temperature Detector (RTD)	5
6	Characteristics of Thermocouple	5
7	Characteristics of LDR	5
8	Calibrate the Load cell with known weights	5
9	Test the performance of Hall Effect Transducer	5
10	Test the performance of piezoelectric transducer	5
11	Test the performance of Instrumentation amplifier using op-amp	5
12	Test the following sensors by giving suitable Input with desirable output device: (i) IC temperature Sensor (ii) Soil Moisture sensor (iii) IR sensor and (iv) Inductive proximity sensor	5
TOTAL HOURS		**60**

ICH371	Sensors and Transducers Practical	L	T	P	C
Practical		0	0	4	2

Equipment Required:

Sl.No	Item Description	Range	Qty. Required
1.	Ammeter	(0-50mA)	4
2.	Voltmeter	(0-5V), (0-10V)	4
3.	Regulated Power Supply	(0-30V)	4
4	Digital Multimeter	-	6
5	Rheostat	-	4
6	Strain gauge module	-	1
7.	LVDT module	-	1
8	Thermistor with industrial standard	-	1
9	3 wire RTD (PT50/PT-100)	-	1
10	Thermocouple (J/K type)	-	1
11	Water bath with heater arrangement	-	2
12	IR & Inductive proximity sensor	-	Each module 2 nos
16	IC temperature sensor	-	2 nos
17	Relays LEDs and buzzers for actuation	-	As required
18	Trainer Kit to test Hall Effect sensor	-	2 nos
19	Trainer Kit to test Piezo Electric sensor	-	2 nos
20	Instrumentation Amplifier Kit	-	4
21	Soil moisture sensor	-	2 nos

ICH372	Circuit Theory and Machines	L	T	P	C
Practicum		1	0	4	3

Introduction:

Electricity is one of the most vital forces that power the modern world and as such understanding the principles of electrical circuit is an important skill that students can develop. This subject helps to reinforce their understanding of principles of electrical circuits and electrical machines. The fundamental knowledge about Electrical circuits both AC and DC is essential for all diploma holders. Practical exercises are essential for teaching in how to prove the theorems in electrical circuits and to conduct tests on electrical machines. Understanding the working principle of DC and AC machines, transformer is a prerequisite for technicians in their workplace.

Course Objectives:

The objective of this course is to enable the students to

- Demonstrate electric circuits and its analysis
- Impart knowledge the concept of 3 phase circuits
- Acquire skills on operating DC Generators and Motors
- Acquire skills on operating AC Motors
- Acquire skills on testing the transformer.

Course Outcomes

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

CO1: apply laws and theorems to find current and voltage in two loop DC resistive circuits.

CO2: construct 3 phase circuits to measure 3 phase power.

CO3: explain the construction and working of DC and AC machines.

CO4: evaluate transformer performance through OC and SC test.

Pre-requisites:

High School Physics, Electrical & Electronics Fundamentals

ICH372	Circuit Theory and Machines	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3			3		3		3	
CO2			3	3					3
CO3		3			3	3		3	
CO4				3					3

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

Instructional Strategy:

- It is advised that teachers have to use different teaching methods to stimulate the interest of students in learning.
- Help students to learn different types of electrical machines and circuits. Teachers should use PPT presentation of electrical circuits to show video of application of the components. Also, should explain examples from daily life, realistic situations, and real-world engineering and technological applications where the electrical machines are used.
- Students may be shown the generators, motors, and starters in the lab. The demonstration can make the subject exciting and foster in the students a scientific mindset. Student activities should be planned on all the topics.
- Demonstration method may be used with step-by-step procedure to Perform the experiments given in the curriculum
- Teachers are advised to follow inductive strategy to help the students to discover the working principle Electrical circuits.
- Do not let students work on an activity or an experiment with the expected outcome, rather allow students to be honest about whatever the results of the experiment are. If the results are different from the expectations, students should do an analysis where could be the source of error, if any?

ICH372	Circuit Theory and Machines	L	T	P	C
Practicum		1	0	4	3

Assessment Methodology:

TYPE OF ASSESSMENT	DURATION (PERIODS)	MARKS	CONVERTED TO	MARKS	REMARKS
CAT I	2	50	10	10	50% of Exercises
CAT II	2	50	10	10	All Exercises
CAT III		50	10	10	All units MCQs
RECORD			10	10	
	TOTAL			40	

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SCHEME OF EVALUATION
CAT I AND CAT II EXAMINATION

PART	DESCRIPTION	MARKS
A	Drawing Circuit Diagram	20
B	Circuit Construction	15
C	Experimenting with Procedure	05
D	Readings Observed / Calculations / Graph	10
TOTAL		50

END SEMESTER PRACTICAL EXAMINATION

PART	DESCRIPTION	MARKS
A	Drawing Circuit Diagram	20
B	Circuit Construction	15
C	Experimenting with Procedure	05
D	Readings observed/ Calculation / Graph	15
F	Viva Voce	05
TOTAL		60

ICH372	Circuit Theory and Machines	L	T	P	C
Practicum		1	0	4	3

Unit I	Electric Circuit Analysis	
Kirchoff's voltage and current law - Thevenin's theorem, Norton's theorem, super position theorem and Maximum power transfer theorem – Statement and explanations –Calculation of Mesh current– Two loops only- Simple problems.		3
Ex.No.1: Verify the Thevenin's Theorem, by Constructing the two loop DC resistive circuit and measure the current through Load resistance and construct the single loop Thevenin's equivalent of that circuit and measure the current through Load resistor. Ex.No.2: Verify the Norton's Theorem, by Constructing the two loop DC resistive circuit and measure the current through Load resistance and construct the single loop Thevenin's equivalent of that circuit and measure the current through Load resistor. Ex.No.3: Verify Maximum power transfer theorem for the two loop DC resistive circuit. Ex.No.4: Construct the two loop Multi DC source Resistive circuit and Verify the Super position theorem.		12
Unit II	**AC Fundamentals and AC circuits**	
Sinusoidal and non-Sinusoidal waveforms- Period, frequency, amplitude, phase, peak value, average value, RMS value, rectangular and polar conversions, series and parallel RL, RC and RLC Circuits.		3
Ex.No.5: Measurement of unknown frequency using Lissajous's pattern Ex.No.6: Construct RLC series circuit and observe the output waveform. Calculate impedance, reactance, power and power factor.		12
Unit III	**Measurement of 3 Phase Power and Resonance**	
Concept of 3ϕ supply – Line and phase voltage and current in star and delta connected circuits - 3ϕ power – Measurement of 3ϕ power by two-watt meter method - Resonance – condition for resonance – series resonance –parallel resonance curve		3
Ex.No.7: Construct the RLC series resonance circuit and Obtain the Frequency response curve experimentally. Ex.No.8: Construct the RLC parallel resonance circuit and Obtain the Frequency response curve experimentally.		12

ICH372	Circuit Theory and Machines	L	T	P	C
Practicum		1	0	4	3

Unit IV	DC Generators and Motors	
DC machines – Constructional details of DC machines – DC generators - Types – working principle – EMF equation – characteristics of shunt, series and compound generators – applications. DC motor – Types – Motor action – Back EMF – Torque speed characteristics – Speed control of DC shunt motor – Applications, 1ϕ induction motor.		3
Ex.No.09: Conduct a load test on DC Shunt Generator. (simulation or experimental Setup) Ex.No.10: Conduct a load test on 1ϕ induction motor. (simulation or experimental Setup)		12
Unit V	**Transformers**	
Transformer – Ideal Transformer – Principle of working – Constructional details – EMF equation – Turns ratio – Core loss – Copper loss – Efficiency – Regulation – SC and OC tests – Transformer on No load – Transformer on load – Condition for maximum efficiency		3
Ex.No.11: Conduct a load test on Single phase transformer. Ex.No.12: Open circuit and short circuit test on single phase transformer.		12
TOTAL HOURS		**75**

Suggested List of Students Activity (Ungraded)

- Check the web portal for Image and video of different types of Electrical circuits and Machines
- Periodical quizzes should be conducted on a weekly/fortnightly basis to reinforce image of different types of Electrical circuits, and working principles
- Students might be asked to find the various components in real life electrical machines, equipment and circuits.
- Students might be asked to use virtual labs for the simulation of electrical circuits using simulation software

Text Books for Reference:

- Electric Circuit Theory by Arumugam and Prem Kumar, Khanna Publishers
- A Textbook of Electrical Technology by B L Theraja, S. Chand and publications
- Electrical Circuits by Sudhakar and Shyam Mohan, McGraw Hill Education

ICH372	Circuit Theory and Machines	L	T	P	C
Practicum		1	0	4	3

Web References

1. https://youtu.be/zs4MnEx7wTQ?list=PLMC_fsTBvdNgouV9R_PRjJHpYHWgMluxV
2. https://youtu.be/uyE_UhLwIXc?list=PLBlnK6fEyqRg41HzkHScol5bdRebCDOAZ
3. https://youtu.be/czeMTuxprpo
4. https://youtu.be/yR9KMC01diM
5. https://youtu.be/Ibq5Ljt9Epo

Equipment Required:

S.No	Name of the Equipment / Software	Required Quantity
1	Ammeters and Voltmeters	5
2	230V-9V, 230V-6V Transformer	5
3	(0-30)V Regulated Power Supply	5
4	Digital Multimeter	5
5	Bread Board	10
6	Connecting wires	As reqd.
7	Resistors, DIB, DCB	5
8	Watt meters (cc-10A, pc-500V)	5
9	DC shunt motor setup	1
10	Single Phase Induction Motor set up	1
11	Single phase transformer setup	2
12	Voltmeter (0-500)V AC	5
13	Ammeter (0-10)A AC	5
14	LabView/Multisim/MATLAB	1

ICH373	Principles of Electronics Engineering	L	T	P	C
Practicum		1	0	4	3

Introduction:

This forms the backbone of electronic engineering and related fields. It introduces students to the basics of electronic devices, their behavior, and how they form the building blocks of various circuits. This knowledge is fundamental for designing complex electronic systems. Understanding electronic devices and circuits prepares students to troubleshoot problems in electronic systems. Additionally, it equips them with the necessary knowledge to apply these concepts in real-world applications such as in telecommunications, consumer electronics, medical devices, etc.

Course Objectives:

The objective of this course is to enable the students to

- Use the Diode in various application circuits
- Use Transistor in Amplifier and Oscillator circuits
- Use the Field effect Transistor and MOSFET in different applications
- Experiment the characteristics of SCR, DIAC and TRIAC
- Experiment the characteristics of optoelectronic devices

Course Outcomes:

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

CO1: analyze the working of electronic devices and their application circuits.

CO2: test the performance of amplifiers and oscillators.

CO3: explain the characteristics and working of various semiconductor devices.

CO4: evaluate the functioning of display devices like LCD.

CO5: choose the type of optoelectronic devices in real time applications.

Pre-requisites:

High School Physics – Electrical and Electronics Fundamentals

ICH373	Principles of Electronics Engineering	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping:

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

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

Instructional Strategy:

- It is advised that teachers have to use different teaching methods to stimulate the interest of students in learning.
- To help students to learn different types of, electronic devices and circuits. Teachers should use PPT presentation of electronic components and circuits to show video of application of the components. Also, should explain examples from daily life, realistic situations, and real-world engineering and technological applications.
- Students may be shown all the electronic devices, in the lab. The demonstration can make the subject exciting and foster in the students a scientific mind set. Student activities should be planned on all the topics.
- Demonstration method may be used with step-by-step procedure to Perform the experiments given in the curriculum
- Teachers are advised to follow inductive strategy to help the students to discover the working principle electronic circuits.
- Do not let students work on an activity or an experiment with the expected outcome, rather allow students to be honest about whatever the results of the experiment are. If the results are different from the expectations, students should do an analysis where could be the source of error, if any?

ICH373	Principles of Electronics Engineering	L	T	P	C
Practicum		1	0	4	3

Assessment Methodology:

TYPE OF ASSESSMENT	DURATION (PERIODS)	MARKS	CONVERTED TO	MARKS	REMARKS
CAT I	2	50	10	10	50% of Exercises
CAT II	2	50	10	10	All Exercises
CAT III		50	10	10	All units MCQs
RECORD			10	10	
	TOTAL			40	

SCHEME OF EVALUATION

CAT I AND CAT II EXAMINATION

PART	DESCRIPTION	MARKS
A	Drawing Circuit Diagram	20
B	Circuit Construction	15
C	Experimenting with Procedure	05
D	Readings Observed / Calculations / Graph	10
TOTAL		50

END SEMESTER PRACTICAL EXAMINATION

PART	DESCRIPTION	MARKS
A	Drawing Circuit Diagram	20
B	Circuit Construction	15
C	Experimenting with Procedure	05
D	Readings observed/ Calculation / Graph	15
F	Viva Voce	05
TOTAL		60

ICH373	Principles of Electronics Engineering	L	T	P	C
Practicum		1	0	4	3

Unit I	Diode and its Application Circuits	
Semiconductor Diodes: PN Junction Diode as Rectifier - Introduction - Classification of Rectifiers - Half wave rectifier - Full wave rectifier with two Diodes, Bridge Rectifier –Zener diode as Voltage Regulator.		3
Ex.No.1: Construct Half wave rectifier circuit using PN junction Diode IN4007 and observe the input and output waveforms in CRO. Ex.No.2: Construct the Bridge Rectifier circuit and observe the input and output waveforms in CRO Ex.No.3: Construct the Voltage regulator circuit using Zener Diode and check the regulated output voltage.		12
Unit II	**Bipolar Junction Transistor and its Application Circuits**	
Transistor – Transistor as an Amplifier – RC coupled amplifier circuit - Transistor oscillator – Classifications – Condition for oscillations (Barkhausen criterion) - Hartley Oscillator – Colpitts Oscillator – RC Phase Shift Oscillator.		3
Ex.No.4: Test the performance of RC coupled Amplifier circuit using NPN Transistor BC107 and observe voltage gain, Input and output waveforms. Ex.No.5: Test the performance of RC Phase shift oscillator circuit using NPN transistor BC107 and observe the output waveform in CRO Ex.No.6: Test the performance of Colpitts oscillator circuit using NPN transistor BC107 and observe the output waveform in CRO		12
Unit III	**FET and MOSFET and its Application Circuits**	
Field Effect Transistor (FET) : Construction – Working – Characteristics – P Channel FET - N Channel FET - Applications – FET amplifier (Common source amplifier) - Difference between FET and BJT MOSFET - Classification: Enhancement mode - Depletion mode - Construction – working - characteristics - MOSFET acting as switch		3
Ex.No.7: Construct a circuit to study the characteristics of JFET in common source configuration Ex.No.8: Test the performance of common source FET amplifier circuit. Ex.No.9: Test the performance of MOSFET as Switch		12

ICH373	Principles of Electronics Engineering	L	T	P	C
Practicum		1	0	4	3

Unit IV	SCR, DIAC and TRIAC	
SCR - Introduction - Working - VI Characteristics - SCR as a switch – SCR half wave rectifier - TRIAC- working principle - Characteristics - DIAC - working principle - characteristics.		3
Ex.No.10: Construct the circuit to test the VI characteristic of SCR Ex.No.11: Construct the circuit to test the VI characteristic of DIAC		12
Unit V	**Optoelectronic Devices**	
Photo Diode - Photo Transistor - Solar cell - LED – LCD - symbol - working principle - characteristic - applications.		3
Ex.No.12: Construct the circuit to test the characteristic of Photo diode Ex.No.13: Construct the circuit to test the characteristic of Photo transistor Ex.No.14: Construct a circuit to test the LCD Display		12
TOTAL HOURS		**75**

Suggested List of Students Activity (Ungraded)

- Check the web portal for Image and video of different types of Electronic Devices, and circuits.
- Periodical quizzes should be conducted on a weekly/fortnightly basis to reinforce image of different types of Electronic circuits, and working principles
- Students might be asked to find the various components in real life equipment circuits.
- Students might be asked to see the demonstration video of various electronics components.
- Students might work the series and parallel connection, working of components using simulation software in the virtual laboratory web portal.

Text Book for Reference:

1. V K Metha, Rohit Metha, Principles of Electronics , S Chand Publications
2. B L Theraja, Basic Electronics - Solid State, S Chand and Company Limited
3. Electronics Devices & Circuits by Salivahanan S, N.Suresh Kumar, A.Vallavaraj, Tata McGraw Publication 3rd Edition 2016

ICH373	Principles of Electronics Engineering	L	T	P	C
Practicum		1	0	4	3

Web References:

1. https://be-iitkgp.vlabs.ac.in/List%20of%20experiments.html
2. https://vlab.amrita.edu/?sub=3&brch=60&sim=1112&cnt=2147

Equipment Required:

S.No	Name of the Equipment / Software	Required Quantity
1	PN Junction Diode 1N4007	10
2	0-30V Regulated Power Supply	5
3	CRO	2
4	Zener Diode (V5.6Z/V7.5Z/ V9.1Z)	10
5	Transistor BC107	10
6	Resistors	20
7	Capacitors	20
8	Function Generator	5
9	JFET Device / Kit	5
10	MOSFET Device / Trainer Kit	5
11	SCR Device	10
12	DIAC Device	10
13	Digital Multimeter	5
14	Bread Board	10
15	Photo Transistor kit	5
16	16 X 2 LCD	2
17	Photo diode kit	5
18	RC coupled amplifier kit	5
19	RC phase shift oscillator kit	5
20	Colpitts oscillator kit	5
21	Connecting wires	As per requirement

ICH374	Basics of C Programming	L	T	P	C
Practicum		1	0	4	3

Introduction:

C is the most widely used computer language, which is being taught as a core course. C is general purpose structural language that is powerful, efficient and compact, which combines features of high-level language and low-level language.

It is closer to both Man and Machine. Due to this inherent flexibility and tolerance, it is suitable for different development environments. Due to these powerful features, C has not lost its importance and popularity in recently developed and advanced software industry.

C can also be used for system level programming and it is still considered as first priority programming language. This course covers the basic concepts of C. This course will act as "Programming concept developer" for students.

Course Objectives:

The objective of this course is to enable the students to

- Comprehend the basic concept of programming language and to interface with computer
- Learn the Basic structure of C program and its various format
- Develop C program using its statements, function pointers
- Develop C program for electronic circuits and Instrumentation Applications
- Execute C program through IDE and observe the result in console output

Course Outcomes:

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

CO1: apply the knowledge gained to develop and execute C program for Electrical and Instrumentation applications

CO2: Develop C programs to solve different problems.

CO3: utilize the basic knowledge to study advanced programming languages.

Pre-requisites:

Digital Logic Theory, Basic Programming Concepts

ICH374	Basics of C Programming	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3			3	3			3	
CO2			3	3	2	3	3		3
CO3				3		2	3	3	

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

Instructional Strategy:

- It is advised that teachers revise the prerequisite knowledge on Digital Logic theory, number representations, conversion through PPT presentation.
- It is recommended to ask the students to write their own program for the given problem statement, discussing with their batch mates and Teacher may analyze it for correctness, and help to develop their programming skill.
- Students may be asked to edit, compile and debug the program in IDE and test it.
- Teacher can recommend relevant YouTube videos to students to master the procedure to work with IDE
- Teacher has to demonstrate the step-by-step procedure on working with IDE
- Teacher may recommend c programming tutorial in native language available in Spoken Tutorial of IIT Bombay.

ICH374	Basics of C Programming	L	T	P	C
Practicum		1	0	4	3

Assessment Methodology:

TYPE OF ASSESSMENT	DURATION (PERIODS)	MARKS	CONVERTED TO	MARKS	REMARKS
CAT I	2	50	10	10	50% of Exercises
CAT II	2	50	10	10	All Exercises
CAT III		50	10	10	All units MCQs
RECORD			10	10	
	TOTAL			40	

SCHEME OF EVALUATION

CAT I AND CAT II EXAMINATION

PART	DESCRIPTION	MARKS
A	Program	20
B	Flowchart	10
C	Debugging and executing the program	10
D	Output	10
TOTAL		50

END SEMESTER PRACTICAL EXAMINATION

PART	DESCRIPTION	MARKS
A	Program	20
B	Flowchart	10
C	Debugging and executing the program	15
D	Output	10
E	Viva Voce	5
TOTAL		60

ICH374	Basics of C Programming	L	T	P	C
Practicum		1	0	4	3

Unit I	Introduction to C, Operators & I/O Statements	
Basic Structure of C program - C Character Set - Constants - Keywords - Identifiers - Constants and Variables - Data types - Declaration of variables - Defining symbolic constants. Arithmetic operators – Relational operators – Logical operators – Assignment operators - Increment and Decrement operators – Conditional operators – Bitwise operators. Formatted Input: scanf() - Formatted Output: printf() - putchar() - getchar()		3
Ex.No.1: Write a C program to find simple and compound interest Ex.No.2: Write a C program to find the solution of a quadratic equation Ex.No.3: Write a C program to find whether the given number is a positive number, negative number or zero		12
Unit II	**Branching Statements, Looping Statements & Arrays**	
Branching Statements: Introduction – conditional and unconditional - if statement – if ... else – if ... else ... if - ladder - nested if ... else - switch statement – goto statement. Loop Statements: Introduction - while, do ... while statements for loop Arrays: Declaration - Initialization – Accessing Array Elements.		3
Ex.No.4: Write C program to find the sum of series using While loop Ex.No.5: Write C program to perform the arithmetic operation based on the numeric key press using switch case statement. (1-Addition, 2-Subtraction, 3-Multiplication, 4-Division) Ex.No.6: Write C program to implement matrix addition		12
Unit III	**Structures, Pointers and Functions**	
Structures: Structure - Definition – Initialization - Arrays of structures - Arrays within structures **Pointers**: Introduction to Pointer – Declaring and Initializing Pointers **Functions:** User Defined Functions: Function declaration and definition - Function parameters - Calling a function - Recursion.		**3**

ICH374	Basics of C Programming	L	T	P	C
Practicum		1	0	4	3

Ex.No.7: Write C program to find factorial of given N numbers using recursive function Ex.No.8: Write C program to prepare the total marks for N students by reading the name, register number and marks1 to mark 6 using array of structure Ex.No.9: Write C program to swap the values of two variables using pointer	12
Unit IV	**Application Programs for Electric Circuit Applications**
Program to implement Ohms law - Program to find equivalent resistance of three resistances connected in series and parallel - Program to display the average, RMS, form factor and crest factor from the given peak value	3
Ex.No.10: Write a C program to implement ohms law Ex.No.11: Write C language program to calculate the equivalent resistance of three resistances connected (a) in series (b) in parallel Ex.No.12: Write C language program to display the average, RMS, form factor and crest factor from the given peak value	12
Unit V	**Application Programs for Instrumentation Applications**
Program to find the arithmetic mean – range - deviation - standard deviation for the given readings - Program to convert Celsius to Fahrenheit and vice versa using function.	3
Ex.No.13: Write C language program to find the Arithmetic mean, Range, Deviation and standard deviation of the give 10 readings Ex.No.14: Write C language program to convert Celsius to Fahrenheit using function	12
TOTAL HOURS	**75**

Suggested List of Students Activity

Other than classroom learning, the following are the suggested student related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course.

- Students can practice to write their own C language program for the different problem statements taken from internet and test the program using online editor
- Students can visit spoken tutorial hosted by IIT Bombay and listen to the programming tutorial to understand

ICH374	Basics of C Programming	L	T	P	C
Practicum		1	0	4	3

- Students can try to execute the program written by their own in Online simulators to practice more programs.
- Students can try a mini project using C language programming skill with necessary tools.

Text Book for Reference:

- Programming in ANSI C, 4th Edition, Prof. E. Balagurusamy, Tata McGraw Hill Publications.
- Let Us C, Yeswanth Kanetkar, BPB Publications, 4th Revised Edition.
- Computer Concepts and C Programming by R. Rajaram, Scitech Publications, Chennai.

Web-Based / Online Resources

Online Compilers for C

1. https://www.programiz.com/c-programming/online-compiler/
2. https://www.onlinegdb.com/online_c_compiler
3. https://onecompiler.com/c
4. https://www.jdoodle.com/c-online-compiler/
5. https://www.tutorialspoint.com/compile_c_online.php

Online C programming Tutorial

1. https://www.tutorialspoint.com/cprogramming/index.htm

Free Visual Programming Language to learn Programming Concepts

2. https://scratch.mit.edu/

Spoken Tutorial Website

3. https://spoken-tutorial.org/

Equipment required

S.No	Name of the Equipment / Software	Required Quantity
1	Desktop Computers / Laptop Computers	10
2	Laser Printer - A4 size	1
3	5 KVA UPS with at least 1 hour backup	1
4	C Compiler	-

ICH401	Industrial Instrumentation	L	T	P	C
Theory		3	0	0	3

Introduction:

Instrumentation engineers must be conversant with the details of measurement of process variables in industries. In any process industries, the major process variables involved are temperature, pressure, flow and level. This subject covers the detailed study to measure various process variables using transducers used in process industries. It also helps the students to understand about the availability o

f various transducers by different principles to measure the same process variable. This subject gives an idea about the selection of transducers for a given process variable by analyzing the advantages and limitations of each transducer

Course Objectives:

At the end of the course, the students would be able to

- Explain the measurement of temperature using mechanical and electrical methods
- Explain the measurement of pressure using mechanical and electrical methods
- Explain the measurement of Flow using mechanical methods
- Explain the measurement of Flow using electrical methods
- Explain the measurement of Level, Humidity and Moisture

Course Outcomes:

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

CO1: analyse principles and working of measuring instruments.

CO2: measure temperature, pressure, flow, level, humidity and moisture using corresponding methods and instruments.

CO3: select industrial instruments for various applications.

Pre-requisites:

Basics Electronics and instrumentation, Sensors and Transducers

ICH401	Industrial Instrumentation	L	T	P	C
Theory		3	0	0	3

CO-PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1		3						3	
CO2		3			3	3		3	
CO3		3			3	3	3	3	

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

Instructional Strategy:

- Teachers have to use different teaching method for easy to learn of students.
- Help the students to make them to understand the different concepts of measurement of process variables through animation video
- Give demo to the students using various multimedia applications.

Assessment Methodology:

Type of Assessment	Duration (Periods)	Marks	Converted to	Marks	Remarks
CAT I (2 units)	2	50	10	10	Best out of two
CAT II (2 units)	2	50	10		
Assignment - I	-	-	-	10	
Assignment - II	-	-	-	10	
MCQ				5	
Model Exam	3	60	5	5	
Total				40	

ICH401	Industrial Instrumentation	L	T	P	C
Theory		3	0	0	3

Unit I	MEASUREMENT OF TEMPERATURE	
	Mechanical Methods: Measurement of Temperature using Liquid in glass thermometer– liquid in steel thermometers, Gas and vapour pressure thermometer - Bimetallic thermometer **Electrical Methods:** Measurement of temperature using Thermo couples with potentiometer and milli voltmeter –cold junction compensation - series and parallel combination – thermopile – RTD – Thermistor **High Temperature Measurement:** Non contact methods – Total Radiation Pyrometers – Photo electric pyrometers – Optical pyrometers – Temperature transmitter	9
Unit II	**MEASUREMENT OF PRESSURE**	
	Mechanical Methods: Measurement of Pressure using Different Types of U-Tube Manometer -Well type manometer-Inclined Manometer -Ring balance Manometer-Micro manometer **Electrical Methods:** Measurement of pressure using strain gauge, capacitive transducer, LVDT and Piezo-electric transducer. **Pressure Calibration**: calibration of pressure using Dead weight tester. **Pressure Transmitters**: Measurement of pressure using Differential pressure transmitter	9
Unit III	**MEASUREMENT OF FLOW USING MECHANICAL METHODS**	
	Bernoulli's theorem – Continuity equation – Reynolds's number – Types of flow - Measurement of flow **-** Inferential flow meters – Differential pressure type meters – Orifice plates – Venturi tube – Flow Nozzle – Dall tube - Pitot tube – Positive displacement type meters – Nutating type meter – Oscillation piston type meter	9
Unit IV	**MEASUREMENT OF FLOW USING ELECTRICAL METHODS**	
	Measurement of Flow : Electromagnetic flow meter – Ultrasonic flow meter – Doppler and Transit time method – Swirl meter – Vortex shedding meter - Thermal mass flow meter – solid flow measurement using conveyor belt method – Turbine flow – Target flow meter – Hot wire anemometer	9

ICH401	Industrial Instrumentation	L	T	P	C
Theory		3	0	0	3

Unit V	MEASUREMENT OF LEVEL, HUMIDITY AND MOSITURE	
	Measurement of Level: Sight glass method - level in open and closed vessel - Measuring by the movement of float - Change in conductance – change in capacitance - Radiation method –Level Transmitter **Measurement of Moisture:** Measurement of Moisture in granular materials - solid penetrable material in paper and textiles. **Measurement of Humidity:** Humidity – Absolute humidity –Relative humidity – measurement of humidity using Psychrometer – Hair Hygrometer. Density and specific gravity – Definition – Measurement using weighing tube type – viscosity – Saybolt Viscometer	9
	TOTAL HOURS	**45**

Suggested List of Students Activity (Ungraded):

- Students can view the video in YouTube related to Measurement of process variables
- Student can interact with Industrial experts to know the latest technology adopted in Process industries
- Student can practice quiz on Measurement of process variables on any online quiz through internet
- Student can visit higher institutions having instrumentation laboratory and interact with other students and faculties to update the knowledge

Text Books for Reference:

1. A Course in Electrical and electronic measurements and instrumentation by A. K. Sawheny, Dhanpat Rai & Sons.
2. Modern Electronics Instrumentation and Measurement Techniques by Albert D.Herfrick.
3. Electrical and Electronics Measurements and Instrumentation by Umesh Sinha, Satya Prakashan, Tech India Publication, 1992.

Web-based/Online Resources:

1. https://onlinecourses.nptel.ac.in/noc23_ch23/preview
2. https://nsi.gov.in/study-materials/DIIPA_Instrumentation&Measurment_of_Process_Variables_07042020.pdf

ICH402	Control Engineering	L	T	P	C
Practicum		2	0	2	3

Introduction:

Control Engineering ensures that there is a strategic method to improve the productivity and enhance the best practices to eliminate the manual control and reduce human error. Engineers and researchers can design and implement systems that achieve desired performance, stability and robustness. Control engineering is crucial in fields such as aerospace, automotive, robotics, manufacturing and many others where precise and reliable control is necessary.

Course Objectives:

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

- Introduce system, control system and its types and to impart knowledge on using Laplace transform and inverse Laplace transform tool.
- Comprehend the concept of obtaining Transfer function using Block diagram reduction techniques and signal flow graph.
- Impart knowledge on Time domain analysis of First order and second order system
- Impart knowledge on frequency domain analysis and its specifications.
- Comprehend the concept of stability and stability analysis of transfer function

Course Outcomes:

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

CO1: analyse the various types of control system and to derive the transfer function using Laplace transform

CO2: derive the transfer function of complex system using block diagram reduction and signal flow graph method

CO3: evaluate the transfer function in time domain to obtain various time domain specifications and steady state error

CO4: compute the transfer function in frequency domain using various graphical methods

CO5: estimate the stability of the system from its transfer function using different techniques

Pre-requisites:

High School Physics and Mathematics, Electrical engineering Fundamentals

ICH402	Control Engineering	L	T	P	C
Practicum		2	0	2	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1		3		3					3
CO2			3	3					
CO3			3	3	3	3			
CO4			3	3					
CO5			3	3		3			

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

Instructional Strategy:

- Students must be given time to understand the basics of control system, then they must be allowed to start the practical session. Let them discover how to write the code using MATLAB, SCILAB or Octavecode.
- It is advised that teachers have to use different teaching methods to stimulate the interest of students in learning.
- Help students to learn different types of control systems. Teachers should use PPT presentation of different control system and should show video of mathematical modeling of system. Also, should explain examples fromdaily life, realistic situations, and real-world engineering and technological applications where the control system engineering is used.
- Students may be shown different types of plots and how the parameters vary with time in time response and with frequency in frequency response. The demonstration can makethesubject exciting and foster in the students a scientific mindset. Student activities should be planned on all the topics.
- Demonstration method may be used to explain the time domain specifications with process control systems
- Teachers are advised to follow inductive specific strategy to help the students to discover the design and analysis of control systems.

ICH402	Control Engineering	L	T	P	C
Practicum		2	0	2	3

Assessment Methodology:

ASSESSMENT FOR PRACTICUM PAPERS WITH END EXAMINATION 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	2 Periods	All Experiments	60 Marks	10 Marks
(OR) CAT 3	1 Period	UNIT V And Activity	15 Marks Theory ->10 Marks Activity ->5 Marks	
Total				40 Marks

SCHEME OF EVALUATION – CAT 3

Sl.No.	Description	Marks
A	Block Diagram / Circuit Diagram	20
B	Procedure for Experimenting / Demonstrating	05
C	Performing Experiment / Demonstration	15
D	Procedure/ Observing Readings/Calculations	10
E	Record	10
Total		60

ICH402	Control Engineering	L	T	P	C
Practicum		2	0	2	3

Unit I	Introduction to Control System	
Control System: Introduction - definition - classification - Linear and Non-linear Systems - Time-invariant and Time variant systems - Static and Dynamic systems - Open loop and closed loop system - Laplace Transform - Inverse Laplace Transform – simple problems -Transfer Function-Transfer function of RLC network – Poles - Zeros - Pole-Zero Plot.		6
Ex.No.1:Write and execute Matlab/Scilab/Octave code to find (a) Laplace transform of given function (b) Inverse Laplace transform of given function Ex.No.2: Write and execute Matlab/Scilab/Octave code to obtain (a) Pole, zero and gain values from a given transfer function (b) Transfer function from pole, zero and gain values (c) Pole zero plot from transfer function		6
Unit II	**Block diagram and signal flow graph**	
Block diagram: Introduction - Rules for block diagram reduction - simple problems - Signal flow graph - terminologies used in signal flow graph - conversion of block diagram to signal flow graph - Mason's gain formula – simple problems.		6
Ex.No.3:Write and execute Matlab/Scilab/Octave code to obtain Transfer function of the following system using block diagram reduction techniques (a) Blocks connected in series (b) Blocks connected in parallel Ex.No.4:Write and execute Matlab/Scilab/Octave code to obtain Transfer function of the signal flow graph using Mason's gain formula		6
Unit III	**Time domain analysis of control system**	
Standard test signals - Type and order of the system – Step response of first order system - Step response of second order system (Undamped and Critically damped system) - Time domain specifications of second order system (definition and formula only) – simple problems - Steady state error - static error constant - simple problems.		6

ICH402	Control Engineering	L	T	P	C
Practicum		2	0	2	3
Ex.No.5:Write and execute Matlab/Scilab/Octave code to obtain (a) Step response of first order system (b) Impulse response of first order system Ex.No.6:Write and execute Matlab/Scilab/Octave code to obtain step response of second order system for critically damped, under damped, over damped and undamped conditions					6
Unit IV	**Frequency Domain Analysis**				
Frequency response: Definition - Advantages - Frequency domain specifications (Definition and formula only) - Polar Plot - Bode plot - determination of gain margin -Phase margin - Gain cross over frequency - Phase crossover frequency - simple problems.					6
Ex.No.7:Write and execute Matlab/Scilab/Octave code to sketch polar plot of the given transfer function Ex.No.8:Write and execute Matlab/Scilab/Octave code to sketch Bode plot of the given transfer function					6
Unit V	**Stability Analysis**				
Stability: Definition – stable system – unstable system – limitedly stable system - absolute stability - relative stability - Location of roots on s plane for stability - Routh Hurwitz criterion: Definition – determination of stability of the system (upto 5^{th} order in characteristic equation) - Root locus: Definition - construction of root locus (real roots only).					6
Ex.No.9: Write and execute Matlab/Scilab/Octave code to sketch root locus plot of the given open loop transfer function transfer function Ex.No.10: Write and execute Matlab/Scilab/Octave code to determine the stability of the system using Routh Hurwitz criterion					6
TOTAL HOURS					**60**

ICH402	Control Engineering	L	T	P	C
Practicum		2	0	2	3

Suggested List of Students Activity (Ungraded)

- Check the web portal for Image and video of different types of control systems, Laplace and inverse Laplace transforms.
- Periodical quizzes should be conducted on a weekly/fortnightly basis to reinforce
- Students might be asked to use virtual labs (LabVIEW software) for the verification of time response plots.

Text Books for Reference:

1. A. Nagoorkani, Control systems by RBA publishers, 2006
2. U. A. Bakshi, V. U. Bakshi, Control System Theory, Technical Publication
3. A. Anand Kumar, Control Systems, PHI Publications

Web Reference:

1. https://youtu.be/dH6WFiKddJU
2. https://youtu.be/4_uTzc0CqE8?list=PLuwKjRfi2s1Vs1RmewlD2sWPbHEGS5fP6
3. https://youtu.be/2Ij1p64fcCU
4. https://youtu.be/EFMQM1KlRq8
5. https://youtu.be/Gi_tP3lF04M

Equipment required

S. No	Name of the Equipment / Software	Required Quantity
1	Desktop Computer / Laptop Computer	30
2	Laser Printer - A4 size	1
3	5 KVA UPS with at least 1 hour backup	1
4	MATLAB/SCILAB/Octave	--

ICH471	Industrial Instrumentation Practical	L	T	P	C
Practical		0	0	4	2

Introduction:

Instrumentation and Control Engineers plays a major role in process industries. The students of Instrumentation and Control Engineering branch need practical knowledge to measure various parameters such as Temperature, pressure, Flow, etc. This subject gives practical exposure to the students about measurement of process variables of instrumentation industries.

Course Objectives:

The objective of this course is to enable the student to

- Measure Temperature using any type of thermometer and Temperature Transmitter
- Measure pressure using U tube manometer and Transducers
- Measure Differential Pressure using DPT
- Measure Flow rate of Fluid flow using flow transducer
- Measure Level of a liquid in a tank using Level Transmitter

Course Outcomes:

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

CO1: measure temperature using Liquid in glass thermometer, Bimetallic thermometer and Temperature Transmitter

CO2: experiment with to measure pressure using U tube manometer and Bourdon tube, LVDT and dead weight tester

CO3: calibrate differential pressure using DPT and measure flow rate using electromagnetic flow meter

CO4: choose appropriate methods like sight glass, level transmitter and float method to determine level

Prerequisite:

Sensors and Transducers Theory and Practical subject

CO/PO Mapping

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

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

ICH471	Industrial Instrumentation Practical	L	T	P	C
Practical		0	0	4	2

Assessment Methodology:

TYPE OF ASSESSMENT	DURATION (PERIODS)	MARKS	CONVERTED TO	MARKS	REMARKS
CAT I	2	50	10	10	50% of Exercises
CAT II	2	50	10	10	All Exercises
OBSERVATION				10	
RECORD				10	
	TOTAL			40	

SCHEME OF EVALUATION

CAT I AND CAT II EXAMINATION

PART	DESCRIPTION	MARKS
A	Drawing Circuit Diagram	20
B	Circuit Construction	15
C	Experimenting with Procedure	05
D	Readings Observed / Calculations / Graph	10
TOTAL		50

End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Experimental Setup Diagram	20
B	Experimenting with Procedure	15
C	Readings Observed	10
D	Calculations / Graph	10
F	Viva voce	05
TOTAL		60

ICH471	Industrial Instrumentation Practical	L	T	P	C
Practical		0	0	4	2

Ex. No	Name of the Experiment	Hours
1	Conduct Experiment to measure Temperature using (i) Liquid in Glass Thermometer (ii) Bimetallic Thermometer	6
2	Conduct Experiment to measure Temperature using Temperature Transmitter and obtain the characteristics of it	6
3	Conduct Experiment to measure the low pressure using U tube manometer	6
4	Conduct Experiment to measure pressure using Bourdon tube and LVDT setup	6
5	Conduct Experiment to calibrate the pressure gauge using Dead weight tester	6
6	Conduct experiment to obtain the characteristics of Differential Pressure Transmitter (DPT)	6
7	Conduct Experiment to measure the flow rate using Electromagnetic flow meter.	6
8	Conduct Experiment to measure level using sight glass method and using float method	6
9	Conduct Experiment to measure level using Level Transmitter	6
10	Experimentally measure the viscosity using say bolt viscometer	6
TOTAL HOUR		**60**

ICH471	Industrial Instrumentation Practical	L	T	P	C
Practical		0	0	4	2

Equipment Required:

Sl. No	Item Description	Range	Qty. Required
1	Mercury in glass thermometer	-	4
2	Bimetallic Thermometer	-	2
3	Temperature Transmitter experimental setup	-	2
4	U tube Manometer experimental setup	-	2
5	Bourdon tube-LVDT Experimental Setup to measure pressure	-	2
6	Dead weight Tester	-	1
7	Differential Pressure Transmitter experimental setup	-	1
8	Electromagnetic flow meter experimental setup to measure flow	-	1
9	Level Measurement trainer	-	1
10	Say bolt viscometer	-	1

ICH472	P&ID using CAD Practical	L	T	P	C
Practical		0	0	4	2

Introduction:

P&IDs are essential in the engineering and design of piping systems and process plants. By diagramming the functional relationship of piping, instrumentation and equipment components, they illustrate the interaction of the process components used to control an entire process. P&IDs include equipment, physical sequences of process branches, valves, instrumentation reducers and control interlocks. they are also important to the maintenance of the equipment used and the ability to adjust the process that they represent. Diploma in instrumentation and control engineers must be familiar with P&I Drawings and also they have to practice to draw P&I Diagrams. This practical subject gives hands on training to draw diagrams.

Course Objectives:

The objective of this course is to enable the student to

- To acquire skill on drawing P&ID for measuring Temperature, Pressure and level of Feedback control system.
- To acquire skill on drawing P&ID for Cascade control system and Feed forward control system.
- To acquire skill on drawing P&ID for Ratio control system and Split range control system.
- To acquire skill on drawing P&ID for ON/OFF Level, Flow and Pressure Control of Centrifugal Pump.
- To acquire skill on drawing P&ID for Boiler feed water pumping and heating system.

Course Outcomes:

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

CO1: analyze the various symbols of P&ID being used in industries

CO2: develop P&ID diagram for various types of closed loop control system used in industries

CO3: elaborate various operations of difference processes from the P&ID diagram

Pre-requisites:

Process control Instrumentation theory

CO/PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1		3		3		3		3	3
CO2			3	3	5	3			
CO3		3					3		

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

ICH472	P&ID using CAD Practical	L	T	P	C
Practical		0	0	4	2

Assessment Methodology:

TYPE OF ASSESSMENT	DURATION (PERIODS)	MARKS	CONVERTED TO	MARKS	REMARKS
CAT I	2	50	10	10	50% of Exercises
CAT II	2	50	10	10	All Exercises
OBSERVATION				10	
RECORD				10	
	TOTAL			40	

SCHEME OF EVALUATION

CAT I AND CAT II EXAMINATION

PART	DESCRIPTION	MARKS
A	Drawing Circuit Diagram	20
B	Circuit Construction	15
C	Experimenting with Procedure	05
D	Readings Observed / Calculations / Graph	10
TOTAL		50

End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Experimental Setup Diagram	20
B	Experimenting with Procedure	15
4C	Readings Observed	10
D	Calculations / Graph	10
F	Viva voce	05
TOTAL		60

ICH472	P&ID using CAD Practical	L	T	P	C
Practical		0	0	4	2

Ex.No	Name of the Exercise	Hours
1	Draw various P&ID symbols with abbreviations	6
2	Draw the P&ID of a Drum type Boiler with only measurement points	6
3	Draw the P&ID of Feedback control system in a chemical reactor for the control of temperature and pressure.	6
4	Draw the P&ID of Cascade control system in a steam heat exchanger and Distillation column.	6
5	Draw the P&ID of Feed forward control system in a stirred tank heater.	6
6	Draw the P&ID of a ratio control system for the control of two flow rates by ratio.	6
7	Draw the P&ID of Split range control scheme in a process	4
8	Draw the P&ID of On/Off Level, Flow and Pressure Control of CentrifugalPump.	4
9	Draw the P&ID for measurement of furnace draft in Boiler	4
10	Draw the P&ID of Boiler feed water pumping and heating system	4
11	Draw the P&ID of flue gas dew point control	4
12	Draw the P&ID of Lube oil cooler	4
TOTAL HOUR		**60**

ICH472	P&ID using CAD Practical	L	T	P	C
Practical		0	0	4	2

EQUIPMENTS REQUIRED

Sl.No	Name of the Equipments / Software	Quantity Required
1	Desktop / Laptop	10
2	Laser Printer	01
3	UPS 5 KVA with One Hour Backup	01
4	AUTOCAD / EdrawMax Software	01

ICH473	Analog and Digital Electronics	L	T	P	C
Practicum		1	0	4	3

Introduction:

In Industrial Environment, analog sensors gather data, which can then be converted into digital signals for processing and analysis by digital system. Hence Instrumentation Engineer needs to have the proficiency in both analog signal conditioning circuits as well as Digital processing circuits and in addition conversion of Analog domain to Digital domain vice versa. It is mandatory for Instrumentation engineer to get practice with constructing and testing and analysis of fundamental Analog and Digital circuits.

Course Objectives:

The objective of this course is to enable the student to

- Design and test various signal processing circuits using operational amplifiers
- Design and test the voltage regulator circuit using IC's
- Design and test the Combinational Logic circuit using Basic and Universal gates
- Design and test the Flip-flops to learn their characteristics
- Design and test Analog to Digital and Digital to analog conversion Circuits

Course Outcomes:

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

CO1: identify different gate ICs using theoretical knowledge

CO2: distinguish between combinational and sequential digital circuits

CO3: Design various operational amplifier and timer-based circuits.

CO4: Construct and verify the truth table of combinational and sequential digital circuits.

CO5: evaluate D/A converter and A/D converter circuits

Pre-requisite:

Digital Electronic circuits – Number systems

ICH473	Analog and Digital Electronics	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping:

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

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

Instructional Strategy:

- It is advised that teachers revise the prerequisite knowledge through PPT presentation
- It is recommended to ask the students to design their own circuit for the given problem statement, discussing with their batch mates and Teacher may analyze it for correctness.
- Students may be asked to simulate the circuit designed by them using simulation software
- Teacher can recommend relevant YouTube videos to students to master the content of the subject
- Teacher can demonstrate the circuit using virtual lab portal of IIT Bombay

ICH473	Analog and Digital Electronics	L	T	P	C
Practicum		1	0	4	3

Assessment Methodology:

TYPE OF ASSESSMENT	DURATION (PERIODS)	MARKS	CONVERTED TO	MARKS	REMARKS
CAT I	2	50	10	10	50% of Exercises
CAT II	2	50	10	10	All Exercises
CAT III		50	10	10	All units MCQs
RECORD			10	10	
	TOTAL			40	

SCHEME OF EVALUATION
CAT I AND CAT II EXAMINATION

PART	DESCRIPTION	MARKS
A	Drawing Circuit Diagram	20
B	Circuit Construction	15
C	Experimenting with Procedure	05
D	Readings Observed / Calculations / Graph	10
TOTAL		50

END SEMESTER PRACTICAL EXAMINATION

PART	DESCRIPTION	MARKS
A	Drawing Circuit Diagram	20
B	Circuit Construction	15
C	Experimenting with Procedure	05
D	Readings observed/ Calculation / Graph	15
F	Viva Voce	05
TOTAL		60

ICH473	Analog and Digital Electronics	L	T	P	C
Practicum		1	0	4	3

Unit I	Analog IC 741 Operational amplifier based circuits	
Operational Amplifier –Symbol - pin diagram - working- characteristics– Specifications - Inverting amplifier- Non Inverting amplifier – Integrator - Differentiator – gain derivation.		3
Ex.No.1: Construct the inverting amplifier with gain 10 and Non inverting amplifier with gain 11 and observe output voltages for the given positive and negative DC input voltages, and Draw the Voltage transfer characteristic curve. Ex.No.2: Construct the practical Integrator and Differentiator circuit using operational amplifier with DC gain and corner frequency. Observe the input and output waveforms and frequency response.		12
Unit II	**Analog IC 7812 / 7912 and 555 Timer based circuits**	
IC78xx, IC79xx Pin Details - specifications of– Regulator circuit using IC7812 and IC7912 - Pin Details of 555 Timer IC – Operation of internal circuit diagram – Monostable multivibrator circuit - Astable multivibrator circuit		3
Ex.No.3: Construct and test the IC voltage regulator circuit using IC7812 and IC7912. Ex.No.4: (i) Construct the circuit configuring 555 timer in mono stable mode and test the output using LED. Observe the LED is glowing for the set time. (ii) Construct and test the circuit configuring 555 timer in astable mode and test the circuit output using CRO. Observe the output pulse waveform for the set ON time and OFF time.		12
Unit III	**Digital Logic Gate IC's based circuits**	
Symbol, Truth Table and Boolean expression of OR, AND, NOT, NOR, NAND, EX-OR, EX-NOR Logic gates - Design of Half adder- Half subtractor –Full Adder – Full subtractor		3
Ex.No.5: Experimentally verify the Truth table of OR, AND, NOT, NOR, NAND and EXOR gate using IC 7432,7408,7404,7402 ,7400 and 7486 Ex.No.6: Design, Construct and test Half adder, half subtractor using Gate IC 7486, IC 7408, IC 7404		12

ICH473	Analog and Digital Electronics	L	T	P	C
Practicum		1	0	4	3

Unit IV	Digital Flip-flop IC based circuits	
SR Flip_ Flop –JK Flip-flop- JKMS Flip-flop – D Flip-flop - T Flip-flop – Counter: 4 bit ripple counter up counter- 4 bit ripple down counter		3
Ex.No.7: Experimentally verify the truth table of D, T, JKMS Flip-Flop Ex.No.8: Construct 3 bit ripple up counter using T Flip Flops and observe the counting sequence Using LED's		12
Unit V	**ADC and DAC circuits**	
Digital to analog conversion - Binary weighted resistor method - R-2R Ladder Method- DAC specifications - successive approximation type ADC - Integration type ADC – ADC IC0808 pin details		3
Ex.No.9: Construct and verify R-2R ladder Digital to Analog converter using operational amplifier. Ex.No.10: Construct and verify A/D convertor using ADC 0808 IC.		12
TOTAL HOURS		**75**

Suggested List of Students Activity (Ungraded):

- Students can practice to design their own circuit using the algorithmic procedure
- Students can practice to work on the circuit virtual lab portal of IIT Bombay
- Students can simulate the circuit and see the output using simulation software

Text Book for Reference:

1. Linear Integrated circuits by D.Roy Choudhury
2. Digital Electronics by Godse, 3rd Edition.
3. Digital Principles and Applications by Albert Paul Malvino and Donald P. Leach, TMH.

Web-based/Online Resources:

1. https://www.vlab.co.in/participating-institute-iit-bombay
2. http://vlabs.iitkgp.ac.in/vlt/
3. https://www.tutorialspoint.com/digital_circuits/index.html

ICH473	Analog and Digital Electronics	L	T	P	C
Practicum		1	0	4	3

Equipment Required:

Sl.No.	Name of the Equipment	Qty. Required
1	Digital trainer kit	5
2	IC 741	20
3	Function generator	3
4	CRO	2
5	Capacitors of required capacitance values	20 each
6	Resistors of required values	20 each
7	IC7812, IC 7912	20 each
8	IC 555	20
9	Digital Multimeter	10
10	IC 7432, IC 7408, IC 7404, IC 7402, IC 7400, IC 7486	20 Each
11	IC 7474, IC 7476	20 Each
12	ADC 0808 IC	10
13	Regulated power supply (0-30V)	05
14	Connecting wires	As per requirement

ICH474	8051 Microcontroller	L	T	P	C
Practicum		1	0	4	3

Introduction

Controlling all the machineries are realized through Electronics. Without Electronics controlling the machines, devices, systems are not possible. Microcontroller is the most reliable, cost effective and flexible for all control activities. It plays major role in Machines, domestic gadgets, automobile etc. Here is an attempt to introduce the familiar Intel 8051 microcontroller with some programming examples. As microcontroller is like the brain of any Digital control system, it is obvious that control engineer must have practical knowledge about it. This subject gives opportunity to learn hardware, programming and interfacing of real system with microcontroller. This is the basis for embedded system.

Course Objectives:

The objective of this course is to enable the student to

- Learn the 8051 Microcontroller Hardware
- Write the Assembly Language program, compile and run through KEIL IDE
- Interface the various input and output devices with 8051 microcontroller
- Develop application program with 8051 microcontroller
- Develop program and embedding into 8051 on chip memory and test

Course Outcomes:

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

CO1: analyze the architecture of 8051 microcontroller

CO2: develop 8051 assembly language programs for timers, counters and interrupt-based applications

CO3: implement the interfacing of various input/output devices, sensors and actuators with 8051 microcontrollers

CO4: evaluate and embed the application program written in assembly language into 8051 microcontroller using KEIL IDE

Pre-requisite:

Digital Electronic circuits - Programming Knowledge – Number systems

ICH474	8051 Microcontroller	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1		3		3				3	
CO2			3	3		3			3
CO3				3	3	3			3
CO4			3	3	3	3	3		3

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

Instructional Strategy

- It is advised that teachers revise the prerequisite knowledge through PPT presentation
- It is recommended to ask the students to write their own program for the given problem statement, discussing with their batch mates and Teacher may analyze it for correctness, and help to develop their programming skill.
- Students may be asked to edit, compile and Debug the program in KEIL IDE and test it with Hardware
- Teacher can recommend relevant YouTube videos to students to master the procedure to work with KEIL IDE
- Teacher have to demonstrate the step by step procedure on working with KEIL IDE and embedding the program into the 8051 development board

ICH474	8051 Microcontroller	L	T	P	C
Practicum		1	0	4	3

Assessment Methodology:

TYPE OF ASSESSMENT	DURATION (PERIODS)	MARKS	CONVERTED TO	MARKS	REMARKS
CAT I	2	50	10	10	50% of Exercises
CAT II	2	50	10	10	All Exercises
CAT III		50	10	10	All units MCQs
RECORD			10	10	
	TOTAL			40	

SCHEME OF EVALUATION
CAT I AND CAT II EXAMINATION

PART	DESCRIPTION	MARKS
A	Drawing Circuit Diagram	20
B	Circuit Construction	15
C	Experimenting with Procedure	05
D	Readings Observed / Calculations / Graph	10
TOTAL		50

END SEMESTER PRACTICAL EXAMINATION

PART	DESCRIPTION	MARKS
A	Drawing Circuit Diagram	20
B	Circuit Construction	15
C	Experimenting with Procedure	05
D	Readings observed/ Calculation / Graph	15
F	Viva Voce	05
TOTAL		60

ICH474	8051 Microcontroller	L	T	P	C
Practicum		1	0	4	3

Unit I	Architecture and Instruction set	
8051 Microcontroller: Features- Pin details - Architecture - Instruction set - Assembly language program to perform arithmetic operation with 8bit data – Addition – Subtraction – Multiplication - Division		3
Ex.No.1 (i) Write Assembly Language program in to Add two 8-bit data stored at two consecutive Internal memory locations and store the result in the next immediate internal memory location. Test the result in KEIL IDE Memory table. (ii) Write Assembly language program to subtract two 8-bit data stored at Two consecutive Internal memory locations and store the result in the next immediate internal memory location. Test the result in KEIL IDE memory table. Ex.No.2 (i) Write Assembly Language program in to Multiply two 8-bit data stored at two consecutive Internal memory locations and store the result in the next immediate internal memory locations. Test the result in KEIL IDE Memory table. (ii) Write Assembly language program to divide two 8-bit data stored at Two consecutive Internal memory locations and store the result in the next immediate internal memory locations. Test the result in KEIL IDE memory table.		6 6
Unit II	**I/O programming and Timer**	
I/O ports and their functions - Port 0 , Port 1, Port 2, Port 3 - Programming - Timers – Mode 0 , Mode 1, and Mode 2 Programming - Counters – Mode 0 , Mode 1, and Mode 2 Programming.		3
Ex.No.3 Write Assemble language program to perform the following through KEIL IDE (i) when a Toggle switch connected to Input port is ON, 8 LEDs connected to output port glows (ON) and when the toggle is switch is OFF, 8 LEDs are OFF (ii) When Reed switch or LDR connected to input pin activated, Buzzer connected to output pin will be activated. Ex.No.4 (i) Write assembly language program to switch on a LED connected to Output Pin After 1 sec delay (Timer 0- Mode 1) through KEIL IDE (ii) Write and assembly language program through KEIL IDE to count the external event (through toggle switch) and display the count value in the LED's which are connected to output port.		6 6

ICH474	8051 Microcontroller	L	T	P	C
Practicum		1	0	4	3

Unit III	**Interrupt programming and ADC/DAC interfacing**	
8051 Interrupts- Programming External Hardware Interrupts - ADC and DAC interfacing programs.		3
Ex.No.5	Write assembly Language program through KEIL IDE to blink LED which is connected to P1.0 when the External interrupt INT0 (P3.2) is activated.	6
Ex.No.6	Write the assembly language program through KEIL IDE to interface 8 bit ADC and DAC and test it.	6
Unit IV	**LED and LCD Display interfacing with 8051 through ports**	
7-segment LED Display - Multiplexed Multi digit 7-segment LED interface with 8051 16 X 2 LCD Display interface with 8051- programs		3
Ex.No.7	Write an assembly language program through KEIL IDE to interface Multiplexed multi digit 7-segment displays with 8051 through internal parallel ports to display the word "ICE"	6
Ex.No.8	Write an assembly language program through KEIL IDE to interface 16 X 2 LCD displays with 8051 to display the word "Temperature"	6
Unit V	**Actuator control**	
Stepper Motor interface with 8051- Assembly language Program - DC Motor driver interfacing with 8051 microcontroller - H-bridge circuit working - Assembly language program.		3
Ex.No.9	Write an assembly program in KEIL to interface stepper Motor with 8051 through its internal port and to run clockwise direction to 90 degrees and to run Anticlockwise direction to 90 degrees. Choose the stepper motor with step angle 1.8 degree.	6
Ex.No.10	Write an assembly language program through KEIL IDE, to interface a DC motor through H-bridge and required driver circuit , to run the motor in forward and in the reverse direction	6
TOTAL HOURS		**75**

ICH474	8051 Microcontroller	L	T	P	C
Practicum		1	0	4	3

Suggested List of Student Activity (Ungraded):

- Students can practice to write their own Assembly language program for the different problem statements taken from internet and test the program using online editor
- Students can visit virtual lab hosted by IIT Bombay and practice the instruction set to understand
- Students can try any 8051 offline simulators downloaded from the internet and install in your own system and try to practice more programs
- Students can try a mini project using assembly language programming skill with necessary tools and hardware

Text Books for Reference:

1. Muhammad Ali Mazidi Janice Gillispie Mazidi Rolin D. McKinlay, The 8051 Microcontroller and Embedded Systems Using Assembly and C Second Edition
2. A. P Godse, Dr. D. A. Godse, Microcontroller 8051, Technical Publication
3. I. Scott Mackenzie, Raphael, C. W. Phan, The 8051 Microcontroller, Pearson

Web-based Online Resources:

- http://www.vlsiip.com/keil/
- https://www.youtube.com/watch?v=i2lqxC8YG1U&list=PLlJpeJ0GkQ5eU8ySELiG42N3QrOtWKdAT - KEIL software tutorial in TAMIL

Equipment Required:

Sl.No.	Item Description	Quantity Required
1	KEIL Development Board with USB /RS232 cable to connect with computer	As Required
2	KEIL µvision5 IDE software	-
3	Digital I/O interface Board with LDR, Buzzer, Toggle switches and 8 LED's	2
4	8-bit ADC interface Board	2
5	8-bit DAC interface Board	2
6	7-Segment multiplexed Multi digit Display Interface Board	2
7	16 X 2 LCD interface Board	2
8	Stepper motor Interface Board	2
9	DC Motor interface Board with H-Bridge circuit	2

ICH501	Process Control Instrumentation	L	T	P	C
Theory		5	0	0	5

Introduction

In industries, there is a huge demand of qualified engineers in the areas of Process Control Instrumentation. The basic concepts and the detailed study of Process Control are covered in this subject. The importance is given to make the students to understand about the elements of Closed Loop Control System in detail. The students of Instrumentation and Control engineering branch are having wide career options in process industries. This subject provide a general idea to the students to select anyone of the career options like Project engineers, Maintenance engineers, Erection and Commissioning engineers, Automation engineers, Design engineers etc.

Course Objectives

The objective of this course is to enable the students to

- Acquire knowledge in single loop process control system and its components
- Comprehend the concept of various controller principles and its implementation
- Acquire knowledge on different controller tuning methods
- Comprehend the various Final Control Elements being used to adjust the process parameter in the industry
- Acquire knowledge on Complex control systems such as Feed forward, Ratio control etc.,

Course Outcomes:

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

CO1: make use of various components of process control loop to achieve set point in control systems

CO2: analyze the different control principles being used in the industry and its implementation through electronic and pneumatic systems.

CO3: design the optimum process parameter values to achieve the set point using different tuning methods

CO4: elaborate the concept of complex control methods such as Feed forward, Ratio control, Cascade control and its implementation in heat exchanger

CO5: explain the concept of PLC, DCS and different communication protocols.

Pre-requisites

Basic knowledge of Electrical, Electronics and Instrumentation

ICH501	Process Control Instrumentation	L	T	P	C
Theory		5	0	0	5

CO/PO Mapping:

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

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

Instructional Strategy:

- It is advised that teachers have to use different teaching methods to stimulate the interest of students in learning.
- To help students to learn different types of process, controllers and final control elements. Teachers should use PPT presentation to show video of application of the various types of process, controllers and final control elements Also, should explain examples from daily life, realistic situations, and real-world engineering and technological applications.
- Students may be shown all the available controllers in the lab. The demonstration can make the subject exciting and foster in the students a scientific mind set. Student activities should be planned on all the topics.
- Demonstration method may be used with step-by-step procedure to show the working of different types of final control element.
- Teachers are advised to follow inductive strategy to help the students to know the working principle of complex control system
- Students may be given Process control simulation software and instructed to simulate the single process control loop for small applications

ICH501	Process Control Instrumentation	L	T	P	C
Theory		5	0	0	5

Assessment Methodology:

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

ICH501	Process Control Instrumentation	L	T	P	C
Theory		5	0	0	5

Unit I	SIMPLE PROCESS CONTROL SYSTEMS AND TERMINOLOGY	
Process - Continuous and Batch process - process variables Functional block diagram of an automatic process control system - set point - measured value – error - liquid level control system – flow control system – temperature control system with transportation lag - self regulation - Introduction to Piping and Instrumentation diagram - symbols for equipment, piping, instrumentation and control, P&ID diagram for simple Liquid level control system		15
Unit II	**CONTROL PRINCIPLES**	
Controller - reverse and direct action, controller modes: Discontinuous: ON-OFF Control with differential gap, without differential gap – continuous: proportional controller - proportional band(PB) - effect of PB on a controller output – offset - integral control - Derivative control - PI - PD - PID definition, salient features, applications and limitations of above controllers - selection of control action - electronic controllers - error detector - two position controller - P,I,D, PI, PD, PID controllers - pneumatic controllers for PID action - flapper nozzle mechanism, pneumatic relay.		15
Unit III	**TUNING OF CONTROLLERS AND FINAL CONTROL ELEMENTS**	
Concept of tuning - criteria for controller tuning – quarter Decay ratio - IAE - ISE - ITAE - methods of tuning - open loop response method - process reaction curve - closed loop response method - ultimate cycle method - damped oscillation method. Control valve: Types: gate – butterfly – ball – globe – knife – characteristics of control valve - flashing & cavitation – solenoid valve – signal convertors – P to I and I to P converters – Positioner.		15

ICH501	Process Control Instrumentation	L	T	P	C
Theory		5	0	0	5

Unit IV	COMPLEX AND DIGITAL CONTROL SYSTEMS	
Feed forward control system - Feed forward control of heat exchanger - Comparison of feedback control system and feed forward control system. Ratio control - examples - Cascade control - cascade control of heat exchanger - cascade control of distillation column - Direct digital control (DDC) of single loop - Direct digital control with multiple control loops.		15

Unit V	PLC AND DISTRIBUTED CONTROL SYSTEM	
Programmable Logic Controller (PLC): Architecture – operation – components - ladder logic programming – application – advantages. Distributed control system (DCS): Architecture – operation – components – application – advantages. Communication protocols in DCS: Fieldbus – Profibus – Modbus – HART.		15
TOTAL HOURS		**75**

ICH501	Process Control Instrumentation	L	T	P	C
Theory		5	0	0	5

Suggested List of Students Activity (Ungraded)

- Check the web portal to study different types of controllers and final control elements.
- Periodical quizzes should be conducted on a weekly/fortnightly basis to reinforce the different types of controllers and their working principles.
- Students might be asked to see the demonstration video of various process control systems

Text Books for Reference:

1. Curtis D. Johnson, Process control instrumentation technology, 8th edition, Pearson education
2. Shuchen B Thakore & Bharat I Bhatt, Introduction to Process Engineering and Design, 2nd edition, McGraw-Hill Education, 2007.
3. R.P. Vyas, Process Control and Instrumentation, 8th edition, Denett & Co., 2015.

Reference Websites

- ocw.mit.edu/courses/10-450-process-dynamics-operations-and-control-spring-2006/pages/lecture-notes/
- www.control.lth.se/fileadmin/control/Education/EngineeringProgram/FRTF10/2019/book2016.pdf
- msubbu.in/ln/ctrl/index.html

VIDEO LECTURES

- nptel.ac.in/courses/103105064
- acl.digimat.in/nptel/courses/video/103101. 142/L01.html
- www.youtube.com/watch?v=1rO9nJriVR0

ICH581	Mechanical Measurements and Instrumentation	L	T	P	C
Theory		4	0	0	4

Introduction:

Mechanical Measurements and Instrumentation covers the topics of measurement of variables related to Mechanical instrumentation and Analytical instrumentation. It gives detailed information to the students about the measurement of variables related to velocity, acceleration, force, torque, shaft power, pH and gas analysis. It also provides an idea about Chromatographs, detectors and spectral analysis. This subject provides an exposure to the environmental pollution monitoring and control.

Course Objectives:

The objective of this course is to enable the student to

- Impart knowledge about the various types of comparators.
- Comprehend the different methods of measurement of linear, angular velocity and accelerometer.
- Acquire Knowledge on the different methods of force, torque and shaft power measurement.
- Learn the concept of pH and its measuring electrode.
- Acquire knowledge about the various gas analyser and chromatography

Course Outcomes

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

CO1: Identify the construction and working principles of devices for measuring force, torque, and shaft power.

CO2: analyze the types, construction and working principles of comparators.

CO3: elaborate the principles and construction of instruments used for measuring velocity and acceleration.

CO4: describe the principles, construction and operation of pH measurement electrodes and gas analysers.

CO5: discuss the basic principles and construction of chromatography and spectral analysis instruments.

Pre-requisites:

Basics of Electronics and Instrumentation

ICH581	Mechanical Measurements and Instrumentation	L	T	P	C
Theory		4	0	0	4

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PS02
CO1	3							3	3
CO2		3			2				
CO3		3			2				
CO4		3			2	2			
CO5		3							

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

Instructional Strategy

1. It is advised that teachers have to use different teaching methods to stimulate the interest of students in learning.
2. To help students to learn different types of comparators, accelerometer, dynamometer, PH meter and chromatography. Teachers should use PPT presentation of image and symbol of components and to show video of application of the components. They should explain examples from daily life, realistic situations, and real-world engineering and technological applications.
3. Students may be shown all the comparator, accelerometers and PH meter in the lab. The demonstration can make the subject exciting and foster in the students a scientific mind set. Student activities should be planned on all the topics.
4. Demonstration method may be used with step-by-step procedure to test the various components using meters.
5. Teachers are advised to follow inductive strategy to help the students to discover the working principle of various comparators, force, torque and shaft measurement.
6. Do not let students work on an activity or an experiment with the expected outcome, rather allow students to be honest about whatever the results of the experiment are. If the results are different from the expectations, students should do an analysis where could be the source of error, if any?

ICH581	Mechanical Measurements and Instrumentation	L	T	P	C
Theory		4	0	0	4

Assessment Methodology:

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

ICH581	Mechanical Measurements and Instrumentation	L	T	P	C
Theory		4	0	0	4

Unit I	COMPARATORS	
Introduction – Types - Mechanical Comparators-Dial Gauge- Optical comparators-Zeiss ultra optimeter - Electrical Comparator - Electronic comparator - Pneumatic Comparators - Solex Pneumatic Comparator - construction - Principle of operation - Advantages -Disadvantages		12
Unit II	**MEASUREMENT OF VELOCITY AND ACCELERATION**	
Linear Velocity Measurement - Doppler effect method - Linear Encoder-Angular velocity measurement–Drag cup rotor A.C Tacho generator Accelerometer-Seismic Accelerometer–Piezoelectric Accelerometer- strain gauge accelerometer –LVDT Accelerometer -Principle of operation - construction - Advantages-Disadvantages		12
Unit III	**MEASUREMENT OF FORCE, TORQUE AND SHAFT POWER**	
Force Measurement: Definition-Principle of operation- construction - Pendulum scale –Loadcell- Hydraulic loadcell–Pneumatic load cell–Strain gauge load cell. **Torque Measurement:** Definition-Principle of operation- construction - Optical torsion meter – Electrical torsion meter – Strain gauge torsion meter. **Shaft Power Measurement:** Definition- Principle of operation -construction -Prony brake Dynamometer–Rope Brake Dynamometer.		12
Unit IV	**MEASUREMENT OF pH AND GASANALYSIS**	
Measurement of pH: Definition - Electrodes - Principle of operation - construction – Hydrogen electrode - Calomel electrode - Glass electrode. **Gas Analyzer:** Principle of operation -construction –Oxygen analyzer –Paramagnetic oxygen analyzer–CO analyzer–SO_2analyzer.		12

ICH581	Mechanical Measurements and Instrumentation	L	T	P	C
Theory		4	0	0	4

Unit V	CHROMATOGRAPHY AND SPECTRAL METHOD OF ANALYSIS	
Chromatography: Definition - Classification - Principle of operation - Construction –Gas Chromatography – Liquid chromatography – Retention time-Deadtime-Chromatogram-Significance- Advantages **Detectors:** Principle of operation -Construction - TCD – FPD - ECD. **Spectral Analysis:** - Beer's law - IR/UV radiation sources - IR/UV Spectro photometry - working -applications		**12**
TOTAL HOURS		**60**

Text Books for Reference:

1. A.K.Sawhney and Puneet Sawhney, "Mechanical measurements and Instrumentation & Control", Dhanpat Rai & Co (P) ltd.
2. K.Rajpat "Mechanical measurements and Instrumentation" S.K.Kataria & sons, NewDelhi-3.
3. Gurdeep R Chatwaland Sham K. Anand "Instrumentation methods and chemical Analysis"-Himalaya Publishing House.

Web-based/Online Resources:

1. https://www.visionxinc.com/what-is-an-optical-comparator
2. https://infinitalab.com/metrology-testing-service/what-is-zeiss-ultra-optimeter/
3. https://circuitglobe.com/electrical-tachometer.html

ICH582	Embedded System Design with Arduino	L	T	P	C
Theory		4	0	0	4

Introduction:

Embedded system is inevitable in today's Industrial applications. ARDUINO is an open source based prototyping platform used to sense and control physical devices. The purpose of this subject is to become familiar with ARDUINO based embedded system design methods both in hardware and software. Embedded applications at student level are dealt to give exposure to the students to build projects using ARDUINO.

Course Objectives:

The objective of this course is to enable the students to

- Acquire knowledge on Embedded system and its characteristics
- Acquire knowledge on the Arduino Board descriptions of various types of Arduino Boards
- Gain knowledge programming the Arduino through embedded c language
- Gain knowledge on various sensor modules , Actuator modules and Display devices modules to interface with Arduino
- Gain knowledge on using the Arduino for measurement applications

Course Outcomes:

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

CO1: analyse the concept of embedded system, its characteristics, applications

CO2: classify various types of Arduino Boards available in the market

CO3: Develop skills in using the Arduino platform, including the IDE, libraries, and hardware components.

CO4: Design Arduino sketch for various measurement applications and to make digital meters

CO5: implement the interfacing of various sensor, actuator and display device modules with Arduino

Pre-requisites:

Basic knowledge of Digital logic theory, Digital electronic circuits, Analog circuits, C programming

ICH582	Embedded System Design with Arduino	L	T	P	C
Theory		4	0	0	4

CO/PO Mapping:

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1		3						3	3
CO2		3		3	3			3	
CO3			3	3	3	3			
CO4			3		3	3			
CO5			3						

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

Instructional Strategy:

- It is suggested that teachers have to use different teaching methods to stimulate the interest of students in learning.
- To help students to learn fundamentals of Arduino Hardware and programming, Teachers should use PPT presentation and to show video of Arduino based student's projects.
- Demonstration method may be used with step-by-step procedure to work with ARDUINO IDE.
- Teachers are suggested to follow inductive strategy to help the students to know the Industrial applications of embedded systems.
- It is suggested to the teachers to make the students to learn Arduino Board description of One Arduino Board (Arduino UNO), sensor modules, actuator modules, LCD/LED display modules. After learning these, teacher may give their own idea of simple application and may ask the student to do the mini project to implement that application.
- It is suggested to the teachers to make use of tinkercad online portal to teach, demonstrate, simulate and to give mini project work to the students

ICH582	Embedded System Design with Arduino	L	T	P	C
Theory		4	0	0	4

Assessment Methodology:

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

ICH582	Embedded System Design with Arduino	L	T	P	C
Theory		4	0	0	4

Unit I	INTRODUCTION TO EMBEDDED SYTEM	
Embedded System – Definition - Embedded System Vs General Computing Systems – Characteristics - Classification - Small Scale- Medium Scale- Sophisticated – Major Application Areas – Purpose of Embedded Systems - Quality Attributes of Embedded Systems –structure of embedded system – Processors in embedded system - Microprocessor Vs Microcontroller- Compiler- cross compiler- Assembler-Simulator.		12
Unit II	**ARDUINO HARDWARE**	
Arduino – Arduino History – Features **Arduino Family**: Arduino Nano - Arduino Uno - Arduino Mega -Arduino Nano Board descriptions- Arduino uno Board descriptions –- Arduino Mega Board descriptions – Arduino Board installation - Digital and Analog Peripherals – Communication Models – Communication Interface.		12
Unit III	**ARDUINO PROGRAMMING& LIBRARY FUNCTIONS**	
Procedure to setup Arduino IDE– structure of Arduino sketch – **Data types-** constant – Variable - Boolean-Char-Unsigned char-int- unsigned int -Long- unsigned long-short-float-double - **Variable scope:** Local variable – Global Variable–**Operators:** Arithmetic – Comparison - Boolean- bitwise- compound **Control Statements:** if –if... else- if...elseif...else –switch case –While – Do while –for loop- infinite loop **Functions**: Function declaration**-**Time manipulation functions- declaring arrays **Arduino Function Libraries**: pinMode() - digitalRead() – digitalWrite()- analogRead() - analogReference()		12

ICH582	Embedded System Design with Arduino	L	T	P	C
Theory		4	0	0	4

Unit IV	ARDUINO INTERFACE WITH DEVICES, SENSORS and ACTUATORS	
Arduino Hardware and sketch for interfacing Devices: Blinking LED- Reading analog voltage- Reading Digital inputs- Interfacing seven segment Display- Interfacing 16 X 2 LCD display- Interfacing relays, buzzer and switches. **Arduino Hardware and Sketch for interfacing Sensors:** Temperature sensor LM35, Humidity sensor DHT22, IR motion sensor(PIR) – ultrasonic sensor HC-SR04 - Light sensor(LDR) **Arduino Hardware and Sketch for interfacing Actuators:** DC Motor - Servo motor – Stepper Motor		12
Unit V	**EMBEDDED APPLICATION DEVELOPMENT WITH ARDUINO**	
Arduino Hardware and sketch: Measurement of unknown resistance - Measurement of temperature –Measurement of light intensity –Measurement of distance in cm –Measurement of angle of rotation using potentiometer – Measurement of humidity – any application to communicate with android phone through Bluetooth – any application to use wifi and local area network – any application to send data through internet.		12
TOTALHOURS		**60**

Suggested List of Students Activity (Ungraded)

- Check the web portal to study Arduino Tutorial and learn Arduino Hardware and programming
- Periodical quizzes should be conducted on a weekly basis to reinforce the knowledge on Arduino hardware and programming
- Students might be asked to work with online/offline Arduino simulator software.
- Students might be given small project type assignment and can simulate it with online simulation portal

ICH582	Embedded System Design with Arduino	L	T	P	C
Theory		4	0	0	4

REFERENCE BOOKS:

1. Introduction to Embedded Systems (2nd Edition) by K V Shibu, McGrawHill India
2. Embedded Systems Architecture, Programming and Design by Raj Kamal, Tata McGraw-Hill Publishing
3. Arduino Based Embedded Systems Interfacing, Simulation and LabView GUI by Rajesh Singh, Anita Gehlot, Bhupendra Singh, Sushaban Choudhury, CRC Press
4. Sams Teach Yourself Arduino Programming in 24 Hours by Richard Blu
5. Arduino for Dummies by John Nussey
6. Arduino Cookbook (3rd edition) by Michael Margolis, Brian Jepson and Nicholas Robert Weldin, O'reilly
7. Arduino Made Simple with Interactive Projects by Ashwin Pajankar, BPB Publications

LIST OF LEARNING WEBSITE:

1. https://arduino.cc
2. https://www.tutorialspoint.com/arduino

ICH583	Industrial Power Electronics	L	T	P	C
Theory		4	0	0	4

Introduction:

Industrial power electronics play a crucial role in modern manufacturing and industrial processes by providing efficient and precise control over electrical power. The widespread adoption of industrial power electronics lies in their ability to enhance energy efficiency, provide precise control, improve reliability and safety, and support the integration of emerging technologies like renewable energy sources. These factors contribute to the overall competitiveness and sustainability of industrial operations. Instrumentation Engineers must be convergent with Power electronics circuits, its operation, debugging so that, they can maintain and manage the emerging situations in industry.

Course Objectives:

The objective of this course is to enable the student to

- Learn the Thyristor family devices and its Triggering circuit
- Control the output power in converter circuit
- Learn the Chopper circuits and its control applications
- Design the single and three phase inverters
- Regulate AC voltage through PWM

Course Outcomes:

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

CO1: apply basic control strategies to chopper circuits and their applications in DC transmission systems

CO2: analyze the operation of single-phase and three-phase converters under different loads.

CO3: design various trigger circuits for power devices

CO4: Explain the working of single-phase and three-phase inverters, function of UPS systems.

CO5: Describe the principles of AC voltage regulators, cyclo-converters and their applications in industrial systems.

Pre-requisite:

Basic Electronics - Analog Electronic circuits

ICH583	Industrial Power Electronics	L	T	P	C
Theory		4	0	0	4

CO/PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3							3	
CO2		3							
CO3			3						
CO4		3		3	3				
CO5		3			3				

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

Instructional Strategy:

- It is suggested that teachers revise the prerequisite knowledge through PPT presentation
- It is recommended to ask the students to see various power circuits in the website
- It is recommended to simulate the power electronics circuits using ORCAD, MATLAB
- Teacher can recommend relevant YouTube videos
- Teacher has to demonstrate the step-by-step procedure on working with simulation software tool

ICH583	Industrial Power Electronics	L	T	P	C
Theory		4	0	0	4

Assessment Methodology:

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

ICH583	Industrial Power Electronics	L	T	P	C
Theory		4	0	0	4

Unit I	POWER DEVICES AND TRIGGER CIRCUITS	
Thyristor family –Working principle, VI characteristics, Applications of SCR. Triggering of SCR - Gate triggering –Types – Concepts of DC triggering, AC triggering, Pulse gate triggering – Pulse transformer in trigger circuit – Resistance firing circuit and waveform – Resistance capacitor firing circuit and waveform, Synchronized UJT triggering (ramp triggering) and waveform. MOSFET- IGBT - Construction - working principle - Applications		12
Unit II	**CONVERTERS**	
Converters – Definition – Single phase Half controlled bridge converter with resistive load and resistive inductive load- importance of flywheel diode – Single phase fully controlled bridge converter with resistive load – voltage and current waveforms – Single phase fully controlled bridge converter with RL load –voltage and current waveforms. Commutation: Natural commutation – Forced commutation – Types of forced commutation (mention the types only) 3 phase half-controlled bridge converter with resistive load - current and voltage waveform -3 phase fully controlled bridge with resistive load – current and voltage waveforms.		14
Unit III	**CHOPPERS**	
Introduction – applications -principle of chopper-control strategies (time ratio and current limit control)-types of choppers- type A, B, C, D, and E- step up chopper – PWM control circuit for driving MOSFET in chopper. DC Transmission- principle – advantages – drawbacks		10
Unit IV	**INVERTERS AND APPLICATIONS**	
Inverter Definition Requirement of an inverter –Single phase inverter with resistive load – Single phase inverter with RL load –Methods to obtain sine wave output from an inverter- output voltage control in inverters - Basic three phase bridge inverters with 120 conduction mode – circuit, trigger sequence, waveform UPS – Need for UPS –ON Line UPS -OFF Line UPS - Comparison of ON-line and OFF-line UPS		12

ICH583	Industrial Power Electronics	L	T	P	C
Theory		4	0	0	4

Unit V	AC VOLTAGE REGULATORS				
Introduction to AC Voltage Controller – Principle of On-Off Control – Principle of Phase Control – Single Phase voltage Controller with Resistive Loads – Single Phase voltage Controller with RL load -Three Phase Full Wave Controller – Cyclo converters – Single Phase Cyclo-converters – AC Voltage controllers with PWM Control					12
TOTALHOURS					**60**

Suggested List of Students Activity (Ungraded):

- Students can practice to simulate the learnt circuits using simulation software tool
- Students can read magazines related to power electronics to update the current scenario
- Students can visit the industries to know the practical application of the circuits in the industry.

Text Books for Reference:

1. Power Electronics, M.H.Rashid, PHI Publications, 3rd edition, and 2005.
2. Power Electronics, Vedam Subrahmanyam, New Age International Publishers, Second Edition, 2006
3. Power Electronics, Dr. P.S. Bimbhra, Khanna Publishers

ICH584	Analytical Instrumentation	L	T	P	C
Theory		4	0	0	4

Introduction:

Analytical instrumentation refers to a wide array of tools and techniques used to analyze and quantify the composition of substances or materials. These instruments are crucial in various scientific fields, including chemistry, biology, environmental, pharmaceuticals, and materials science. They enable researchers and professionals to determine the identity, concentration, and properties of chemical compounds or elements present in a sample.

Course Objective:

The objective of this course is to enable the students to

- Acquire knowledge on colorimeter and various spectrophotometers
- Acquire knowledge on various types of chromatograph and analytical techniques
- Acquire knowledge on Industrial gas analyzers and pollution monitoring instruments
- Gain knowledge on pH meters and Dissolved component analyzers
- Gain knowledge on Nuclear Magnetic Resonance based instruments and microscopic techniques.

Course Outcomes:

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

CO1: apply the principles of spectral analysis to determine the concentration of substances.

CO2: classify various types of spectrophotometry and chromatography

CO3: Identify the quality of gas using industrial gas analyzers, pollution using pollution monitoring Instruments

CO4: illustrate the various measurement of pH using different types of electrodes, dissolved components using analyzers.

CO5: elaborate the concept of Nuclear Magnetic Resonance based instruments and mass spectrometers.

ICH584	Analytical Instrumentation	L	T	P	C
Theory		4	0	0	4

Pre-requisites:

Basics of instrumentation, Industrial Instrumentation

CO/PO Mapping:

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3							3	
CO2		3				3			
CO3	3				3				
CO4		3							
CO5		3			3				

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

Instructional Strategy:

- It is suggested that teachers have to use different teaching methods to stimulate the interest of students in learning.
- To help students to learn fundamentals of Analytical instruments, Teachers should use PPT presentation and to show video
  Of various analyzing techniques using different types of instruments
- Demonstration method may be used with step-by-step procedure to analyze liquid, gas, air pollutants etc.,
- Teachers are suggested to follow inductive strategy to help the students to know the Industrial applications of Analytical Instruments.
- It is suggested to the teachers to show the YouTube video to handle different types of analytical instruments to the students

ICH584	Analytical Instrumentation	L	T	P	C
Theory		4	0	0	4

Assessment Methodology:

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

ICH584	Analytical Instrumentation	L	T	P	C
Theory		4	0	0	4

Unit I	SPECTROPHOTOMETRY	
Spectral methods of analysis – Beer-Lambert law – UV-Visible spectroscopy – IR Spectrophotometry - FTIR spectrophotometry – Atomic absorption spectrophotometry - Flame emission and atomic emission photometry – Construction, working principle, sources detectors and applications.		12
Unit II	**CHROMATOGRAPHY**	
General principles – classification – chromatographic behaviour of solutes – quantitative determination - Column chromatography-Planer Chromatography-Paper Chromatography-Thin layer Chromatography- Gas chromatography – Liquid chromatography – High-pressure liquid chromatography – Applications.		12
Unit III	**INDUSTRIAL GAS ANALYZERS AND POLLUTION MONITORING INSTRUMENTS**	
Gas analysers – Oxygen, NO_2 and H_2S types, IR analysers, thermal conductivity detectors, analysis based on ionization of gases. Air pollution due to carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation - Dust and smoke measurements.		12
Unit IV	**pH METERS AND DISSOLVED COMPONENT ANALYZERS**	
Principle of pH measurement, glass electrodes, hydrogen electrodes, reference electrodes, selective ion electrodes, ammonia electrodes, biosensors Dissolved oxygen analyzer - Sodium analyzer - Silicon analyser - Water quality Analyzer.		12
Unit V	**NUCLEAR MAGNETIC RESONANCE AND MICROSCOPIC TECHNIQUES**	
Basic principles, Instrumentation and Applications - NMR spectrometer - Electron spin Resonance spectroscopy -Scanning Electron Microscope (SEM) - Transmission Electron Microscope (TEM) Mass Spectrometry – Sample system – Ionization methods – Mass analyzers – Types of mass spectrometry		12
TOTAL HOURS		**60**

ICH584	Analytical Instrumentation	L	T	P	C
Theory		4	0	0	4

Suggested List of Students Activity (Ungraded)

- Check the web portal to study various analytical techniques and analytical instruments being used in the industry
- Periodical quizzes should be conducted on a weekly basis to reinforce the knowledge on Analytical Instrumentation

Text Books for Reference:

1. Willard, H.H., Merritt, L.L., Dean, J.A., Settle, F.A.," Instrumental methods of analysis", CBS publishing & distribution, 7th Edition, 2012.
2. Braun, R.D., "Introduction to Instrumental Analysis", Pharma Book Syndicate, Singapore, 2006.
3. Khandpur, R.S., "Handbook of Analytical Instruments", Tata McGraw-Hill publishing Co.Ltd., 2nd Edition 2007.

ICH571	Process Control Instrumentation Practical	L	T	P	C
Practical		0	0	4	2

Introduction:

Process control instrumentation practical play a crucial role in the education and training of students by providing hands-on experience, fostering essential skills, and preparing them for careers in industries where process control is paramount**.** Practical sessions provide an opportunity for students to apply theoretical knowledge gained in lectures to real-world scenarios. It allows them to manipulate actual instruments, understand their functionalities, and observe how they interact with the processes they are controlling.

Course Objectives:

The objective of this course is to enable the student to

- Gain practical knowledge to handle the single loop process control station
- Control a simple process control station using different control algorithms such as P, PI, PID etc.
- Tune the single Process control loop using various tuning methods
- Gain hands on experience to handle the Final control element in the process station
- Gain hands on experience to achieve the set point in a temperature, pressure, flow process stations
- Gain practical knowledge on PLC

Course Outcomes:

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

CO1: apply ON-OFF control strategy for pressure and level processes

CO2: design digital PID control of temperature process

CO3: implement the PID control in a level process setup

CO4: handle the control valve, P to I, I to P converters in process station

Pre-requisites:

Basics of Instrumentation, sensors and Transducers and Process control Instrumentation Theory

CO/PO Mapping

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

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

ICH571	Process Control Instrumentation Practical	L	T	P	C
Practical		0	0	4	2

Assessment Methodology:

TYPE OF ASSESSMENT	DURATION (PERIODS)	MARKS	CONVERTED TO	MARKS	REMARKS
CAT I	2	50	10	10	50% of Exercises
CAT II	2	50	10	10	All Exercises
OBSERVATION				10	
RECORD				10	
	TOTAL			40	

SCHEME OF EVALUATION

CAT I AND CAT II EXAMINATION

PART	DESCRIPTION	MARKS
A	Drawing Circuit Diagram	20
B	Circuit Construction	15
C	Experimenting with Procedure	05
D	Readings Observed / Calculations / Graph	10
TOTAL		50

SCHEME OF EVALUATION

End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Experimental Setup Diagram/Block diagram	20
B	Experimenting with Procedure/software design and connection	15
C	Readings Observed/Execution	10
D	Calculations / Graph/Output	10
F	Viva Voce	05
	TOTAL	60

ICH571	Process Control Instrumentation Practical	L	T	P	C
Practical		0	0	4	2

Ex.No.	Name of the Exercise	Hours
1	Obtain the transfer function model of Thermocouple	5
2	Experimentally obtain the Characteristics of Control Valve	5
3	Experimentally obtain the characteristics of P to I converter	5
4	Experimentally obtain the characteristics of I to P converter	5
5	Experimentally implement On-Off Control in a Pressure Process.	5
6	Obtain the characteristics of analog PID controller	5
7	Conduct experiment to observe response of On-Off control in a Level Process	5
8	Observe response of PID controller in a Level Process	5
9	Observe the response of a Digital PID controller in a Temperature Process	5
10	Desing and implement PID controller for the temperature process using MATLAB	5
11	Design and implement cascade controller using MATLAB	5
12	Turn On-Off the motor based on object counter using PLC	5
TOTAL HOURS		**60**

ICH571	Process Control Instrumentation Practical	L	T	P	C
Practical		0	0	4	2

Equipment Required:

Sl. No	Name of the Equipment / Software	Required Nos.
1.	Digital PID controller kit for temperature process	1
2.	Level Control setup	1
3.	Control Valve setup	1
4.	Analog PID controller kit	1
5.	P to I Converter and I to P converter setup	1
6.	Compressor unit	1
7.	Computer with MATLAB software	2
8.	Thermocouple	1
9.	PLC Trainer kit with on/off motor control interface	1

ICH572	PLC Programming	L	T	P	C
Practicum		1	0	4	3

Introduction:

A diploma holder when employed in automated power station will be required to work with Programmable Logic Controllers. In industry, many manufacturing processes demand a sequence of operation, which are to be performed repetitively. Early automation systems were mechanical in design, timing and sequencing being effected by gears and cams. Slowly these design concepts were replaced by electrical drives which were controlled by relays and now by programmable logic controllers (PLCs). PLCs are widely used in all industries for efficient control operations. A diploma holder in industry is called upon to design, modify and troubleshoot such control circuits. Looking at the industrial applications of PLCs in the modern industry, this subject finds its usefulness in the present curriculum.

Course Objectives:

At the end of the course, the students will be able to

- Acquire knowledge on PLC hardware and to Implement Ladder Logic Program for simple applications
- Use the PLC for Time delay generation and Counting application
- Implement the control of sequential operation using PLC and to handle the Motor operations
- Implement the control operations required for the Industrial applications
- Implement the control operations required for commercial applications

Course Outcomes:

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

CO1: analyze the components of PLC and its operations.

CO2: develop PLC ladder logic program for various applications.

CO3: design the timers and counters in PLC for various applications.

CO4: construct PLC program for various domestic and industrial applications

CO5: solve many industrial problems by providing solutions using PLC.

Pre-requisites:

Digital Logic Theory, Digital electronic circuits, sensors and transducers

ICH572	PLC Programming	L	T	P	C
Practicum		1	0	4	3

CO-PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1		3		3				3	
CO2			3	3					
CO3			3	3	3				3
CO4			3	3		3	3		
CO5		3		3		3			

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

Instructional Strategy:

- Teachers have to use different teaching method for easy to learn of students.
- To help the students to learn different types of instruments and their measurements.
- To Give Demo to the students by teachers using various multimedia.

ICH572	PLC Programming	L	T	P	C
Practicum		1	0	4	3

Assessment Methodology:

TYPE OF ASSESSMENT	DURATION (PERIODS)	MARKS	CONVERTED TO	MARKS	REMARKS
CAT I	2	50	10	10	50% of Exercises
CAT II	2	50	10	10	All Exercises
OBSERVATION			10	10	
RECORD			10	10	
	TOTAL			40	

SCHEME OF EVALUATION
CAT I AND CAT II EXAMINATION

PART	DESCRIPTION	MARKS
A	Drawing circuit diagram	20
B	Experimenting with procedure	15
C	Readings observed/calculations/Graph	10
D	Result	5
TOTAL		50

END SEMESTER PRACTICAL EXAMINATION

PART	DESCRIPTION	MARKS
A	Drawing circuit diagram	20
B	Experimenting with procedure	15
C	Readings observed/calculations/Graph	15
D	Result	5
E	Viva Voce	5
TOTAL		60

ICH572	PLC Programming	L	T	P	C
Practicum		1	0	4	3

Unit I	PLC Hardware and Ladder Logic programming	
PLC – Definition – Functional Block Diagram of PLC – Input Field Devices – Output Field Devices – Memory Organization Ladder Programming – Basic Ladder Logic Symbols - Relay Type Instructions: Normally Closed , Normally Opened Output coil - Logical Instructions: AND, OR, NAND, NOR, XOR, NOT		3
Ex.No.1: Design and Develop Ladder Logic Program to switch ON the pilot lamp when START Push button is pressed and lamp will be continuously ON even after the push button is released. Pilot lamp will be switched OFF when STOP button is pressed Ex.No.2: Design and Develop Ladder Logic Program to simulate the following Logic functions: NOT, AND, OR, NAND, NOR, XOR, X-NOR Logic. Ex.No.3: Design and Develop Ladder Logic Program to meet the following requirements When Switch 1 OR Switch 2 ON, Lamp ON When Switch 3 AND Switch 4 ON , Lamp OFF Ex.No.4: Design and Develop Ladder Logic program to meet the following requirements When Switch 1 ON, Lamp 1 and Lamp 2 ON When Switch 1 OFF, Lamp 1 OFF and Lamp 2 ON When Switch 2 ON , Lamp 2 OFF , Lamp 3 ON and Lamp 4 ON When Switch 2 OFF, Lamp 2 ON, Lamp 3 ON, Lamp 4 ON		12
Unit II	**PLC Timer and Counter programming through Ladder logic Diagram**	
Timer Instructions: On Delay Instruction - Off Delay Instruction - Retentive timer Instruction and Non-retentive Timer Instruction - Ladder Diagram timing application. **Counter Instructions**: Count-Up instruction - Count-Down Instruction, Reset (RST) - Ladder diagram for counting application		3

ICH572	PLC Programming	L	T	P	C
Practicum		1	0	4	3

Ex.No.5: **(i)** Develop and Implement Ladder Logic Diagram to switch ON the pilot lamp 10 second after the toggle switch is pressed. (ii) Develop and Implement Ladder Logic Diagram to switch OFF the pilot lamp 10 seconds after the toggle switch is pressed. (iii) Develop and Implement Ladder logic Diagram for cyclic ON & OFF of a Pilot Lamp **Ex.No.6:** Design and Develop Ladder Logic Diagram to count the event of toggling the switch And pilot lamp should be switched ON when the count value is 15.	12
Unit III **Branch and Sequencer Instructions**	
Branching Instructions: Jump to Label, Jump to Subroutine, Return, Subroutine, Master Control Reset (MCR). Shift & Sequence Instructions: Bit Shift Left, Bit Shift Right, Sequencer Output Sequencer Compare, Sequencer Load.	3
Ex.No.7: Develop and implement a Ladder logic program for the sequence control of four outputs repetitively**.** **Ex.No.8:** Develop and implement a Ladder Logic program to run the motor in the forward direction when START_FORWARD switch is pressed and to run the motor in Reverse Direction When the START_REVERSE switch is pressed.	12
Unit IV **Data Manipulation, Mathematical and Compare Instructions**	
Data Compare Instructions: Equal (EQU) EQU, Less Than (LES), Less Than or Equal (LEQ), Not Equal (NEQ), Greater Than (GRT), Greater Than or Equal (GEQ)	3
Ex.No.9: Develop and Implement Ladder Logic Diagram for the On/Off Level Control. **Ex.No.10:** Develop and implement a Ladder logic Diagram for conveyor control	12
Unit V **Applications of PLC**	
Data Manipulation Instructions: Move (MOV), Masked Move (MVM) Math Instructions: ADD, SUB, MUL, DIV, SQR	3
Ex.No.11: Develop and Implement a Ladder logic Diagram for Car parking. **Ex.No.12:** Develop and Implement a Ladder Logic Diagram for Lift control	12
TOTAL HOURS	**75**

ICH572	PLC Programming	L	T	P	C
Practicum		1	0	4	3

Text Book for Reference:

1. Introduction to Programmable Logic Controllers by G. Dunning, Thomson / Delmar Learning, New Delhi (3rd edition)
2. Madhuchhanda Mitra, Samarjit sen Gupta,"PLC and Industrial Automation and Introduction", Penram international Publishing (India) Pvt Ltd.
3. Programmable Logic Controllers by F.D.Petruzella, McGraw Hill India, New Delhi, 2003.

Web-based/Online Resources

- https://instrumentationtools.com/car-parking-system-plc-programming
- https://instrumentationtools.com/plc-program-water-level-control
- https://instrumentationtools.com/plc-program-conveyor-motor
- https://instrumentationtools.com/elevator-plc-ladder-logic

Equipment Required:

Sl.No.	Items Description	Quantity Required
1.	MODULE with Programmable Logic controller, Push Button/ Toggle switches, Pilot Lamp, provision to connect interface modules, Provision to connect with computer	05
2.	PC Pentium Dual core	10
3.	PC to PLC Interface cable	05
4.	ON- OFF Level control module to work with PLC	2
5.	Conveyor Control Module to work with PLC	2
6.	Lift control Module to work with PLC	2
7.	Car parking module to work with PLC	2

ICH585	MECHANICAL MEASUREMENTS AND INSTRUMENTATION PRACTICAL	L	T	P	C
Practical		0	0	4	2

Introduction:

Mechanical measurements and Instrumentation practical covers the topics of measurement of Variable related to Mechanical instrumentation and Analytical instrumentation. It gives detailed information to the students about the measurement of variables related to velocity, acceleration, force, torque, shaft power, Ph. This subject is designed to implement whatever is studied mechanical measurements and instrumentation theory subject including measuring force, velocity, displacement, distance, etc., using measuring instrumental setup and also to construct signal conditioning circuits and testing it.

Course Objective:

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

- Acquire skill on handling mechanical comparator and electronic comparator.
- Acquire skill on measuring speed, distance and acceleration using stroboscope, ultrasonic meter and piezo electric accelerometer.
- Acquire skill on measuring force and torque using strain gauge, Hydraulic load cell and torque meter.
- Acquire skill measuring the pH values and percentage of oxygen of given samples using pH electrode and Oxygen analyzer.
- Acquire skill on measuring the absorbance and transmittance of sample using spectrometer.

Course Outcomes:

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

CO1: measure fundamental parameters using comparators, stroboscopes, ultrasonic meters, accelerometers, etc.

CO2: analyze the oxygen content in the given sample using oxygen analyzer

CO3: conduct experiments for measurement of force, torque, power, pH, and absorbance.

Pre-requisites:

Industrial Instrumentation theory, Sensors and Transducers

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3			3				3	
CO2		3		3	3	3			
CO3				3		3			

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

ICH585	MECHANICAL MEASUREMENTS AND INSTRUMENTATION PRACTICAL	L	T	P	C
Practical		0	0	4	2

Assessment Methodology:

TYPE OF ASSESSMENT	DURATION (PERIODS)	MARKS	CONVERTED TO	MARKS	REMARKS
CAT I	2	50	10	10	50% of Exercises
CAT II	2	50	10	10	All Exercises
OBSERVATION				10	
RECORD				10	
	TOTAL			40	

SCHEME OF EVALUATION

CAT I AND CAT II EXAMINATION

PART	DESCRIPTION	MARKS
A	Drawing Circuit Diagram	20
B	Circuit Construction	15
C	Experimenting with Procedure	05
D	Readings Observed / Calculations / Graph	10
TOTAL		50

End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Experimental Setup Diagram	20
B	Experimenting with Procedure	15
4C	Readings Observed	10
D	Calculations / Graph	10
F	Viva voce	05
TOTAL		60

ICH585	MECHANICAL MEASUREMENTS AND INSTRUMENTATION PRACTICAL	L	T	P	C
Practical		0	0	4	2

Ex.No	Name of the Exercise	Hours
1	Find out the measurement of given component and compare with a standard component using mechanical comparator and slip rings	5
2	Construct and test an Electronic Comparator	5
3	Measurement of Angular speed using Stroboscope	5
4	Measurement of distance using Ultrasonic meter	5
5	Measurement of Acceleration using Piezo Electric Accelerometer	5
6	Measurement of force using Strain Gauge Load Cell	5
7	Measurement of force using Hydraulic Load Cell	5
8	Measurement of Torque	5
9	Measurement of shaft power using Rope brake Dynamometer	5
10	Measurement of pH value of various solutions using digital pH meter	5
11	Measurement of percentage of Oxygen of given sample using Oxygen analyzer	5
12	Measurement of Absorbance and Transmittance of test solutions using Spectrometers	5
TOTAL HOURS		**60**

ICH585	MECHANICAL MEASUREMENTS AND INSTRUMENTATION PRACTICAL	L	T	P	C
Practical		0	0	4	2

Equipment Required:

S.No	Item Description	Quantity Required
1	Dial Gauge	1
2	Stroboscope	1
3	Ultrasonic Distance meter	1
4	Piezo Electric accelerometer	1
5	Strain gauge load cell	1
6	Hydraulic load cell	1
7	Torsion meter	1
8	Digital PH meter	1
9	Oxygen Analyzer	1
10	Spectro meter	1
11	Rope Brake Dynamometer	1
12	CRO	1

ICH586	Embedded System Design with ARDUINO Practical	L	T	P	C
Practical		0	0	4	2

Introduction:

The Arduino platform has become quite popular with people just starting out with electronics. Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message and turn it into an output activating a motor, turning on an LED, publishing something online. Arduino is one of those Embedded System Devices (called as an Embedded Development Board), which got very famous in the maker's community due to its free and open-source nature. Instrumentation Engineers must be familiar with embedded system development.

Course Objectives:

The objective of this course is to enable the student to

- Gain Knowledge on Embedded system Design using ARDUINO
- Acquire skill on working with ARDUINO BOARD to embed the Arduino program into the Board to build applications
- Gain Skill on Programming the ARDUINO using C code for different applications
- Gain Skill on interfacing the various sensor and Actuator modules with ARDUINO board
- Gain Skill on building small applications using ARDUINO BOARD and ARDUINO IDE

Course Outcomes:

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

CO1: build embedded applications with ARDUINO board

CO2: develop C code to implement various applications using ARDUINO board

CO3: test ARDUINO Board interface with various sensor and actuator Modules

CO4: construct ARDUINO hardware for different measurement applications

CO5: design mini project for small applications using ARDUINO

Pre-requisite:

Sensors and Transducers Theory and Practical subject

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1			3	3					3
CO2			3	3	3	3			
CO3			3	3		3			
CO4		3	3	3					
CO5		3	3	3		3			

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

ICH586	Embedded System Design with ARDUINO Practical	L	T	P	C
Practical		0	0	4	2

Assessment Methodology:

TYPE OF ASSESSMENT	DURATION (PERIODS)	MARKS	CONVERTED TO	MARKS	REMARKS
CAT I	2	50	10	10	50% of Exercises
CAT II	2	50	10	10	All Exercises
OBSERVATION				10	
RECORD				10	
	TOTAL			40	

SCHEME OF EVALUATION

CAT I AND CAT II EXAMINATION

PART	DESCRIPTION	MARKS
A	Drawing Circuit Diagram	20
B	Circuit Construction	15
C	Experimenting with Procedure	05
D	Readings Observed / Calculations / Graph	10
TOTAL		50

End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Experimental Setup Diagram	20
B	Experimenting with Procedure	15
4C	Readings Observed	10
D	Calculations / Graph	10
F	Viva voce	05
TOTAL		60

ICH586	Embedded System Design with ARDUINO Practical	L	T	P	C
Practical		0	0	4	2

Ex.No.	Name of the Exercise	Hours
1	Familiarization of ARDUINO board, ARDUINO IDE and ARDUINO sketch. Develop c program to blink LED in the ARDUINO board	5
2	Construct a circuit to interface 16 X 2 LCD to ARDUINO hardware. Write a C program to display your name in the LCD.	5
3	Construct circuit using ARDUINO hardware and develop C program to measure unknown resistance and test it	5
4	Construct circuit using ARDUINO hardware and develop C program to measure temperature using LM35 temperature sensor and test it.	5
5	Construct circuit using ARDUINO hardware and develop C program to measure light intensity using LDR and test it	5
6	Construct circuit using ARDUINO hardware and develop C program to measure distance using ultrasonic distance sensor and test it	5
7	Construct circuit using ARDUINO hardware and develop C program to measure angular displacement using potentiometer sensor and test it	5
8	Construct circuit using ARDUINO hardware and develop C program to measure humidity using Humidity sensor and test it	5
9	Construct circuit using ARDUINO hardware and develop C program to detect motion using PIR sensor and test it	5
10	Construct circuit using ARDUINO hardware and develop C program to control speed, step and direction of Bipolar stepper motor	5
11	Construct circuit using ARDUINO hardware and develop C program to control Servo motor for angular positioning	5
12	Construct circuit using ARDUINO hardware and develop C program to control DC motor.	5
TOTAL HOURS		**60**

ICH586	Embedded System Design with ARDUINO Practical	L	T	P	C
Practical		0	0	4	2

Equipment Required:

Sl.No.	Name of the Equipments / Software	Quantity Required
1	ARDUINO Development Kit	As req.
2	Switches, sensors, 16 X 2 LCD, LED's, POT, LDR, PIR sensor, LM35 temperature sensor, HC-SR04 ultra sonic sensor, Humidity sensor, Stepper motor, servo motor, DC motor and Bread board	As req.
3	Arduino IDE open source software	-

ICH587	INDUSTRIAL POWER ELECTRONICS PRACTICAL	L	T	P	C
Practical		0	0	4	2

Introduction:

The objective of this practical session is to introduce students to the fundamental concepts and applications of power electronics in industrial settings. This practical aims to provide hands-on experience with power electronic devices, circuits, and systems commonly used in various industrial applications. It's essential to ensure proper safety precautions are followed when working with high-power electronic devices and circuits.

Course Objectives:

The objective of this course is to enable the student to

- Acquire skill on constructing and testing MOSFET and SCR based power circuits.
- Gain skill on constructing and testing single phase Converter and Chopper circuits
- Acquire skill on constructing and testing Inverter circuits
- Gain skill on Constructing and testing the open loop speed control of single phase AC motor
- Acquire skill on simulating three phase half controlled and fully controlled converter

Course Outcomes:

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

CO1: apply the principles of power electronics to control the speed of AC motors using open-loop methods.
CO2: implement bridge converter, inverter and chopper using appropriate circuits.
CO3: construct commutation circuits for SCR-based control systems.
CO4: simulate and analyze converter circuits (half and fully controlled) with different loads using Multisim.
CO5: test the firing circuit for SCR.

Pre-requisite:

Electronic devices and circuits, Industrial power electronics theory

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3			3					
CO2			3	3					
CO3			3	3				3	
CO4			3	3	3	3			
CO5			3	3	3				

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

ICH587	INDUSTRIAL POWER ELECTRONICS PRACTICAL	L	T	P	C
Practical		0	0	4	2

Assessment Methodology:

TYPE OF ASSESSMENT	DURATION (PERIODS)	MARKS	CONVERTED TO	MARKS	REMARKS
CAT I	2	50	10	10	50% of Exercises
CAT II	2	50	10	10	All Exercises
OBSERVATION				10	
RECORD				10	
	TOTAL			40	

SCHEME OF EVALUATION

CAT I AND CAT II EXAMINATION

PART	DESCRIPTION	MARKS
A	Drawing Circuit Diagram	20
B	Circuit Construction	15
C	Experimenting with Procedure	05
D	Readings Observed / Calculations / Graph	10
TOTAL		50

End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Experimental Setup Diagram	20
B	Experimenting with Procedure	15
C	Readings Observed	10
D	Calculations / Graph	10
F	Viva voce	05
TOTAL		60

ICH587	INDUSTRIAL POWER ELECTRONICS PRACTICAL	L	T	P	C
Practical		0	0	4	2

Ex. No.	Name of the Experiment	Hours
1	Obtain the VI Characteristics of MOSFET.	5
2	Construct and test the RC firing circuit for SCR.	5
3	Construct and test a single phase Half Controlled Bridge converter with resistive load.	5
4	Construct and test a single phase Fully Controlled Bridge converter with resistive load.	5
5	Construct and test a PWM based DC Chopper using MOSFET/ IGBT.	5
6	Construct and test a Step-up Chopper.	5
7	Construct and test the SCR Commutation circuits.	5
8	Construct and test a single phase inverter.	5
9	Construct and test the single phase parallel inverter using MOSFET	5
10	Construct and test the open loop speed control of single phase AC motor.	5
11	Simulate the three phase half controlled converter with R load.	5
12	Simulate the three phase fully controlled converter with R load.	5
	TOTAL HOURS	**60**

ICH587	INDUSTRIAL POWER ELECTRONICS PRACTICAL	L	T	P	C
Practical		0	0	4	2

Equipment Required:

S No	Name of the Equipment / Software	Required No's
1.	Characteristics of MOSFET Trainer Kit	1
2.	RC Firing Circuit for SCR Trainer Kit	1
3.	Single Phase Half Controlled Bridge Converter with R load Trainer Kit	1
4.	Single Phase Fully Controlled Bridge Converter with R load Trainer Kit	1
5.	PWM based Step down DC Chopper using MOSFET / IGBT Trainer Kit	1
6.	SCR Commutation Circuit Trainer Kit	1
7.	Step up Chopper Trainer Kit	1
8.	Single Phase Inverter Trainer Kit	1
9.	Single Phase Parallel Inverter using MOSFET / IGBT Trainer Kit	1
10.	Open Loop Speed Control of Single-phase AC motor Trainer Kit	1
11.	Simulation Software- PSpice/ MultiSIM / MATLAB	--
12.	20 MHz Dual Trace CRO with suitable probes	4

ICH588	Virtual Instruments and Measurements Practical	L	T	P	C
Practical		0	0	4	2

Introduction:

Virtual instrumentation refers to the use of software-based tools and algorithms to emulate traditional hardware instruments, such as oscilloscopes, signal generators, and data loggers, typically for measurement and control applications**.** Traditional hardware instruments can be expensive, especially when multiple instruments are needed for various measurements. Virtual instrumentation allows students to access a wide range of instruments and functionalities without the need for physical hardware, significantly reducing costs for educational institutions. Incorporating practical exercises based on virtual instrumentation can enhance students' understanding of fundamental principles, promote hands-on learning experiences, and prepare them for careers in fields where measurement and control are essential components.

Course Objectives:

The objective of this course is to enable the student to

- Create Virtual Instrument for measuring purpose
- Create virtual Instrument with User friendly interface in the front panel
- Create Block diagram-based program to define the function of instrument
- Create Block diagram using graphical programming tool
- Create Virtual Instrument to measure, Indicate, control applications
-

Course Outcomes:

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

CO1: design virtual instruments with LabVIEW software.

CO2: create front panel and block diagram for simple applications.

CO3: construct virtual calculator, virtual CRO and logic gates.

CO4: implement control application using virtual instruments.

Prerequisite:

Sensors and Transducers Theory and Practical subject

CO/PO Mapping

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

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

ICH588	Virtual Instruments and Measurements Practical	L	T	P	C
Practical		0	0	4	2

Assessment Methodology:

TYPE OF ASSESSMENT	DURATION (PERIODS)	MARKS	CONVERTED TO	MARKS	REMARKS
CAT I	2	50	10	10	50% of Exercises
CAT II	2	50	10	10	All Exercises
OBSERVATION				10	
RECORD				10	
	TOTAL			40	

SCHEME OF EVALUATION

CAT I AND CAT II EXAMINATION

PART	DESCRIPTION	MARKS
A	Drawing Circuit Diagram	20
B	Circuit Construction	15
C	Experimenting with Procedure	05
D	Readings Observed / Calculations / Graph	10
TOTAL		50

End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Experimental Setup Diagram	20
B	Experimenting with Procedure	15
4C	Readings Observed	10
D	Calculations / Graph	10
F	Viva voce	05
TOTAL		60

ICH588	Virtual Instruments and Measurements Practical	L	T	P	C
Practical		0	0	4	2

Ex.No.	Name of the Experiment	Hrs.
1	Design a VI to simulate full adder and full subtractor.	5
2	Design a VI to convert industrial standard pressure to current and current to pressure.	5
3	Design a VI to find the sum of N natural numbers using while loop.	5
4	Design a VI to find the factorial of a given number using For loop.	5
5	Design a VI to find the maximum and minimum value of an array.	5
6	Design a VI to Sort even numbers using while loop.	5
7	Create a VI to simulate a simple calculator which performs addition, subtraction, multiplication and division using case structure.	5
8	Create a VI to generate sinewave using formula node.	5
9	Design a VI to generate and measure various types of signals.	5
10	Design virtual CRO capable of addition of two waveforms with front panel and block diagram.	5
11	Design front panel and block diagram to simulate logic gate functions: AND, OR, NOT, NAND, NOR, EX-OR and EX-NOR.	5
12	Design front panel and block diagram to simulate tank control system.	5
TOTAL HOURS		**60**

Equipment Required:

Sl.No	Item Description	Range	Quantity Required
1.	Desktop / Laptop Computer	-	10
2.	LABVIEW software	-	-
3.	LASER Printer	-	1
4	UPS 5 KVA with One Hour Backup	-	1

ICH573	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 student with practical skills necessary to navigate the complexities of the business world. This also empowers students to become an Innovator or Entrepreneur. With necessary tools and knowledge, educational institutions are preparing the next generation of entrepreneurs to tackle the challenges and opportunities that lie ahead. This syllabus will explore the different facets of innovation, including its importance, types and strategies for fostering a culture of innovation within organizations

Course Objectives

The objective of this course is to enable the students

- 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 students should be able to

CO 1: Differentiate between Innovation and Start-ups

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

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

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

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

Pre-requisites:

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

CO/PO Mapping

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

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

Assessment Methodology

	Continuous Assessment (40 marks)			End Semester Examination (60 marks)
	CA1	**CA2**	**CA3**	
Mode	Class Assessment (Unit I,II & Unit III)	Seminar Presentations (Unit IV)	Submission of Industry Visit Project Report (Unit V)	Practical Examination (Project)
Duration	2 hours	---	---	3 hours
Exam Marks	50	20	30	100
Converted to	10	10	20	60
Marks	**10**	**10**	**20**	**60**

Continuous Assessment - 40 marks

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

ICH573	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.		6
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.		6
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.		6
UNIT IV		
All the students have to select a minimum of 2 topics from the list given below. They are expected to collect the resources with the help of faculty assigned to them to prepare PPTs for presentation 1. Idea Generation. 2. Innovation Management. 3. Product Development. 4. Business Model Innovation.		9

5. Organizational Culture and Change Management. 6. Leadership and Innovation. 7. Barriers to Innovation. 8. Innovation Marketing. 9. E-Commerce success stories (any one). 10. Role of Start-ups in Higher Education. 11. Professional Networking in Building Brands. 12. How to start a start-up in India.		
UNIT V	**EXPOSURE TO INDUSTRY**	
All the students should visit and study the nearby industries, incubation centres, start-ups etc., and select any one to prepare a project report which covers the Name of the Industry/Organization, Introduction of the Industry, Type of the Industry, Scope of the Industry, Plant Layout and Location, Details of Plant and Machineries, Process flow chart, Manufacturing Methods, Process of Manufacturing, Product Manufacturing, Quality Control, Marketing, Product selling - Conclusion.		**18**
	Total	**45**

End Semester Examination - Project Exam

S. No	Description	Marks
1	Written examination-Unit-I, II&III Theory questions 10 questions Out of 15 questions (10x2=20 marks)	20
2	Presentation of industrial visit project report	10
3	Interaction And Evolution	20
	TOTAL	**60**

ICH574	Industrial Training	Summer vacation	C
internship			2

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 professionals 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

CO 1: Demonstrate proficiency in using industrial machinery, tools, and software.

CO 2: Able to identify, analyze, and solve engineering problems using industry-standard methods and practices.

CO 3: Gain a comprehensive understanding of industrial manufacturing processes, quality control, and safety practices.

CO 4: Exhibit improved communication, teamwork, and professional behavior in an industrial setting.

CO 5: Apply theoretical concepts learned in their coursework to practical engineering tasks and projects.

Duties Responsibilities of the Faculty Mentor.

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

Pre-Training Responsibilities:

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

During Training Responsibilities:

4. Monitoring and Support:
    - Regularly monitor the progress of students during their industrial training. Maintain communication with both students and industry supervisors to track performance and address any issues that may arise.
    - Provide ongoing support and guidance to students, offering advice on technical challenges, professional conduct, and workplace etiquette.
5. Technical Guidance:

- Offer technical guidance and mentorship related to the specific engineering discipline or specialization of the students. Help them apply theoretical knowledge to practical situations encountered in the industry.

6. Problem-Solving Assistance:
    - Assist students in overcoming obstacles or challenges encountered during their training. Encourage them to develop problem-solving skills and resilience in real-world engineering scenarios.
7. Feedback and Evaluation:
    - Provide constructive feedback on students' performance based on reports, assessments, and observations gathered from industry supervisors.
    - Evaluate students' achievements in relation to their training objectives and competencies developed during the program.

Post-Training Responsibilities:

8. Reflection and Debriefing:
    - Conduct debriefing sessions with students to reflect on their training experiences, discuss lessons learned, and identify areas for further improvement.
    - Help students articulate their learning outcomes and how these experiences contribute to their professional growth.
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 organisation where the training was undergone after attestation by the supervisors. The comprehensive report should incorporate study of plant / product / process / construction along with intensive in-depth study on any one of the topics such as processes, methods, tooling, construction and equipment, highlighting aspects of quality, productivity and system. The comprehensive report should be completed in the last week of Industrial training. Any data, drawings etc. should be incorporated with the consent of the Organisation.

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)	5
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.	5
E	Report and Presentation.	10
Total		50 40

End Semester Examination - Project Exam

Sl.No.	Description	Marks
A	Daily activity report and attendance certificate	10
B	Comnprehensive report on internship, relevant internship certificate	10
C	Presentation by the student at the end of the Internship	20
D	Viva voce	20
Total		**60**

ICH681	Advanced Engineering Mathematics	L	T	P	C
Theory		3	0	0	3

Introduction

Mathematics is essential for engineering students to understand core engineering subjects. It provides the framework for engineers to solve problems in engineering domains. This course is designed to bridge the gap between diploma mathematics and B.E/B.Tech mathematics in matrix algebra, differential calculus, vector calculus, differential equations, and Laplace transforms.

Course Objectives

The objective of this course is to enable the students to

1. Understand the concepts of eigen-values and eigen-vectors of matrices.
2. Learn the notation of partial differentiation and determine the extremities of functions of two variables.
3. Acquire knowledge in vector calculus which is significantly used to solve engineering problems.
4. Formulate and solve differential equations.
5. Understand Laplace transformation and its engineering applications.

Course Outcomes

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

CO1: apply the knowledge of partial differentiation to evaluate Jacobian and extremities of two variable functions.

CO2: evaluate eigenvalues and corresponding eigenvectors of a square matrix.

CO3: determine the gradient of a scalar field, the divergence and curl of vector fields.

CO4: solve ordinary differential equations using various techniques.

CO5: implement Laplace transforms to solve first-order ordinary differential equations.

Pre-requisites

Matrices, Determinants, Differentiation, Integration and Vector Algebra.

ICH681	Advanced Engineering Mathematics	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

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

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

Instructional Strategy

- A theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome-based.
- All demonstrations/Hands-on practices might be under a simulated environment.
- Use an inducto-deductive approach to achieve the desired learning objectives.
- Use open-ended questions to nurture the problem-solving and reasoning skills among students.
- Support and guide the students for self-study.
- State the need for mathematics with engineering studies and provide real-life examples.

ICH681	Advanced Engineering Mathematics	L	T	P	C
Theory		3	0	0	3

Assessment Methodology:

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) -10 marks	10 Marks
	During the semester	Subject/ General		
Total				40 Marks

ICH681	Advanced Engineering Mathematics	L	T	P	C
Theory		3	0	0	3

Unit I	EIGENVALUES AND EIGENVECTORS	
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.		7
Unit II	**FUNCTIONS OF SEVERAL VARIABLES**	
Partial derivatives of two variable and three variable functions (up to second order) – Homogeneous functions and Euler's theorem (excluding proof) – Jacobian matrix and determinant – Maxima and minima of functions of two variables – Simple problems.		7
Unit III	**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.		7
Unit IV	**DIFFERENTIAL EQUATIONS**	
Differential equation – Formation – Order and degree – Solution of a differential equation – Equations of first order and first degree – Variable separable method – Leibnitz's Linear equations – Second order equations of the form $(aD^2 + bD + c)y = e^{nx}$ where a, b, c and n are constants and the auxiliary equation $(am^2 + bm + c = 0)$ has only real roots – Complementary function – Particular integral – General solution – Simple problems.		7
Unit V	**LAPLACE TRANSFORMS**	
Definition of Laplace transform – Laplace transforms of standard functions - Linearity and change of scale property (excluding proofs) – First shifting property – Laplace transforms of derivatives – Properties (excluding proofs) – Inverse Laplace transforms – Properties (excluding proofs) – Solving first order ordinary differential equation using Laplace transforms – Simple problems.		7
	Revision + Test	10
	TOTAL HOURS	45

Suggested list of Students Activity,

- Demonstrate the applications of eigen-values in stability analysis, decouple of three-phase systems and vibration analysis.

ICH681	Advanced Engineering Mathematics	L	T	P	C
Theory		3	0	0	3

- 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.

Reference Books:

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

Web Reference

1. https://www.khanacademy.org/math/
2. https://www.mathportal.org/
3. https://openstax.org/subjects/math/
4. https://www.mathhelp.com/
5. https://www.geogebra.org/
6. https://www.desmos.com/
7. https://phet.colorado.edu/

ICH682	Entrepreneurship	L	T	P	C
Theory		3	0	0	3

Introduction

Development of a diploma curriculum is a dynamic process responsive to the society and reflecting the needs and aspirations of its learners. Fast changing society deserves changes in educational curriculum particularly to establish relevance to emerging socio-economic environments; to ensure equity of opportunity and participation and finally promote concern for excellence. In this context the course on entrepreneurship and start ups aims at instilling and stimulating human urge for excellence by realizing individual potential for generating and putting to use the inputs relevant to social prosperity and thereby ensuring good means of living for every individual, providing jobs and developing the Indian economy.

Course Objectives

After completing this subject, the student will be able to

- Acquire entrepreneurial spirit and resourcefulness
- Familiarize Acquire knowledge about the business idea and product selection
- Analyze the banking and financial institutions
- Understand the pricing policy and cost analysis
- Get knowledge about the business plan preparation

Course Outcomes

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

CO1: explain the process of entrepreneurship

CO2: analyse the importance of generation of ideas and product selection

CO3: categorize various financial and non-financial schemes

CO4: estimate various cost components to arrive the pricing of product

CO5: compose project feasibility report

Pre-requisites

Knowledge of basics of Engineering and Industrial engineering

ICH682	Entrepreneurship	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

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

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

Instructional Strategy

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

ICH682	Entrepreneurship	L	T	P	C
Theory		3	0	0	3

Assessment Methodology:

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

ICH682	Entrepreneurship	L	T	P	C
Theory		3	0	0	3

Unit I	Entrepreneurship – Introduction and Process	
Concept of entrepreneurship - Importance, Myths about Entrepreneurship, Pros and Cons of Entrepreneurship, Process of Entrepreneurship, Competencies and characteristics of an entrepreneur -, Ethical Entrepreneurship, Entrepreneurial Values and Attitudes, Creativity, Innovation and entrepreneurship- Entrepreneurs - as problem solvers, Mindset of an employee and an entrepreneur, - Risk Taking-Concepts		7
Unit II	**Business Idea**	
Types of Business: Manufacturing, Trading and Services, Stakeholders: sellers, vendors and consumers and Competitors, E- commerce Business Models, business idea generation -Types of Resources - Human, Capital and Entrepreneurial tools and resources, etc.,- setting business goals- Patent, copyright and Intellectual property rights, Customer Relations and Vendor Management, -Business Ideas vs. Business Opportunities, Opportunity – SWOT ANALYSIS of a business idea - Business Failure – causes and remedies.- Types of business risks,		7
Unit III	**Banking**	
Size and capital based classification of business enterprises- Role of financial institutions, Role of Government policy, Entrepreneurial support systems, Incentive schemes for state government, and Incentive schemes for Central governments.		7
Unit IV	**Pricing and Cost Analysis**	
Types of Costs - Variable - Fixed- Operational Costs - Break Even Analysis - for single product or service, -financial Business Case Study, Understand the meaning and concept of the term Cash Inflow and Cash Outflow- Pricing- Calculate Per Unit Cost of a single product, , Understand the importance and preparation of Income Statement, Prepare a Cash Flow Projection- Factors affecting pricing.- GST.		7

ICH682	Entrepreneurship	L	T	P	C
Theory		3	0	0	3

Unit V	Business Plan Preparation	
Feasibility Report – Technical analysis, financial analysis- Market Research - Concept, Importance and Process- tools for market research- Market Sensing and Testing, Marketing and Sales strategy, Digital marketing, Branding - Business name, logo, tag line, Promotion strategy, Business Plan Preparation, -Concept and Importance, , Execution of Business Plan.		7
	Revision + Test	10
	TOTAL HOURS	45

Suggested list of Students Activity.

1. Students can explore app development or web design. They'll learn about technology, user experience, and marketing.
2. Hosting events, workshops, or conferences allows students to practice project management, networking, and marketing skills.
3. Encourage students to address social or environmental issues through innovative business solutions. This fosters empathy and creativity.
4. Part of entrepreneurship clubs or organizations provides networking opportunities, mentorship, and exposure to real-world challenges.
5. Competitions like business plan contests or pitch events allow students to showcase their ideas and receive feedback.
6. Students can create and sell handmade crafts, artwork, or other products. This teaches them about production, pricing, and customer relations.
7. Students can provide consulting services in areas they're knowledgeable about, such as social media marketing or financial planning.
8. Encourage students to create and manage their own small business or offer freelance services. This hands-on experience helps them understand various aspects of entrepreneurship.

ICH682	Entrepreneurship	L	T	P	C
Theory		3	0	0	3

Text and Reference Books:

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

Web Reference:

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

ICH683	Project Management	L	T	P	C
Theory		3	0	0	3

Introduction

Project management is the systematic application of knowledge, skills, tools, and techniques to project activities to meet specific project requirements. It involves planning, organizing, and managing resources to achieve project goals within defined scope, time, and budget constraints. Project management encompasses several key processes and phases, including initiation, planning, execution, monitoring and controlling, and closing. It is essential across various industries to ensure projects are completed successfully, efficiently, and effectively, aligning with organizational objectives and stakeholder expectations. Project managers play a crucial role in leading teams, managing risks, ensuring quality, and communicating with stakeholders to drive project success.

Course Objectives

After completing this subject, the student will be able,

- To understand the concept, characteristics and elements of projects.
- To understand the stages in Project Life Cycle.
- To appreciate the need for Project Portfolio Management System.
- To know the considerations in choosing appropriate project management structure.
- To understand the components of techno-economic feasibility studies.
- To know about the detailed project report
- To learn about project constraints.
- To understand the techniques of evaluation.
- To get insight into the Social Cost Benefit Analysis Method.
- To know how to construct project networks using PERT and CPM.
- To learn how to crash project networks
- To understand the meaning of project appraisal.
- To understand the meaning of project audits.
- To know the qualities of an effective project manager.
- To understand the stages in the Team Development model.

ICH683	Project Management	L	T	P	C
Theory		3	0	0	3

Course Outcomes

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

CO1: discuss the principles of Project Management

CO2: plan project schedules.

CO3: take part in project commitments.

CO4: choose enterprise support.

CO5: compile Detailed Project Report (DPR).

Pre-requisites

Basic Knowledge.

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO 2
CO1	3					3		2	
CO2		3							
CO3			3						
CO4		3							
CO5		3							

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

Instructional Strategy

- It is advised that teachers take steps to pique pupils' attention and boost their curiosity to learn.
- Implement task-based learning activities where students work on specific tasks or projects.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- All demonstrations/Hand-on practices may be followed in the real environment as far as possible.

ICH683	Project Management	L	T	P	C
Theory		3	0	0	3

Assessment Methodology:

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

ICH683	Project Management	L	T	P	C
Theory		3	0	0	3

Unit I	Project Management – An Overview, Project Portfolio Management System and Structure, Steps in Defining Project and Project Delays	
Project – Classification – Importance of Project Management – An Integrated Approach – Project Portfolio Management System – The Need – Choosing the appropriate Project Management Structure: Organizational considerations and project considerations – steps in defining the project – project Rollup – Process breakdown structure – Responsibility Matrices – External causes of delay and internal constraints.		7
Unit II	**Various Stages and Components of Project Feasibility Studies, Phases of a Project, Stages in Project Life Cycle and Project Constraints**	
Project feasibility studies - Opportunity studies, General opportunity studies, specific opportunity studies, pre-feasibility studies, functional studies or support studies, feasibility study – components of project feasibility studies – Managing Project resources flow – project planning to project completion: Pre-investment phase, Investment Phase and operational phase – Project Life Cycle – Project constraints.		7
Unit III	**Project Evaluation under Certainty and Uncertainty, Project Evaluation, Commercial and Social Cost Benefit Analysis**	
Project Evaluation under certainty - Net Present Value (Problems - Case Study), Benefit Cost Ratio, Internal Rate of Return, Urgency, Payback Period, ARR – Project Evaluation under uncertainty – Methodology for project evaluation – Commercial vs. National Profitability – Social Cost Benefit Analysis, Commercial or National Profitability, social or national profitability.		7

ICH683	Project Management	L	T	P	C
Theory		3	0	0	3

Unit IV	Developing Project Network using PERT and CPM, Project Appraisal and Control Process.	
Developing a Project Plan - Developing the Project Network – Constructing a Project Network (Problems) – PERT – CPM – Crashing of Project Network (Problems - Case Study) – Resource Leveling and Resource Allocation – how to avoid cost and time overruns – Steps in Project Appraisal Process – Project Control Process – Control Issues – Project Audits – the Project Audit Process – project closure – team, team member and project manager evaluations.		7
Unit V	**Project Managing Versus Leading of Project, Qualities of Project Manager and Managing Project Teams, Team Building Models and Performance Teams and Team Pitfalls.**	
Managing versus leading a project - managing project stakeholders – social network building (Including management by wandering around) – qualities of an effective project manager – managing project teams – Five Stage Team Development Model – Situational factors affecting team development – project team pitfalls.		7
	Revision + Test	10
	TOTAL HOURS	45

Suggested list of Students Activity,

Project Simulation and Role-Playing:

- Activity: Participate in simulated project scenarios where students take on different roles within a project team (e.g., project manager, team member, stakeholder).
- Purpose: This helps students understand the dynamics of project management, including leadership, communication, and team collaboration.

ICH683	Project Management	L	T	P	C
Theory		3	0	0	3

Case Study Analysis:

- Activity: Analyze real-world case studies of successful and failed projects.
- Purpose: This activity enables students to apply theoretical knowledge to practical situations, identify best practices, and learn from the challenges and solutions implemented in real projects.

Project Plan Development:

- Activity: Develop a comprehensive project plan for a hypothetical or real project, including scope, schedule, budget, risk management, and quality management plans.
- Purpose: This allows students to practice creating detailed and structured project plans, honing their skills in planning and organizing project activities.

Group Project:

- Activity: Work in teams to manage a project from initiation to closure, simulating a real project environment.
- Purpose: Group projects help students learn how to work collaboratively, manage group dynamics, and apply project management tools and techniques in a team setting.

Project Management Software Training:

- Activity: Gain hands-on experience with project management software such as Microsoft Project, Asana, or Trello.
- Purpose: This activity equips students with practical skills in using technology to plan, track, and manage project tasks and resources efficiently.

Reference Books:

1. Clifford F. Gray And Erik W. Larson, Project Management – The Managerial Process, Tata Mcgraw Hill.
2. Dragan Z. Milosevic, Project Management Toolbox: Tools And Techniques For The Practicing Project Manager,
3. Gopalakrishnan, P/ Ramamoorthy, V E, Textbook Of Project Management, Macmillan India. Ltd.
4. Harold Kerzner, Project Management: A Systems Approach To Planning, Scheduling, And Controlling, Eighth Edition, John Wiley & Sons
5. Jason Charvat, Project Management Methodologies: Selecting, Implementing, And Supporting Methodologies And Processes For Projects, John Wiley & Sons

ICH683	Project Management	L	T	P	C
Theory		3	0	0	3

6. Kevin Forsberg, Ph.D, Hal Mooz, Visualizing Project Management: A Model For Business And Technical Success, Second Edition, Pmp And Howard Cotterman, John Wiley & Sons.

Web Reference

https://youtu.be/pc9nvBsXsuM

NPTEL Courses

https://youtu.be/PqQqTAu_FiM

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ICH684	Medical Instrumentation	L	T	P	C
Theory		3	0	0	3

Introduction:

Bio medical engineering education is in the growing stage. But every year, there is a tremendous increase in the use of modern medical equipment in the hospital and health care industry therefore it is necessary for every student to understand the functioning of different medical equipment. This course is to enable the students to learn the basic principles of different bio medical instruments and clinical measurement, Bio-medical recorders, Therapeutic instruments, Biotelemetry and Modern imaging techniques instruments.

Course Objectives:

The objective of this course is to enable the students to

- Acquire Knowledge on the generation of Bio-potential and its measurement using various electrodes.
- Gain Knowledge on the working principles of operations of ECG recorder, EEG recorder and EMG recorder.
- Acquire Knowledge on the working principles of audio meter, pacemaker and ventilators.
- Gain knowledge about the importance of patient safety and various methods of accident prevention.
- Acquire knowledge on the basic principle of CT, MRI scanner and operation of various imaging techniques.

Course Outcomes:

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

CO1: apply the principles of bio-potential generation and identify various electrodes and clinical measurement techniques for monitoring physiological parameters.

CO2: analyze the structure and function of bio-telemetry systems and evaluate methods to ensure patient safety against electrical hazards.

CO3: explain the working principles and configuration of diagnostic instruments like ECG, EEG, EMG, ERG, and audiometers.

CO4: discuss therapeutic instruments such as pacemakers, defibrillators, dialysis machines, and heart-lung machines.

CO5: elaborate the working principles of modern imaging techniques such as X-ray, CT, MRI, ultrasound, and laser-based medical devices.

Pre-requisites:

Basics of Electronics & Instrumentation, Electronic devices and circuits, Analog and digital electronic circuits.

ICH684	Medical Instrumentation	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping:

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

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

Instructional Strategy:

- It is advised that teachers must use different teaching methods to stimulate the interest of students in learning.
- To help students to learn different types of Diagnostic and Therapeutic equipment, Teachers should use PPT presentation of image and to show video of application of the Diagnostic and Therapeutic Equipment. Also, should explain examples from daily life, realistic situations, and visit hospitals and demonstrate the equipment.
- Students may be shown all the Diagnostic, Therapeutic, and operating theater equipment in the lab. The demonstration can make the subject exciting and foster in.
- The students have a scientific mind set. Student activities should be planned on all the topics.
- Demonstration method may be used with step-by-step procedure to use the diagnostic equipment to diagnose the disease in a human body.
- Teachers are advised to follow an inductive strategy to help the students to discover the working principle of various diagnostic and therapeutic instruments.

ICH684	Medical Instrumentation	L	T	P	C
Theory		3	0	0	3

Assessment Methodology:

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

ICH684	Medical Instrumentation	L	T	P	C
Theory		3	0	0	3

Unit I	PHYSIOLOGICAL & CLINICAL MEASUREMENTS	
	Bio Potential and Electrodes: Components of human instrument system – Bio-potential and their generation – resting & action potential. Electrodes -Micro- Skin Surface – Needle electrodes. **Clinical Measurements:** Measurement of blood pressure – Direct method- indirect Method – Blood flow meter - Electromagnetic blood flow meter- Ultrasonic blood flow meter. Measurement of blood pH – CO_2 method of respiration rate – Lung Volume – Heart rate	9
Unit II	**DIAGNOSTIC INSTRUMENTS**	
	Electro cardiograph: 12 Lead systems – ECG recorder – analysis of ECG waves. **Electro Encephalograph:** 10-20% lead System - EEG recorder- EEG wave types **Electro Myograph:** EMG Waves - EMG Recording unit - Measurement of conduction velocity. **Electro Retinograph :** ERG Recording Unit – ERG waves. **Audiometer:** Basic Audiometer Block diagram - Types	9
Unit III	**THERAPEUTIC INSTRUMENTS**	
	Cardiac pacemaker: Need for pacemaker – Classification – External pacemaker – Implantable pacemaker – Programmable pacemaker. **Cardiac Defibrillators:** Need for defibrillators – Types – AC defibrillators - DC Defibrillators. **Heart lung Machine**: Block Diagram - Oxygenators – Blood pumps. **Dialysis**: Hemo dialysis – peritoneal dialysis – Working	9
Unit IV	**BIO – TELEMETRY AND PATIENT SAFETY**	
	Bio – Telemetry: Introduction to Bio telemetry - Physiological parameter adaptable to bio telemetry - components of a bio telemetry system – Application of bio telemetry. **Patient Safety:** Physiological effects of electric current – Electrical Shock Hazards-Micro shock – Macro shock- Methods of accident Prevention against electric hazards – GFI – equi potential grounding system.	9
Unit V	**MODERN IMAGING TECHNIQUES**	
	Laser: Laser – Properties - principles - application of laser in medicine. Operation of Co_2 Laser & ND – YAG Laser. **X –Ray:** X-Ray apparatus – Block Diagram – operation - Angiography – CT Scanner. **Ultrasonic imaging Technique**: Echo cardiography – Working – Operating modes **Magnetic resonance imaging Technique**: MRI Scan Principles - Working	9
	TOTAL HOURS	45

ICH684	Medical Instrumentation	L	T	P	C
Theory		3	0	0	3

Suggested List of Activities (upgraded):

- Students can view the video in YouTube on different kind of Medical instruments being used in hospitals
- Student can view the procedure of using the Medical instruments in the hospital to Patients in the video
- Students can visit hospital and can observe the different kind of Medical instruments being used in hospital for diagnosing and therapeutic purpose.
- Student can try to open the old medical instruments and see the inner parts and circuits and try to debug the problem.
- Students have to practice the design and construction of Medical electronics circuits
- Student can read Magazines related to Bio medical equipment in online or in offline
- Students have to practice to measure Blood pressure using Sphygmomanometer, can practice to take ECG, EEG with the concerned equipment.

Text Books for Reference:

1. Dr. M. Arumugam – Biomedical Instrumentation, Anuradha Publications, Chennai
2. Medicine and clinical Engineering, Jacobson and Webstar, Prentice-Hall
3. Introduction to Biomedical Instrumentation, Mandeep Singh, PHI Learning Pvt. Ltd, 2nd edition 2010.

ICH685	Industrial Automation and Drives	L	T	P	C
Theory		3	0	0	3

Introduction:

Fundamental knowledge in the field of Industrial Automation and Drives are essential for Instrumentation Engineers. As most of the devices are electrical and electronics based, the student is required to develop a basic understanding of the concepts and related terms of automation, Pneumatics, Hydraulics, and Industrial Drives which is in this backdrop that this course has been designed. An Instrumentation Engineer must be familiar with the basics of Industrial Automation, Pneumatics and Hydraulics Systems, Components of Automation and Electrical Safety which is also be dealt in this subject.

Course Objectives:

The objective of this course is to enable the students to

- Acquire knowledge on different types of automation, various components and levels of Industrial automation.
- Gain Knowledge on Pneumatic System and various types of valves, speed Control of Pneumatic Circuits.
- Acquire knowledge on Hydraulic System and the various types of hydraulic accumulators, speed Control of Hydraulic Circuits.
- Illustrate the Parts, various types of Electric drives and construction working of Stepper motor and Servo motors.
- Identify the various circuit breaker, Sensors in Automation and Analyze the safety precaution in Industry.

Course Outcomes:

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

CO1: identify the different circuit breakers, sensors, and electrical safety methods in industry.

CO2: analyze the different elements of Pneumatic and Hydraulic systems

CO3: discuss the types of accumulators in Hydraulic systems, control valves of Pneumatic systems and its speed control methods.

CO4: select required types of drives and special motors.

CO5: explain the different types and Components of automation in Industry.

Pre-requisites:

Electrical circuits and machines & Instrumentation Fundamentals.

ICH685	Industrial Automation and Drives	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping:

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

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

Instructional Strategy:

- It is advised that teachers must use different teaching methods to stimulate the interest of students in learning.
- To help students to learn different types of automation. Teachers should use PPT presentation of image, symbol of components and to show video of application of the components.
- Also, should explain examples from daily life, realistic situations, and real-world engineering and technological applications.
- Students may be shown all the Pneumatics and Hydraulics components, Electrical drives, and Sensor in the lab. The demonstration can make the subject exciting and foster in the students a scientific mind set. Student activities should be planned on all the topics.
- Demonstration method may be used with step-by-step procedure to demonstrate the working of motors.
- Teachers are advised to follow inductive strategy to help the students to discover the working principle of Pneumatics and Hydraulics components, Electrical drives and Sensor.
- Do not let incidents work on an activity or an experiment with the expected outcome, rather allow students to be honest about whatever the results of the experiment are. If the results are different from the expectations, students should do an analysis where could be the source of error, if any?

ICH685	Industrial Automation and Drives	L	T	P	C
Theory		3	0	0	3

Assessment Methodology:

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

ICH685	Industrial Automation and Drives	L	T	P	C
Theory		3	0	0	3

Unit I	BASICS OF INDUSTRIAL AUTOMATION	
Automation - Definition – Types of automation in Industry – Requirements of automation – Components of Industrial Automation- Industrial automation levels- Advantages and Disadvantages of automation-` Applications of Industrial Automation – List of various Latest Automation Technologies.		9
Unit II	**PNEUMATIC SYSTEMS**	
Pneumatic system - Introduction - Elements of Pneumatic power supply – FRL Unit - Pressure control valves - Pressure relief valve - Pressure reducing valve - Directional control valve (DCV) - Poppet and spool valve - 3/2 DCV - 4/3 DCV - 5/2 DCV - Valve symbols- working-Applications of pneumatic systems. Pneumatic circuits – Speed Control of a single acting cylinder and Double acting cylinder with meter in and meter out circuits.		9
Unit III	**HYDRAULIC SYSTEMS**	
Hydraulic system – Introduction–Elements of Hydraulic power supply – Hydraulic accumulators – Definition - Types – Weight of gravity type accumulator – Spring loaded type accumulator - Gas filled accumulator – Applications of Hydraulic systems- Comparison between hydraulic and Pneumatic Systems. Hydraulic circuits – Double acting cylinder with meter in and meter out circuits		9
Unit IV	**INDUSTRIAL DRIVES**	
Electric drive - Definition - Parts - Types - Individual - Group - Multi motor-Comparisons of Electric Drives - Block diagram of Variable Frequency Drive (VFD) Selection factors of motor- Stepper Motor-Types – VR stepper motor - Construction - Working Principle - Applications- Servo motor- Permanent magnet Servo motor- Brushless Servo motor-Construction –working- Applications.		9

ICH685	Industrial Automation and Drives	L	T	P	C
Theory		3	0	0	3

Unit V	AUTOMATION COMPONENTS AND ELETRICAL SAFETY	
	Automation Components: Sensors- Temperature Sensor - Proximity Sensor- Pressure Sensor- Level Sensor - Infrared Sensor **Electrical safety**: Circuit breakers- Miniature Circuit Breaker (MCB)- Earth Leakage Circuit Breaker (ELCB) - Earthing – Need for Earthing-Types of earthing - Electric shock- first aid, precautions - causes of accident and their preventive measures.	9
	TOTAL HOURS	**45**

Suggested List of Students Activity (Ungraded)

- Check the web portal for Image and video of different types of Automation, Pneumatics Components, Sensors and Electric drives.
- Periodical quizzes should be conducted on a a weekly/fortnightly basis to reinforce the valve symbols, image of different types of motors and working principles
- Students might be asked to find the various components in real life equipment, circuits.
- Students might be asked to see the demonstration video of various electrical drives.
- Students might work the automation components using simulation software in the virtual laboratory web portal.

Text Books for Reference:

1. R.Srinivasan, Hydraulics and Pneumatic control, Second edition, McGraw Hill Education, 2008.
2. R.Srinivasan, Special Electrical Machines, Second edition, Lakshmi Publication, 2018.
3. G.K.Dubey, Fundamentals of Electrical Drives, Second edition , Narosa Publishing House Pvt LTD, 2010

Website Reference:

1. https://archive.nptel.ac.in/courses/108/105/108105062/
2. https://www.electricaltechnology.org/2015/09/what-is-industrial-automation.html
3. https://themechanicalengineering.com/pneumatic-system

ICH686	Computer Control of Process	L	T	P	C
Theory		3	0	0	3

Introduction:

Computer controlled Process is a prominent course to make the students aware about the need of computers in a Process control system. This course is intended to develop the basic understanding about Data Acquisition system and the working principle of Digital Control Systems. The student will acquire knowledge in HART Communication Protocols and Field Bus architecture. The student will also become familiar with the SCADA System architecture, its components and various Industrial applications of SCADA. SCADA is used in Process control systems in almost every Instrumentation industry.

Course Objectives:

The objective of this course is to enable the students to

- Acquire knowledge on the need for Data acquisition system and Data acquisition techniques in PC based Data acquisition and control.
- Gain Knowledge on the need of Computer in control systems and the working principle of various digital control systems.
- Acquire knowledge on HART Communication Protocols and Field Bus architecture.
- Gain Knowledge on SCADA System architecture and its components.
- Gain knowledge on the SCADA Protocols and the Industrial applications of SCADA.

Course Outcomes:

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

CO1: discuss the principle of operation of data acquisition system and data acquisition techniques in computer-based process control.

CO2: explain the Digital Control interfacing and principle of various digital control systems.

CO3: analyse the HART Protocols, Communication modes, and field bus architecture.

CO4: elaborate the principle of SCADA System architecture and its components.

CO5: describe the SCADA Protocols and the Industrial applications of SCADA.

Pre-requisites:

Sensors and Transducers, Measurement of process variables and Process Control Instrumentation.

ICH686	Computer Control of Process	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping:

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

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

Instructional Strategy:

- It is advised that teachers have to use different teaching methods to stimulate the interest of students in learning.
- To help students to learn PC Based Data Acquisition System and its control. Teachers should use PPT presentation to show video of Computer based control in a process. Also, should explain examples from daily life, realistic situations, and real-world engineering and technological applications.
- The demonstration can make the subject exciting and foster in the students a scientific mind set. Student activities should be planned on all the topics.
- Demonstration method may be used with step-by-step procedure to show the principle of Digital Control Systems.
- Teachers are advised to follow inductive strategy to help the students to know the SCADA System architecture and its Industrial Applications.

ICH686	Computer Control of Process	L	T	P	C
Theory		3	0	0	3

Assessment Methodology:

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

ICH686	Computer Control of Process	L	T	P	C
Theory		3	0	0	3

Unit I	DATA ACQUISITION SYSTEM	
Data Acquisition System: Definition- need for data acquisition systems - Sampling theorem – Sampling and digitising – Aliasing – Sample and hold circuit–Interfacing ADC and DAC with Microprocessor - Multiplexer - Multiplexed channel operation –Microprocessor based data acquisition systems- PC-Based data acquisition and control.		9
Unit II	**DIGITAL CONTROL SYSTEMS**	
Need of computer in a control system - Functional block diagram of a computer control system- Direct digital control-Digital control interfacing- Digital temperature control system – Digital liquid level Control system -Digital flow control system Digital position control system.		9
Unit III	**HART AND FIELD BUS**	
Highway Addressable Remote Transducer (HART) –Definition - Introduction – HART Communication Protocol – Communication Modes – HART Commands – HART Applications. Field Bus-Introduction - General field bus Architecture- Basic requirements of Field bus standard- Field Bus topology- Interoperability and Inter changeability.		9
Unit IV	**SCADA SYSTEMS**	
Evolution of SCADA – Definition - SCADA system Architecture- Communication requirements-Properties of SCADA system-Features-Advantages – Disadvantages- Remote terminal units - Interface Units -Human Machine Interface Units(HMI) - Data Logger- Intelligent Electronic Devices (IDE)- SCADA Server- Control System - Control Panel.		9
Unit V	**INDUSTRIAL APPLICATIONS OF SCADA**	
SCADA - Hardware and software, System Master station, SCADA Protocols - SCADA systems in operation and control of interconnected power system - Power System Automation- Substation SCADA System- Petroleum Refining Process- Water Purification System- Chemical Plant.		9
TOTAL HOURS		**45**

ICH686	Computer Control of Process	L	T	P	C
Theory		3	0	0	3

Suggested List of Students Activity (Ungraded)

- Check the web portal to study the Data Acquisition techniques, Digital Control techniques, HART and Field bus.
- Periodical quizzes should be conducted on a weekly/fortnightly basis to reinforce the need of computer in Process Control System.
- Students might be asked to see the demonstration video of SCADA architecture and its Industrial applications

Text Books for Reference:

1. M.Chidambaram, Computer Control of Processes, Naroza Publishing House Pvt. Ltd., 2006
2. Krishna Kant, Computer Based Industrial Control, PHI,2007
3. Stuart A. Boyer , SCADA: Supervisory Control and Data Acquisition Systems, 4th Edition, ISA Press, 2010

Website link for Reference:

http://www.digimat.in/nptel/courses/video/108108099/L30.html

ICH687	Power Plant Instrumentation	L	T	P	C
Theory		3	0	0	3

Introduction:

The course is designed to familiarize the student with the functions and instrumentation available in a modern power generation plant. The student is first exposed to an in-depth analysis of the process of controlling the generation of electricity from traditional fuel sources. This is followed by a study of instrumentation and control aspects of alternative forms of electricity generation.

Course Objectives:

The objective of this course is to enable the students to

- Acquire knowledge on the overview of different methods of power generation.
- Gain Knowledge on the various measurements involved in power generation plants.
- Acquire knowledge on the working principles of different types of devices used for analysis.
- Gain knowledge on the working principle of different types of controls and control loops
- Acquire knowledge on the working principles of measurement of various turbine parameters like speed, vibration and temperature and their control.

Course Outcomes:

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

CO1: apply principles of analytical measurement to determine flue gas composition, fuel quality, and air pollution parameters in power plants.

CO2: explain various power generation methods including hydro, thermal, solar, nuclear and wind power plants and their major components.

CO3: interpret the working principles of various measurement instruments used in power plants like airflow meters, steam and radiation detectors

CO4: analyze control loops in boilers and assess the control strategies used for combustion, furnace draft and drum level in power plants

CO5: illustrate turbine monitoring systems, control mechanisms for speed, vibration, lubrication and cooling in turbo-alternators.

Pre-requisites:

Basics of Instrumentation, Sensors and transducers, Measurement of process variables, Process control Instrumentation.

ICH687	Power Plant Instrumentation	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PS02
CO1	3								2
CO2		3							
CO3					3	3			
CO4					3				
CO5					3	3			

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

Instructional Strategy:

- It is advised that teachers have to use different teaching methods to stimulate the interest of students in learning.
- To help students to learn different types of power generation methods and power plants. Teachers should use PPT presentation and to show video of power generation in different types of power plants. Also, should explain examples from daily life, realistic situations, and real-world engineering and technological applications.
- Students may be shown models of different types of power plants. The demonstration of one particular power plant can make the subject exciting and foster in the students a scientific mind set.
- Teachers are advised to follow an inductive strategy to help the students to discover the working principle of various components, switches and relays.

ICH687	Power Plant Instrumentation	L	T	P	C
Theory		3	0	0	3

Assessment Methodology:

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

ICH687	Power Plant Instrumentation	L	T	P	C
Theory		3	0	0	3

Unit I	POWER GENERATION METHODS	
Introduction - Hydro Electric Power Plant – Classification of hydroelectric power plant – Components used in Hydro Electric power plant – Working - Thermal power plant – Circuits in thermal power plant – Components used in Thermal power plant –Working of thermal power plant – Solar power plant – working of solar power plant – Nuclear power plant – Components used in nuclear power plant – working of pressurized water reactor & boiling water reactor – Wind power plant – Basic components used in wind power plant – Working.		9
Unit II	**MEASUREMENTS IN POWER PLANTS**	
Airflow Measurements – Variable head flow meters – Hot wire Anemometer – Steam Flow Measurement – Steam temperature measurement – Drum level measurement – Dust measurements – Smoke Measurements – Radiation Detectors – Geiger Muller counter – scintillation counter – Pressure gauges		9
Unit III	**ANALYTICAL MEASUREMENT**	
Introduction – Oxygen Measurement in flue gas – CO_2 in flue gas – combustibles analyzer – infrared flue gas analyzers – chromatography – Air pollution monitoring instruments - Fuel analyzers – Coal calorimeter and gas calorimeter.		9
Unit IV	**CONTROL LOOPS IN BOILERS**	
Block diagram of boiler control systems - combustion control – air / fuel ratio control – single point positioning – parallel positioning - combustion control - coal / air ratio control - furnace draft control using feed forward and feedback control – Boiler drum level control - single , two and three element control – Boiler feed water pumping and heating systems – flue gas dew point control – soot blowing .		9
Unit V	**TURBINE MONITORING AND CONTROL**	
Introduction – Speed, Vibration, Shell temperature monitoring and control – Lubrication system for Turbo Alternator – Block Diagram –Controls in lubrication systems – Lube oil pressure / Flow control – Lube oil temperature control – Lube oil tank level control – Turbo alternator cooling systems – Classification of cooling system – Open or once through system - closed system – air cooling system.		9
TOTAL HOURS		45

ICH687	Power Plant Instrumentation	L	T	P	C
Theory		3	0	0	3

Suggested List of Activities (upgraded):

- Students can visit nearby power plant and inspect the different types of instrumentation employed in power plant
- Students can see the video in YouTube related to power generation methods and instrumentation used in power generation
- Students can play quiz game on different type of sensors, actuators employed in power plants and update the knowledge
- Students can read magazines on Power plant and update their knowledge on renewable energy methods and required instrumentation for it

Text Books for Reference:

1. Krishnaswamy .K and Ponnibala . M,Power plant instrumentation, PHI Learning PVT Ltd.,
2. P.Tamilmani , Power plant instrumentation , Sams Publishers, Chennai.
3. P.K.NAG , Power plant Engineering, Tata McGraw – Hill Education, Third Edition 2007

ICH688	Industrial Process Control Instrumentation	L	T	P	C
Theory		3	0	0	3

Introduction:

The aim of introducing this subject is to make the students more conversant with the process terminology and all types of control involved in process industries. This subject covers the detailed instrumentation and control of Heat exchanger, Steam boiler, Distillation column, Dryer, Pump and Compressor. Also, it provides an idea about the instrumentation and control in Paper and Pulp industry and pharmaceutical industry briefly. This subject gives more confidence to the students to choose their career as Instrumentation engineers in process industries.

Course Objectives:

The objective of this course is to enable the students to

- Acquire knowledge on Heat transfer unit operations.
- Acquire knowledge on control of Heat and Mass transfer unit operations.
- Gain knowledge on Control of Pumps and compressors.
- Acquire knowledge of Instrumentation and control in Paper and pulp Industries.
- Gain Knowledge about process control in Pharmaceutical and Fermentation industries.

Course Outcomes:

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

CO1: identify control methods in pharmaceutical and fermentation industry.

CO2: explain the different types of control of heat exchanger and boiler.

CO3: analyze the various controls of distillation column and dryers.

CO4: examine the control methods of pumps and compressors.

CO5: describe the paper and pulp industry control systems.

Pre-requisites:

Process Control Instrumentation

ICH688	Industrial Process Control Instrumentation	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

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

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

Instructional Strategy

- It is advised that teachers have to use different teaching methods to stimulate the interest of students in learning.
- To help students to learn different types of control of heat exchanger. Teachers should use PPT presentation of image, symbol of components and to show video of application of the control methods.
- Also, should explain examples from daily life, realistic situations, and real-world engineering and technological applications.
- Students may be shown all the Control operations in the video demonstration. The demonstration can make exciting and foster in the students a scientific mind set. Student activities should be planned on all the topics.
- Demonstration method may be used with step-by-step procedure to demonstrate working of Pumps.
- Teachers are advised to follow an inductive strategy to help the students to discover the working principle of Compressors.
- Do not let students work on an activity or an experiment with the expected outcome, rather allow students to be honest about whatever the results of the experiment are. If the results are different from the expectations, students should do an analysis where could be the source of error, if any?

ICH688	Industrial Process Control Instrumentation	L	T	P	C
Theory		3	0	0	3

Assessment Methodology:

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 Questions (1out of 2) ->10Marks	10 Marks
	During the semester	Subject/ General		
Total				40 Marks

ICH688	Industrial Process Control Instrumentation	L	T	P	C
Theory		3	0	0	3

Unit I	CONTROL OF HEAT TRANSFER UNIT OPERATIONS	
Control of Heat exchanger – Variables and Degrees of Freedom – Liquid-To-Liquid Heat Exchangers – Feedback Control – Steam Heated Exchanger – Feedback Control – Bypass Control – Cascade Control - Control of Steam Boiler – Boiler Equipment – In-line instruments of Drum type Boiler – Combustion Control.		9
Unit II	**CONTROL OF HEAT AND MASS TRANSFER UNIT OPERATIONS**	
Control of Distillation Column – Distillation Equipment – Variables and degrees of freedom – Pressure Control – Feed Control – Reboiler Control – Reflux Control - Control of Dryers – Principles – Control – Batch dryers – Atmospheric tray dryer – Batch Fluid bed dryer – Continuous dryers – Double drum dryer – Rotary dryer.		9
Unit III	**CONTROL OF PUMPS & COMPRESSORS**	
Control of Pumps –Pump control methods –Centrifugal Pump –On-Off Level Control – On-Off Flow Control – On-Off Pressure Control – Speed Variation – Rotary Pump – On-Off Control – Safety and Throttling Control – Reciprocating Pump – On-Off Control – Throttling Control. Control of Compressors – Capacity control methods of Compressors – Centrifugal Compressor –Surge Control – Anti surge Control – Rotary Compressor – Bypass and Suction Control – Reciprocating Compressor – On-Off Control – Constant Speed Capacity Control.		9
Unit IV	**CONTROL INSTRUMENTATION IN PAPER AND PULP INDUSTRY**	
Description of the Process – Basis weight measurement – Consistency Sensors – Typical Control Systems in the Paper industry – Blow down Tank Control – Digester Liquor Feed Pump Control – Brown Stock Washer Level Control – Stock Chest Level Control – Basis Weight Control of a Paper Machine – Valves in the Paper industry.		9
Unit V	**PROCESS CONTROL IN PHARMACEUTICAL AND FERMENTATION INDUSTRY**	
Description of the Process – Fermentation – Measurement Hardware in the Pharmaceutical industry – Flow, Level, Pressure measurement – Temperature measurement – Smoke detector – Analyzers in the Pharmaceutical industry – Fermentation Control System – pH Control – Temperature Control – Tablet Coating Control.		9
TOTAL HOURS		**45**

ICH688	Industrial Process Control Instrumentation	L	T	P	C
Theory		3	0	0	3

Suggested List of Students Activity (Ungraded)

- Check the web portal for Image and video of different types of heat transfer unit operations.
- Periodical quizzes should be conducted on a weekly/fortnightly basis to reinforce the control methods, image of different types of pumps and working principles.
- Students might be asked to find the various components in real life equipment.
- Students might be asked to see the demonstration video of various industry oriented processes.
- Students might work on the Industrial Process Control components using simulation software in the virtual laboratory web portal.

Text books for reference:

1. Bela G.Liptak, Instrumentation in Processing Industries, Second Edition, Chilton Book Co Publications, 2009
2. Gregory K. McMillan, P. Hunter Vegas, 'Process/Industrial Instruments and Controls Handbook', Sixth Edition, McGraw Hill Publication, 2019
3. Dale R. Patrick and Stephan W. Fardo, Industrial Process Control Systems, Second Edition, River Publications, 2021.

ICH689	Industrial Robotics	L	T	P	C
Theory		3	0	0	3

Introduction:

Industrial robotics refers to the use of robots in manufacturing and industrial processes to automate tasks traditionally performed by human workers. These robots are specifically designed to carry out repetitive, dangerous, or precise tasks with a high level of accuracy and efficiency. Industrial robotics continues to evolve rapidly, driven by advancements in technology such as artificial intelligence, machine learning, and sensor technology. As robots become more sophisticated and versatile, they are expected to play an increasingly important role in shaping the future of manufacturing and industrial automation.

Course Objectives:

The objective of this course is to enable the students to

- Understand different components of robot
- Compare various types of robots
- Study the working of various robot controller
- Study the various types of End Effectors
- Understand the working of sensors Vision system.
- Study the Robot Programming and Robot programming Languages.
- Appreciate the application of Robots in Industries.

Course Outcomes:

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

CO1: describe key concepts, structure, anatomy and classification of industrial robots with components.

CO2: elucidate the working principles of robot controllers, drive systems, and feedback devices used in robotic systems.

CO3: demonstrate the application of sensors, end effectors, and vision systems in robotic operations and choose suitable components for specific functions.

CO4: Compare different robot programming methods and evaluate the use of programming languages and motion interpolation techniques in automation.

Pre-requisites:

Basic knowledge of Robots, Robot controller, End Effectors, Sensors, Robot programming and Applications of Robots.

ICH689	Industrial Robotics	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping:

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3								3
CO2		3							
CO3					3	3			
CO4					3	3			

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

Instructional Strategy

- It is advised that teachers have to use different teaching methods to stimulate the interest of students in learning.
- To help students to learn different types of sensors and transducers. Teachers should use PPT presentation to show video of application of the various types of sensors and transducers. Also, should explain examples from daily life, realistic situations, and real-world engineering and technological applications.
- Students may be shown all the available sensors in the lab. The demonstration can make the subject exciting and foster in the students a scientific mind set. Student activities should be planned on all the topics.
- Demonstration method may be used with step-by-step procedures to show the working of different types of sensors and transducers.
- Teachers are advised to follow inductive strategy to help the students to know the working principle of special sensors.
- Do not let students work on an activity or an experiment with the expected outcome, rather allow students to be honest about whatever the results of the experiment are. If the results are different from the expectations, students should do an analysis where it could be the source of error, if any

ICH689	Industrial Robotics	L	T	P	C
Theory		3	0	0	3

Assessment Methodology:

ASSESSMENT FOR THEORY PAPERS				
Assessment	**Duration**	**Portions covered**	**Mark allocation**	**Reduced to**
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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

ICH689	Industrial Robotics	L	T	P	C
Theory		3	0	0	3

Unit I	FUNDAMENTALS OF ROBOT TECHNOLOGY	
Introduction – Definition - Robot Anatomy - Basic configuration of Robotics - Robot Components – Manipulator, End Effectors, Drive system, Controller and Sensors. Mechanical arm – Degree of freedom – Links and joints – Construction of Links- Types of joints. Classification of Robots - Cartesian- Cylindrical- spherical- articulated - SCARA - Work envelope - Work Volume – Comparison of Work envelope and Work volume. Introduction to PUMA Robot.		9
Unit II	**ROBOT CONTROLLER AND DRIVE SYSTEMS**	
Robot Controller- Configuration - Four types of controls – Open loop and closed loop controller –servo systems - Speed of response and stability **Drive system:** Pneumatic drives – Hydraulic drives – Electrical drives – Stepper motor- DC Servo motor – working - Salient features – Applications and comparison of drives. **Feedback Devices:** Potentiometers - Optical encoders - Resolvers - DC Tachometer.		9
Unit III	**END EFFECTORS, SENSORS, AND VISION SYSTEMS**	
End Effectors: Grippers and tools – Mechanical Grippers- Magnetic Grippers- Vacuum Grippers - Adhesive Grippers. **Sensors:** Requirements of Sensors –Types of sensors- Tactile sensors- Touch sensors- Proximity sensors -Range Sensors- Force sensors- Photo electric sensors. **Machine Vision System:** Sensing and digitizing image data – Signal conversion – Image storage – Lighting techniques – Robotic Applications – Robot operation aids – teach pendant - Manual data input (MDI) and computer control.		9
` Unit IV	**ROBOT PROGRAMMING**	
Robot Programming – Lead Through methods and textual Robot Languages – Motion specification – motion Interpolation – Basic Robot Languages – Generation of Robot programming Languages- Robot Language structure - On-Line and Off- Line Programming – Basic Robot commands – Teach Pendent.		9

ICH689	Industrial Robotics	L	T	P	C
Theory		3	0	0	3

Unit V	INDUSTRIAL APPLICATIONS OF ROBOTS	
Robot Application in manufacturing – material handling – Material transfer – pick and place operations – palletizing and de-palletizing - Press loading and unloading – Die casting – Machine tool loading and unloading – Spot welding – Arc welding – Spray painting – Assembly finishing – Automatic Guided vehicle system.		9
TOTAL HOURS		**45**

Suggested List of Students Activity (Ungraded)

- Check the web portal to study different types of Robot and sensors.
- Periodical quizzes should be conducted on a weekly/fortnightly basis to reinforce the different types of robots and their working principles.
- Students might be asked to see the demonstration video of various Robots.

Text Books for Reference:

1. Deb S. R. and Deb S., “Robotics Technology and Flexible Automation”, Tata McGraw Hill Education Pvt. Ltd, 2010
2. A.K.Gupta, S.K.Arora, Industrial Automation and Robotics, Laxmi Publications (P) Ltd, 2013
3. RK Mittal, IJ Nagrath, Robotics and Control, Tata McGraw Hill Education Pvt, 1st July 2018

Website Reference:

Lecture Notes:

1. https://www.academia.edu/38824957/Robotics_by_rk_mittal
2. file:///C:/Users/sunda/Downloads/OER000000209%20(1).pdf

Video Lectures

1. https://youtube/CQVgM9OivV8
2. https://youtube/0s5m-AsXcpM?si=GA-dKE9DKOQ1rTOD&t=581
3. https://youtube/p7GOXb3Kc6I?si=IoiTCzGfjmBQZu8x&t=190
4. https://youtube/8mOHS8M1Pmc?si=cV8CO-H8M4NUeqBa&t=27

ICH671	Internship	Periods	C
Project		550	12

Introduction

Internships in educational institutions are designed to provide students with practical experience in their field of study and to bridge the gap between academic knowledge and professional practice.

Objectives

After completing Internship, Interns will be able to,

- Apply the theoretical knowledge and skill during performance of the tasks assigned in internship.
- Demonstrate soft skills such as time management, positive attitude and communication skills during performance of the tasks assigned in internship.
- Document the Use case on the assigned Task.
- Enable interns to apply theoretical knowledge gained in the classroom to real-world practical applications.
- Provide hands-on experience in the industrial practices.
- Develop essential skills such as communication, organization, teamwork, and problem-solving.
- Enhance specific skills related to the intern's area of focus.
- Offer a realistic understanding of the daily operations and responsibilities.
- Provide opportunities to work under the guidance of experienced supervisors and administrators.
- Allow interns to explore different career paths.
- Help interns make informed decisions about their future career goals based on first hand experience.
- Facilitate the establishment of professional relationships with supervisor, administrators, and other professionals in the field.
- Provide access to a network of contacts that can be beneficial for future job opportunities and professional growth.

ICH671	Internship	Periods	C
Project		550	12

- Foster personal growth by challenging interns to step out of their comfort zones and take on new responsibilities.
- Build confidence and self-efficacy through successful completion of internship tasks and projects.
- Give insight into the policies, regulations, and administrative practices.
- Allow interns to observe and understand the implementation of standards and policies in practice.
- Provide opportunities for constructive feedback from supervisors and mentors, aiding in the intern's professional development.
- Enable self-assessment and reflection on strengths, areas for improvement, and career aspirations.
- Encourage sensitivity to the needs and backgrounds of different groups, promoting inclusive and equitable industrial practices.

Course Outcomes

CO1: Demonstrate improved skills.

CO2: Exhibit increased professional behavior.

CO3: Apply theoretical knowledge and principles in real-world practices.

CO4: Develop and utilize assessment tools to evaluate the learning and practices.

CO5: Engage in reflective practice to continually improve their learning and professional growth.

ICH671	Internship	Periods	C
Project		550	12

Facilitating the Interns by an Internship Provider.

Orient intern in the new workplace. Give interns an overview of the organization, Explain the intern's duties and introduce him or her to co-workers.

Develop an internship job description with clear deliverables and timeline.

Allow the interns in meetings and provide information, resources, and opportunities for professional development.

The interns have never done this kind of work before, they want to know that their work is measuring up to organizational expectations, hence provide professional guidance and mentoring to the intern.

Daily progress report of Intern is to be evaluated by industry supervisor. examine what the intern has produced and make suggestions. Weekly supervision meetings can help to monitor the intern's work.

Duties Responsibilities of the Faculty Mentor

To facilitate the placement of students for the internship

To liaison between the college and the internship provider

To assist the Industrial Training Supervisor during assessment

Instructions to the Interns

- Students shall report to the internship provider on the 1st day as per the internship schedule.
- Intern is expected to learn about the organization, its structure, product range, market performance, working philosophy etc.
- The interns shall work on live projects assigned by the internship provider.
- The Intern shall record all the activities in the daily log book and get the signature of the concerned training supervisor.
- Intern shall have 100% attendance during internship programme. In case of unavoidable circumstances students may avail leave with prior permission from the concerned training supervisor of the respective internship provider. However, the maximum leave permitted during internship shall be as per company norms where they are working and intern shall report the leave sanctioned details to their college faculty mentor.

ICH671	Internship	Periods	C
Project		550	12

- The interns shall abide all the Rules and Regulations of internship provider
- Intern shall follow all the safety Regulations of internship provider.
- On completion of the internship, the intern shall report to the college and submit the internship certificate mentioning duration of internship, evaluation of interns by internship provider, Student's Diary and Comprehensive Training Report.

Attendance Certification

Every month students have to get their attendance certified by the industrial supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and submit it to the institution supervisor. Regularity in attendance and submission of report will be duly considered while awarding the Internal Assessment mark.

Training Reports

The students have to prepare two types of reports: Weekly reports in the form of a diary to be submitted to the concerned staff in-charge of the institution. This will be reviewed while awarding Internal

Industrial Training Diary

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

Comprehensive Training Report

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

Any data, drawings etc. should be incorporated with the consent of the Organisation.

ICH671	Internship	Periods	C
Project		550	12

Scheme of Evaluation

Internal Assessment

Students should be assessed for 50 Marks by industry supervisor and polytechnic faculty mentor during 8th Week and 15th Week. The total marks (50 + 50) scored shall be converted to 40 marks for the Internal Assessment.

Sl. No.	Description	Marks
A	Punctuality and regularity. (Attendance)	10
B	Level / proficiency of practical skills acquired. Initiative in learning / working at site	10
C	Ability to solve practical problems. Sense of responsibility	10
D	Self expression / communication skills. Interpersonal skills / Human Relation.	10
E	Report and Presentation.	10
Total		50

ICH671	Internship	Periods	C
Project		550	12

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 internship period (Dec - May). The marks scored will be converted to 60 marks for the End Semester Examination.

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

ICH672	Fellowship	Periods	C
Project		550	12

Introduction

The Fellowship in the Diploma in Engineering program is designed to provide aspiring engineers with a comprehensive educational experience that combines theoretical knowledge with practical skills. This fellowship aims to cultivate a new generation of proficient and innovative engineers who are equipped to meet the challenges of a rapidly evolving technological landscape.

Participants in this fellowship will benefit from a robust curriculum that covers core engineering principles, advanced technical training, and hands-on projects. The program emphasizes interdisciplinary learning, encouraging fellows to explore various branches of engineering, from mechanical and civil to electrical, electronics & communication and computer engineering. This approach ensures that graduates possess a versatile skill set, ready to adapt to diverse career opportunities in the engineering sector.

In addition to academics, the fellowship offers numerous opportunities for professional development. Fellows will engage with industry experts through seminars, workshops, and internships, gaining valuable insights into real-world applications of their studies. Collaborative projects and research initiatives foster a culture of innovation, critical thinking, and problem-solving, essential attributes for any successful engineer.

By offering this fellowship, participants become part of a vibrant community of learners and professionals dedicated to advancing the field of engineering. The program is committed to supporting the growth and development of each fellow, providing them with the tools and resources needed to excel both academically and professionally.

The Fellowship in the Diploma in Engineering is more than just an educational endeavor; it is a transformative journey that equips aspiring engineers with the knowledge, skills, and experiences necessary to make significant contributions to society and the engineering profession.

ICH672	Fellowship	Periods	C
Project		550	12

Objectives

After completing students will be able to,

- Provide fellows with a solid foundation in core engineering principles and advanced technical knowledge across various engineering disciplines.
- Equip fellows with hands-on experience through laboratory work, projects, and internships, ensuring they can apply theoretical knowledge to real-world scenarios.
- Promote interdisciplinary understanding by encouraging exploration and integration of different engineering fields, fostering versatility and adaptability in fellows.
- Encourage innovation and creativity through research projects and collaborative initiatives, enabling fellows to develop new solutions to engineering challenges.
- Facilitate professional growth through workshops, seminars, and interactions with industry experts, preparing fellows for successful careers in engineering.
- Develop critical thinking and problem-solving skills, essential for tackling complex engineering problems and making informed decisions.
- Strengthen connections between academia and industry by providing opportunities for internships, industry visits, and guest lectures from professionals.
- Foster leadership qualities and teamwork skills through group projects and collaborative activities, preparing fellows for leadership roles in their future careers.
- Instill a sense of ethical responsibility and awareness of the social impact of engineering practices, encouraging fellows to contribute positively to society.
- Promote a culture of lifelong learning, encouraging fellows to continually update their knowledge and skills in response to technological advancements and industry trends.
- Prepare fellows to work in a global engineering environment by exposing them to international best practices, standards, and cross-cultural experiences.

ICH672	Fellowship	Periods	C
Project		550	12

Course Outcomes

CO1: Demonstrate a strong understanding of core engineering principles and possess the technical skills necessary to design, analyze, and implement engineering solutions across various disciplines.

CO2: Apply theoretical knowledge to practical scenarios, effectively solving engineering problems through hands-on projects, laboratory work, and internships.

CO3: Exhibit the ability to conduct research, develop innovative solutions, and contribute to advancements in engineering through critical thinking and creative approaches to complex challenges.

CO4: Understand and adhere to professional and ethical standards in engineering practice, demonstrating responsibility, integrity, and a commitment to sustainable and socially responsible engineering.

CO5: Enhance strong communication skills, both written and verbal, and be capable of working effectively in teams, demonstrating leadership and collaborative abilities in diverse and multidisciplinary environments.

Important points to consider to select the fellowship project.

Selecting the right fellowship project is crucial for maximizing the educational and professional benefits of a Diploma in Engineering program.

- **Relevance to Future Plans**: Choose a project that aligns with your long-term career aspirations and interests. This alignment will ensure that the skills and knowledge you gain will be directly applicable to your desired career path.
- **Industry Relevance**: Consider the current and future relevance of the project within the industry. Opt for projects that address contemporary challenges or emerging trends in engineering.
- **Access to Facilities**: Ensure that the necessary facilities, equipment, and materials are available to successfully complete the project. Lack of resources can hinder the progress and quality of your work.
- **Mentorship and Guidance**: Select a project that offers strong mentorship and support from experienced faculty members or industry professionals. Effective guidance is crucial for navigating complex problems and achieving project objectives.
- **Project Scope**: Assess the scope of the project to ensure it is neither too broad nor too narrow. A well-defined project scope helps in setting clear objectives and achievable milestones.
- **Feasibility**: Evaluate the feasibility of completing the project within the given timeframe and with the available resources. Consider potential challenges and ensure you have a realistic plan to address them.

ICH672	Fellowship	Periods	C
Project		550	12

- **Technical Skills**: Choose a project that allows you to develop and enhance important technical skills relevant to your field of study. Practical experience in using specific tools, technologies, or methodologies can be highly beneficial.
- **Soft Skills**: Consider projects that also offer opportunities to develop soft skills such as teamwork, communication, problem-solving, and project management.
- **Innovative Thinking**: Select a project that encourages creativity and innovative problem-solving. Projects that push the boundaries of traditional engineering approaches can be particularly rewarding.
- **Societal Impact**: Consider the potential impact of your project on society or the engineering community. Projects that address significant challenges or contribute to social good can be highly fulfilling and make a meaningful difference.

Guidelines to select Fellowship

- Ensure the program is accredited by a recognized accrediting body and has a strong reputation for quality education in engineering.
- Ensure it covers core engineering principles that align with your interests and career goals.
- Investigate the qualifications and experience of the faculty mentor. Look for programs with faculty who have strong academic backgrounds, industry experience, and active involvement in research.
- Check if the program provides adequate hands-on training opportunities, such as laboratory work, workshops, and access to modern engineering facilities and equipment.
- Assess the program's connections with industry. Strong partnerships with companies can lead to valuable internship opportunities, industry projects, and exposure to real-world engineering challenges.
- Explore the availability of research opportunities. Participation in research projects can enhance your learning experience and open doors to innovative career paths.
- Look for programs that offer professional development resources, such as workshops, seminars, and networking events with industry professionals and alumni.
- Ensure the program provides robust support services, including academic advising, career counselling, mentorship programs, and assistance with job placement after graduation.

ICH672	Fellowship	Periods	C
Project		550	12

- Consider the cost of the program and available financial aid options, such as scholarships, grants, and fellowships. Evaluate the return on investment in terms of career prospects and potential earnings.
- Research the success of the program's alumni. High employment rates and successful careers of past graduates can indicate the program's effectiveness in preparing students for the engineering field.

Duties Responsibilities of the Faculty Mentor

Each student should have a faculty mentor for the Institute.

- Get the approval from the Chairman Board of Examinations with the recommendations of the HOD/Principal for the topics.
- Provide comprehensive academic advising to help fellows select appropriate specializations, and research projects that align with their interests and career goals.
- Guide fellows through their research projects, offering expertise and feedback to ensure rigorous methodology, innovative approaches, and meaningful contributions to the field.
- Assist fellows in developing technical and professional skills through hands-on projects, laboratory work, and practical applications of theoretical knowledge.
- Offer career advice and support, helping fellows explore potential career paths, prepare for job searches, and connect with industry professionals and opportunities.
- Provide personal mentorship, fostering a supportive relationship that encourages growth, resilience, and a positive academic experience.
- Facilitate connections between fellows and industry professionals, alumni, and other relevant networks to enhance their professional opportunities and industry exposure.
- Ensure fellows have access to necessary resources, including research materials, lab equipment, software, and academic literature.
- Regularly monitor and evaluate the progress of fellows, providing constructive feedback and guidance to help them stay on track and achieve their goals.
- Instill and uphold high ethical and professional standards, encouraging fellows to practice integrity and responsibility in their work.
- Assist with administrative tasks related to the fellowship program, such as preparing progress reports, writing recommendation letters, and facilitating grant applications.

ICH672	Fellowship	Periods	C
Project		550	12

- Organize and participate in workshops, seminars, and other educational events that enhance the learning experience and professional development of fellows.
- Address any issues or conflicts that arise, providing mediation and support to ensure a positive and productive academic environment.

Instructions to the Fellowship Scholar

- Regularly meet with your faculty mentor for guidance on academic progress, research projects, and career planning. Be proactive in seeking advice and support from your mentor.
- Develop strong organizational skills. Use planners, calendars, and task management tools to keep track of assignments, project deadlines, and study schedules. Prioritize tasks to manage your time efficiently.
- Take advantage of opportunities to participate in research projects and hands-on activities. These experiences are crucial for applying your theoretical knowledge and gaining practical skills.
- Focus on improving essential professional skills such as communication, teamwork, problem-solving, and leadership. Participate in workshops and seminars that enhance these competencies.
- Actively seek networking opportunities through industry events, seminars, and meetings. Establish connections with peers, alumni, and professionals in your field to build a strong professional network.
- Seek internships, co-op programs, or part-time jobs related to your field of study. Real-world experience is invaluable for understanding industry practices and enhancing your employability.
- Uphold high ethical standards in all your academic and professional activities. Practice integrity, honesty, and responsibility. Adhere to the ethical guidelines and standards set by your institution and the engineering profession.
- Adopt a mindset of lifelong learning. Stay updated with the latest developments and trends in engineering by reading industry journals, attending conferences, and taking additional courses.

ICH672	Fellowship	Periods	C
Project		550	12

Documents to be submitted by the student to offer fellowship.

- **Completed Application Form**: This is typically the standard form provided by the institution or fellowship program that includes personal information, educational background, and other relevant details.
- **Detailed CV/Resume**: A comprehensive document outlining your educational background, knowledge experience, interest in research experience, publications, presentations, awards, and other relevant achievements if any.
- **Personal Statement**: A document explaining your motivation for applying to the fellowship, your career goals, how the fellowship aligns with those goals, and what you intend to achieve through the program.
- **Recommendation Letters**: Letters from faculty mentor, employer, or professionals who can attest to your academic abilities, professional skills, and suitability for the fellowship.
- **Proposal/Description**: A detailed proposal or description of the fellowship project or study you plan to undertake during the fellowship. This should include objectives, methodology, expected outcomes, and significance of the project.
- **Enrollment Verification**: Documentation verifying your current acceptance status in the academic institution or industry where the fellowship will be conducted.
- **Funding Information**: Details about any other sources of funding or financial aid you are receiving, if applicable. Some fellowships may also require a budget proposal for the intended use of the fellowship funds.
- **Samples of Work**: Copies of the relevant work that demonstrates your capabilities and accomplishments in your field.
- **Endorsement Letter**: A letter from your current academic institution endorsing your application for the fellowship, if required.
- **Ethical Approval Documents**: If your research involves human subjects or animals, you may need to submit proof of ethical approval from the relevant ethics committee.
- **Additional Documents**: Any other documents requested by the fellowship program required by the institution.

ICH672	Fellowship	Periods	C
Project		550	12

Attendance Certification

Every month students have to get their attendance certified by the supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and submit it to the faculty mentor. Regularity in attendance and submission of report will be duly considered while awarding the Internal Assessment mark.

Rubrics for Fellowship. Review I & II.

Sl. No.	Topics	Description
1	Alignment with Objectives	Assess how well the project aligns with the stated objectives and requirements. Determine if the student has addressed the key aspects outlined in the project guidelines.
2	Depth of Research:	Evaluate the depth and thoroughness of the literature review. Assess the student's ability to identify and address gaps in existing research.
3	Clarity of Objectives:	Check if the student has clearly defined and articulated the objectives of the project. Ensure that the objectives are specific, measurable, achievable, relevant, and time-bound (SMART).
4	Methodology and Data Collection:	Evaluate the appropriateness and justification of the research methodology. Assess the methods used for data collection and their relevance to the research questions.
5	Analysis and Interpretation:	Examine the quality of data analysis techniques used. Assess the student's ability to interpret results and draw meaningful conclusions.
6	Project Management:	Evaluate the project management aspects, including adherence to timelines and milestones. Assess the student's ability to plan and execute the project effectively.

ICH672	Fellowship	Periods	C
Project		550	12

7	Documentation and Reporting:	Check the quality of documentation, including code, experimental details, and any other relevant materials. Evaluate the clarity, structure, and coherence of the final report.
8	Originality and Creativity:	Assess the level of originality and creativity demonstrated in the project. Determine if the student has brought a unique perspective or solution to the research problem.
9	Critical Thinking:	Evaluate the student's critical thinking skills in analyzing information and forming conclusions. Assess the ability to evaluate alternative solutions and make informed decisions.
10	Problem-Solving Skills:	Evaluate the student's ability to identify and solve problems encountered during the project. Assess adaptability and resilience in the face of challenges.

INTERNAL MARKS - 40 Marks

As per the rubrics each topic should be considered for the Review I and Review II. Equal weightage should be given for all the topics. It should be assessed by a faculty mentor and the industrial professional or research guide.

Review 1 shall be conducted after 8th week and Review 2 shall be conducted after 14th week in the semester. Average marks scored in the reviews shall be considered for the internal assessment of 30 Marks.

Scheme of Evaluation

PART	DESCRIPTION	MARKS
A	Assessment as per the rubrics.	30
B	Attendance	10
Total		**40**

ICH672	Fellowship	Periods	C
Project		550	12

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 fellowship. The marks scored will be converted to 60 marks for the End Semester Examination.

Sl. No.	Description	Marks
A	Daily Activity Report.	20
B	Comprehensive report of the Fellowship Work.	30
C	Presentation by the student.	30
D	Viva Voce	20
Total		100

ICH673	In-house Project	Periods	C
Project		550	12

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 fulfilment 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.

Objectives

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

- **Integration of Knowledge**: Consolidate and integrate theoretical knowledge acquired in coursework to solve practical engineering problems.
- **Skill Development**: Enhance technical skills related to the specific field of engineering through hands-on experience and application.
- **Problem-Solving Abilities**: Develop critical thinking and problem-solving abilities by addressing complex engineering issues within a defined scope.
- **Project Management**: Gain experience in project planning, execution, and management, including setting objectives, timelines, and resource allocation.
- **Teamwork and Collaboration**: Foster teamwork and collaboration by working in multidisciplinary teams to achieve project goals and objectives.
- **Research Skills**: Acquire research skills by conducting literature reviews, gathering relevant data, and applying research methodologies to investigate engineering problems.
- **Innovation and Creativity**: Encourage innovation and creativity in proposing and developing engineering solutions that may be novel or improve upon existing methods.

ICH673	In-house Project	Periods	C
Project		550	12

- **Communication Skills**: Improve communication skills, both oral and written, by presenting project findings, writing technical reports, and effectively conveying ideas to stakeholders.
- **Ethical Considerations**: Consider ethical implications related to engineering practices, including safety, environmental impact, and societal concerns.
- **Professional Development**: Prepare for future professional roles by demonstrating professionalism, initiative, and responsibility throughout the project lifecycle.

Course Outcomes

CO1: Demonstrate the ability to apply theoretical concepts and principles learned in coursework to solve practical engineering problems encountered during the project.

CO2: Develop and enhance technical skills specific to the field of engineering relevant to the project, such as design, analysis, simulation, construction, testing, and implementation.

CO3: Apply critical thinking and problem-solving skills to identify, analyze, and propose solutions to engineering challenges encountered throughout the project lifecycle.

CO4: Acquire project management skills by effectively planning, organizing, and executing project tasks within defined timelines and resource constraints.

CO5: Improve communication skills through the preparation and delivery of project reports, presentations, and documentation that effectively convey technical information to stakeholders.

Important points to consider to select the In-house project.

- Selecting a project work in Diploma Engineering is a significant decision that can greatly influence your learning experience and future career prospects.
- Choose a project that aligns with your career aspirations and interests within the field of engineering. Consider how the project can contribute to your professional development and future opportunities.
- Ensure the project aligns with your coursework and specialization within the Diploma program. It should complement and build upon the knowledge and skills you have acquired in your studies.
- Evaluate the scope of the project to ensure it is manageable within the given timeframe, resources, and constraints. Avoid projects that are overly ambitious or impractical to complete effectively.

ICH673	In-house Project	Periods	C
Project		550	12

- 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.

ICH673	In-house Project	Periods	C
Project		550	12

- 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.

ICH673	In-house Project	Periods	C
Project		550	12

Instructions to the students.

- Regularly meet with your internal faculty advisor for guidance on academic progress, research projects, and career planning. Be proactive in seeking advice and support from your faculty advisor.
- Use planners, calendars, and task management tools to keep track of assignments, project deadlines, and study schedules. Prioritize tasks to manage your time efficiently.
- Take advantage of opportunities to participate in in-house projects and hands-on activities. These experiences are crucial for applying your theoretical knowledge and gaining practical skills.
- Focus on improving essential professional skills such as communication, teamwork, problem-solving, and leadership. Participate in workshops and seminars that enhance these competencies.
- Actively seek networking opportunities through industry events, seminars, and meetings. Establish connections with peers, alumni, and professionals in your field to build a strong professional network.
- Seek internships, co-op programs, or part-time jobs related to your field of study. Real-world experience is invaluable for understanding industry practices and enhancing your employability.
- Uphold high ethical standards in all your academic and professional activities. Practice integrity, honesty, and responsibility. Adhere to the ethical guidelines and standards set by your institution and the engineering profession.
- Adopt a mindset of lifelong learning. Stay updated with the latest developments and trends in engineering by reading industry journals, attending conferences, and taking additional courses.

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

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

ICH673	In-house Project	Periods	C
Project		550	12

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.

ICH673	In-house Project	Periods	C
Project		550	12

SCHEME OF EVALUATION

The mark allocation for Internal and End Semester Viva Voce are as below.

Internal Marks (40 Marks)*		
Review 1 (10 Marks)	Review 2 (15 Marks)	Review 3 (15 marks)
Committee: 10 Marks.	Committee: 15 Marks	Committee:15 Marks

Note: * The rubrics should be followed for the evaluation of the internal marks during reviews.

END SEMESTER EXAMINATION - Project Exam

The performance of each student in the project group would be evaluated in a viva voce examination conducted by a committee consisting of an external examiner and the project supervisor and an internal examiner.

Record / Report writing (20 Marks)	Presentation (20 Marks)	Viva Voce (20 Marks)
External: 20	External: 20	External: 20

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ANNEXURE - III

DEPARTMENT OF INSTRUMENTATION AND CONTROL ENGINEERING
COMPARISON OF SYLLABUS

Sem.	Name of the Subject	Equivalent Code			
		2015	2018	2023	2024
III	Basics of Instrumentation	IC302	ICE301	ICG301	-
	Electronic Devices	IC303	ICE302	ICG302	ICH370
	Electrical and Electronic circuits	IC 304	ICE303		
	Basics of Instrumentation Lab	IC 371	ICE371	ICG371	ICH371
	Electronic Devices Lab	IC 372	ICE372	ICG372	ICH373
	Electrical and Electronic Circuits Lab	IC 373	ICE373	ICG373	-
	Computer Aided Drafting Lab	IC 374	ICE374	-	-
IV	Instruments and Equipment	IC 401	ICE401	ICG403	ICH302
	Measurement of Process Variables	IC 402	ICE402	ICG402	ICH401
	Control Engineering	IC 403	ICE403	ICG502	ICH402
	C Programming	IC 404	ICE404	ICG303	ICH374
	IE and MPV Lab	IC 471	ICE471	ICG472	-
	C Programming Lab	IC 474	ICE472	ICG374	ICH374
	Communication Skills Practical	*BE 183	*BEE184	BEG278	-
V	Digital Electronics	IC 501	ICE501	ICG401	ICH473
	Process Control Instrumentation	IC 502	ICE502	ICG501	ICH501
	Industrial Instrumentation	IC 504	ICE503	ICG581	ICH581
	Elective Theory - I	IC 50*	ICE50*	ICG58*	-
	Digital Electronics Lab	IC 571	ICE571	ICG471	ICH473
	Process Control Instrumentation Lab	IC 572	ICE572	ICG571	ICH574
	Industrial Instrumentation Lab	IC 573	ICE573	ICG584	-
VI	Microcontrollers and Interfacing	IC 602	ICE601	ICG601	ICH474
	Advanced Process Control	IC 603	ICE602	ICG501	ICH501
	Elective Theory II	IC 60*	ICE60*	ICG68*	-
	Microcontroller and Interfacing Lab	IC 671	ICE671	ICG671	ICH474
	PLC and MATLAB Practical	IC 675	ICE672	-	ICH572
	Simulation Lab	IC 673	ICE673	ICG473	-
	Project work and Entrepreneurship	IC 674	ICE674	-	-
ELECTIVES	Industrial Safety Instrumentation	IC 505	ICE504	-	-
	Industrial Automation	IC 507	ICE505	ICG583	ICH685
	Computer Communication Networks	IC 509	ICE506	-	-
	Biomedical Instrumentation	IC 675	ICE603	ICG602	ICH684
	Embedded Systems	IC 605	ICE604	-	-
	Fiber Optic and Laser Instrumentation	IC 606	ICE605	-	-

QUESTION PAPER PATTERN(End exam Theory)

COURSE CODE: TIME: 2 1/2 Hrs.

COURSE NAME: MAX MARKS: 60

PART - A (30 *1= 30)

Answer **ALL** Questions.

1 to 30 questions.

PART - B (3 * 10= 30)

Answer any **THREE** from the following questions

31.

32.

33.

34.

35.

36.

Note:

1.In PART- A, Question No.1 to 30 should be Multiple Choice Questions based on images, true/false, match the following. Six Multiple Choice Questions from each unit.
2. In Part-B, Question Nos. 31 to 35 should be chosen from each unit.
3. In Part-B, Question No.36 can be from any five units

DEPARTMENT OF INSTRUMENTATION AND CONTROL ENGINEERING

COMPARISON OF H SCHEME WITH G SCHEME SYLLABUS

H Scheme	G Scheme (Previous Autonomous Syllabus)
ICH301 **Sensors and Transducers**	**ICG301:** Basics of Instrumentation **Deletion**: Unit 1: Basics of Instrumentation Unit 2: Characteristics of Instruments **Addition**: Capacitive transducers and Signal conditioning circuits
ICH302 **Electronic Measurements and Instruments**	**ICG403: Measurements and Instruments** **Deletion**: Single phase induction type energy meter, electrodynamometer type wattmeter, DC potentiometer, Kelvin Varley potential divider. Resistance measurement with voltmeter and ammeter, series and shunt type ohm meter. Measurement of frequency, XY recorders **Addition**: Megger, Function generator
ICH401 **Industrial Instrumentation**	**ICG402: Measurement of Process Variables** **Deletion:** McLeod gauge, Pirani gauge, ionization gauge, ultrasonic method **Addition:** Thermopile, Dall tube, Pitot tube
ICH402 **Control Engineering**	**ICG502: Control Engineering** **Addition:** Poles, Zeros, Pole-Zero plot, conversion of block diagram to signal flow graph, determination of the system (upto 5^{th} order)
ICH501 **Process Control Instrumentation**	**ICG501: Process Control Instrumentation** **Deletion:**Sample and Hold Circuit, ADC, DAC **Additon:** Feed forward control of Heat exchanger, DDC with multiple control loops
ICH581 **Mechanical Measurements and Instrumentation**	**ICG581: Industrial Instrumentation** **Deletion:** Resistive potentiometer, loading effect, resolution, LVDT, fiber optic displacement transducers, encoders, ultrasonic displacement sensors. Velocity pickup, acceleration pickup, optical encoder, digital method torque transducer using toother

	flanges, magneto strictive transducer. **<u>Addition</u>:** Solex pneumatic comparator, doppler effect method of velocity measurement, linear encoder, pendulum scale, optical torsion meter, electrical torsion meter, prony brake dynamometer, rope brake dynamometer, So_2 Analyzer
ICH582 **Embedded system design with Arduino**	**ICG681: Embedded system design with Arduino** **<u>Deletion</u>:** Arduino IDE, sketch designing for Arduino, brightness control of LED **<u>Addition</u>:** Compiler, cross compiler, assembler, simulator
ICH583 **Industrial Power Electronics**	**ICG582: Industrial Power Electronics** **<u>Deletion</u>:** Ramp and pedestal trigger circuit for AC load, SEPIC converter, dual converter, modes of dual converter, McMurray inverte, Matrix converter **<u>Addition</u>:** UPS, need for UPS, online UPS, offline UPS, comparison of online and offline UPS,
ICH584 **Analytical Instrumentation**	**No such subject**
ICH681 **Advanced Engineering Mathematics**	**No such subject**
ICH682 **Entrepreneurship**	**ICG573: Entrepreneurship and Startup (Practical)**
ICH683 **Project Management**	**No such subject**
ICH684 **Medical Instrumentation**	**ICG602:** **Biomedical Instrumentation** **<u>Deletion</u>:** Endoscopy, Heart valves, Anaesthesia machine, safety aspects in electro surgical units, high frequency current hazards, explosion hazards **<u>Addition</u>:** Basic Audiometer block diagram, types, GFI, equi potential grounding system, Angiography, Laser, types of laser techniques
ICH685	**ICG583**

Industrial Automation and Drives	**Industrial Automation and Drives** **<u>Deletion</u>:** unit IV: Distributed Control System Unit III: Pumps and Compressors and Unit V: Robotics **<u>Addition</u>:** Unit I : Basics of Industrial Automation Unit V: Automation components and Electrical safety
ICH686 **Computer Control of Process**	**No such subject**
ICH687 **Power Plant Instrumentation**	**ICG682:** **Power Plant Instrumentation** **<u>Deletion</u>:** Computer based control and data logging systems **<u>Addition</u>:** Unit III: Analytical Measurement, Lube oil tank level control, classification of cooling system, open or once through system, closed system, air cooling system
ICH688 **Industrial Process Control Instrumentation**	**No such subject**
ICH689 **Industrial Robotics**	**No such subject**

DEPARTMENT OF INSTRUMENTATION AND CONTROL ENGINEERING
COMPARISON OF H SCHEME WITH DOTE R2023 SCHEME SYLLABUS

SEM	H SCHEME SUBJECTS	DOTE R2023 SCHEME SUBJECTS
III	**Sensors and Transducers: ADDITION:** MEMS, **Electronic Measurements and Instruments:** Same as DOTE R 2023 **Practicals:** Sensors and Transducers, Circuit Theory and Machines, Principles of Electronics Engineering, Basics of C Programming **Circuit Theory and Machines Practical: ADDITION:** AC fundamentals and AC circuits **DELETION: Three phase AC machines** **Skill Modules:** Growth lab, Advanced skills Certification, Club activity, Shop Floor Immersion, Student Led Initiative, Health and wellness, Emerging Technology seminar	**Sensors and Transducers: same core topics** **Measurements and Instruments:** Equivalent subject **Practicals:** Sensors and Transducers, Principles of Electronics Engineering, Basics of C Programming **Circuit Theory and Machines Practical:** same core topics **Skill Modules:** Growth lab, Advanced skills Certification, Club activity, Shop Floor Immersion, Student Led Initiative, Health and wellness, Emerging Technology seminar
IV	**Industrial Instrumentation:** Equivalent to Measurement of Process Variables **Control Engineering:** Same as DOTE R 2023 **Practicals:** Industrial Instrumentation practical is same as Measurement of Process Variable practical , **Practicals** : P&ID using CAD, Analog and Digital Electronics, 8051 Microcontroller **Skill Modules:** Growth lab, Advanced skills Certification, Club activity, Student Led Initiative, Health and wellness, Emerging Technology seminar, Placement training	**Measurement of Process Variables**: same core topics **Control Engineering:** Equivalent Subject **Practicals:** Virtual Instrumentation, Analog and Digital Electronics, 8051 Microcontroller, Measurement of Process Variable **Skill Modules:** Growth lab, Advanced skills Certification, Club activity, Student Led Initiative, Health and wellness, Emerging Technology seminar, Placement training
V	**Process Control Instrumentation: ADDITION**: control valve sizing - CV rating - selection of a control valve - effect of cavitations and flashing on control valve performance, **ADDITION: Unit V**: PLC and Distributed Control system **Elective I:** Mechanical Measurements and Instrumentation same as Industrial Instrumentation, Embedded System Design with ARDUINO, Industrial Power Electronics, Analytical Instrumentation:	**Process Control Instrumentation: Equivalent subject** **Elective I: Industrial Instrumentation**: Equivalent Subject **Elective 1**: Embedded System Design with ARDUINO, Industrial Power Electronics, Analytical Instrumentation

SEM	H SCHEME SUBJECTS	DOTE R2023 SCHEME SUBJECTS
V	**Practicals:** Processs Control Instrumentation**,** PLC programming: **Elective II:** Mechanical measurements and Instrumentation, Embedded system Design with ARDUINO, Industrial Power Electronics, Virtual Instruments and Measurements: **Skill Modules:** Advanced skills Certification, Student Led Initiative, Health and wellness, Placement training, Innovation & startup, Internship	**Practicals:** Processs Control Instrumentation**,** PLC programming: **Elective II:** Industrial Instrumentation, Embedded system Design with ARDUINO, Industrial Power Electronics, P&ID using CAD. **Skill Modules:** Advanced skills Certification, Student Led Initiative, Health and wellness, Placement training, Innovation & startup, Internship
VI	**Elective III (Pathways):** Advanced Engineering Mathematics, Entrepreneurship, Project Management, Medical Instrumentation, Industrial Automation and Drives, Computer Control of Process **Elective IV (Specialization):** Power Plant Instrumentation, Industrial Process Control Instrumentation, Industrial Robotics **Internship/Fellowship/ Inhouse Project:**	**Elective III (Pathways):** Advanced Engineering Mathematics, Entrepreneurship, Project Management, Medical Instrumentation, Industrial Automation and Drives, Computer Control of Process **Elective IV (Specialization):** Power Plant Instrumentation, Industrial Process Control Instrumentation, Industrial Robotics **Internship/Fellowship/ Inhouse Project**