VISION OF THE DEPARTMENT

The Department of Instrumentation Engineering perseveres in becoming a Centre for Excellence in Electronics, Instrumentation and Control Engineering for Higher level learning, Research and Consultancy. The Department aims at imparting high quality education to students and professionals leading them to global competence. Its endeavors are to become a preferred partner to the industry and community for providing Engineering solutions.

MISSION OF THE DEPARTMENT

- Provide the students with strong foundation in Electronics, Instrumentation and Control Engineering.
- Enhance the core competency of the students to cater to the needs of the industries and research organizations.
- Update the curriculum periodically and to upgrade the laboratories with state-of-art equipment.
- Encourage faculty members to keep abreast of current trends through continuing educational programs.
- Carry out interdisciplinary research and consultancy in the cutting-edge technology.
PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

Bachelor of Electronics and Instrumentation Engineering curriculum is designed to prepare the graduates to acquire knowledge, skills and attitudes in order to:

PEO1: Be successful in their technical, professional careers & in their chosen fields such as Electronics, Instrumentation, Process Control & Information Technology.

PEO2: Engross in the life long process of learning to keep themselves abreast of new developments in the emerging areas of Electronics, Instrumentation, Process Control & Information Technology.

PEO3: Sustain the highest integrity and social responsibility in all their endeavors.

PROGRAMME OUTCOMES

PO1: Engineering knowledge: Apply the knowledge of Mathematics, Science, Engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs):

After completion of Electronics and Instrumentation Engineering program, students will gain core competency skills in domains such as Electronics, Instrumentation and Process control and

PSO1: Be able to Select, install, calibrate and maintain instruments used for measurement and analysis and interpret the data obtained to arrive at a significant conclusion.

PSO2: Be able to analyze, design and develop signal conditioning circuits for sensors, actuators and select a suitable Embedded System for realizing various control schemes and smart instruments.

PSO3: Be able to design, develop and implement control schemes for various industrial processes and gain hands on experience in configuring Industrial Automation System such as PLC and DCS.

PEO/PO Mapping:

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### ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
B.E. ELECTRONICS AND INSTRUMENTATION ENGINEERING
REGULATIONS – 2015
CHOICE BASED CREDIT SYSTEM
CURRICULA AND SYLLABI I - VIII SEMESTERS

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* - (6weeks during summer vacation)

**SUMMARY**

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Total
COURSE DESCRIPTION:

This course aims at developing the language skills necessary for the first-year students of Engineering and Technology.

COURSE OBJECTIVES:

1. To develop the four language skills – Listening, Speaking, Reading and Writing.
2. To improve the students’ communicative competence in English.
3. To teach students the various aspects of English language usage.

CONTENTS

UNIT I   GREETING AND INTRODUCING ONESELF  12
Listening - Types of listening – Listening to short talks, conversations; Speaking – Speaking about one’s place, important festivals etc. – Introducing oneself, one’s family/ friend; Reading – Skimming a passage– Scanning for specific information; Writing - Guided writing - Free writing on any given topic (My favourite place/ Hobbies/ School life, writing about one’s leisure time activities, hometown, etc.); Grammar – Tenses (present and present continuous) -Question types - Regular and irregular verbs; Vocabulary – Synonyms and Antonyms.

UNIT II   GIVING INSTRUCTIONS AND DIRECTIONS  12
Listening – Listening and responding to instructions; Speaking – Telephone etiquette - Giving oral instructions/ Describing a process – Asking and answering questions; Reading – Reading and finding key information in a given text - Critical reading - Writing –Process description( non-technical)- Grammar – Tense (simple past& past continuous) - Use of imperatives – Subject – verb agreement – Active and passive voice; Vocabulary – Compound words – Word formation – Word expansion( root words).

UNIT III  READING AND UNDERSTANDING VISUAL MATERIAL  12
Listening- Listening to lectures/ talks and completing a task; Speaking –Role play/ Simulation – Group interaction; Reading – Reading and interpreting visual material; Writing- Jumbled sentences – Discourse markers and Cohesive devices – Essay writing (cause & effect/ narrative); Grammar – Tenses (perfect), Conditional clauses –Modal verbs; Vocabulary –Causeand effect words; Phrasal verbs in context.
UNIT IV CRITICAL READING AND WRITING

Listening - Watching videos/ documentaries and responding to questions based on them; Speaking - Informal and formal conversation; Reading - Critical reading (prediction & inference); Writing - Essay writing (compare & contrast/ analytical) – Interpretation of visual materials; Grammar – Tenses (future time reference); Vocabulary – One word substitutes (with meanings) – Use of abbreviations & acronyms – Idioms in sentences.

UNIT V LETTER WRITING AND SENDING E-MAILS

Listening - Listening to programmes/broadcast/ telecast/ podcast; Speaking – Giving impromptu talks, Making presentations on given topics- Discussion on the presentation; Reading – Extensive reading; Writing - Poster making – Letter writing (Formal and E-mail); Grammar – Direct and Indirect speech – Combining sentences using connectives; Vocabulary – Collocation;

TEACHING METHODS:
Interactive sessions for the speaking module.
Use of audio – visual aids for the various listening activities.
Contextual Grammar Teaching.

EVALUATION PATTERN:
Internals – 50%
End Semester – 50%

TOTAL:60 PERIODS

COURSE OUTCOMES (CO):
Upon Completion of the course, the students will be able to:
1. Improve their reading and writing skills
2. Become fluent and proficient in communicative English
3. Improve their interpersonal communication
4. Have the capacity to discuss texts, verbally and in written form, with an independent intellectual perspective
5. Generate skills in communication through visual imagery and media

TEXTBOOK:

REFERENCES:
3. Redston, Chris & Gillies Cunningham **Face2Face** (Pre-intermediate Student’s Book & Workbook) Cambridge University Press, New Delhi: 2005


**MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES**

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**MA7151** **MATHEMATICS – I**

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*(Common to all branches of B.E. /B.Tech. Programmes in I Semester)*

**COURSE OBJECTIVES**

1. The goal of this course is for students to gain proficiency in calculus computations. In calculus, we use three main tools for analyzing and describing the behavior of functions: limits, derivatives, and integrals. Students will use these tools to solve application problems in a variety of settings ranging from physics and biology to business and economics.

2. To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.

3. To familiarize the student with functions of several variables. This is needed in many branches of engineering.

4. To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

**UNIT I** **DIFFERENTIAL CALCULUS**

Representation of functions - New functions from old functions - Limit of a function - Limits at infinity - Continuity - Derivatives - Differentiation rules - Polar coordinate system - Differentiation in polar coordinates - Maxima and Minima of functions of one variable.

**UNIT II** **FUNCTIONS OF SEVERAL VARIABLES**

Maxima and minima of functions of two variables – Lagrange’s method of undetermined multipliers.

UNIT III INTEGRAL CALCULUS 12
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS 12

UNIT V DIFFERENTIAL EQUATIONS 12
Method of variation of parameters – Method of undetermined coefficients – Homogenous equation of Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients.

TOTAL: 60 PERIODS

COURSE OUTCOMES (CO):
1. Assimilate ideas of limits and continuity and an ability to calculate with them and apply them.
2. Improve the knowledge in algebraic manipulation.
3. Have fluency in differentiation
4. Have fluency in integration using standard methods, including the ability to find an appropriate method for a given integral.
5. Familiarize the ideas of differential equations and facility in solving simple standard examples.

TEXT BOOKS

REFERENCES

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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PH7151 ENGINEERING PHYSICS (Common to all branches of B.E / B.Tech programmes) 3 0 0 3

COURSE OBJECTIVE:
1. To introduce the concept and different ways to determine moduli of elasticity and applications.
2. To instill the concept of sound, reverberation, noise cancellation, and ultrasonic generation, detection and applications.
3. To inculcate an idea of thermal properties of materials, heat flow through materials and quantum physics.
4. To promote the basic understanding of interferometers, principles and applications of lasers, optical fibers and sensors.
5. To establish a sound grasp of knowledge on the basics, significance and growth of single crystals

UNIT I  PROPERTIES OF MATTER  9

UNIT II  ACOUSTICS AND ULTRASONICS  9

UNIT III  THERMAL AND MODERN PHYSICS  9

UNIT IV  APPLIED OPTICS  9

UNIT V  CRYSTAL PHYSICS  9
Single crystalline, polycrystalline and amorphous materials – Single crystals: unit cell, crystal systems, Bravais lattices, ditections and planes in a crystal, Miller indices - interplanar distance.
for a cubic crystal - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - structure and significance of NaCl, CsCl, ZnS and graphite - crystal imperfections: point defects, line defects – Burger vectors, dislocations and stacking faults – Growth of single crystals: Bridgman and Czochralski methods.

TOTAL: 45 PERIODS

COURSE OUTCOME (CO):
1. Understand different moduli of elasticity, their determination and applications.
2. Understand fundamental physical principles underlying the generation and propagation of sound waves in gas and liquid
3. Apply the knowledge of basic quantum mechanics, to set up one dimensional Schrodinger’s wave equation and its application to matter wave system
4. Describe the basic laser physics, working of lasers, holography and principle of propagation of light in optical fibers Recognize various planes in a crystal and describe the structure determination using X-rays, growing single crystals.

TEXTBOOKS:

REFERENCES:

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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COURSE OBJECTIVES
1. To develop an understanding about fundamentals of polymer chemistry.
2. Brief elucidation on surface chemistry and catalysis.
3. To develop sound knowledge photochemistry and spectroscopy.
4. To impart basic knowledge on chemical thermodynamics.
5. To understand the basic concepts of nano chemistry.

UNIT I POLYMER CHEMISTRY
Introduction: Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermostetting. Types and mechanism of polymerization: addition (free radical, cationic, anionic and living); condensation and copolymerization. Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension.

UNIT II SURFACE CHEMISTRY AND CATALYSIS

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY

UNIT IV CHEMICAL THERMODYNAMICS
Second law: Entropy-entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Free energy and work function: Helmholtzand Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius Clapeyron equation; Maxwell relationsVan't Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation- variation of chemical potential with temperature and pressure.
UNIT V  NANO CHEMISTRY

TOTAL : 45 PERIODS

COURSE OUTCOMES (CO)
1. Get familiar with polymer chemistry, surface chemistry and catalysis.
2. Know the photochemistry, spectroscopy and chemical thermodynamics.
3. Know the fundamentals of nano chemistry.
4. Understand the modified chemical or physical properties of the nano structured material
5. Comprehend the concept of structure and concept of polymers

TEXT BOOKS:

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MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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GE7151  COMPUTING TECHNIQUES  L T P C  3 0 0 3

Common to all branches of Engineering and Technology

COURSES OBJECTIVES:
1. To learn programming using a structured programming language.
2. To provide C programming exposure.
3. To introduce foundational concepts of computer programming to students of different branches of Engineering and Technology.

UNIT I  INTRODUCTION  9
Introduction to Computers – Computer Software – Computer Networks and Internet - Need for logical thinking – Problem formulation and development of simple programs - Pseudo code - Flow Chart and Algorithms.

UNIT II  C PROGRAMMING BASICS  9

UNIT III  ARRAYS AND STRINGS  9

UNIT IV  POINTERS  9
Macros - Storage classes –Basic concepts of Pointers– Pointer arithmetic - Example Problems - Basic file operations

UNIT V  FUNCTIONS AND USER DEFINED DATA TYPES  9

TOTAL : 45 PERIODS

COURSES OUTCOMES(CO):
At the end of the course, the student should be able to:
1. Write C program for simple applications
2. Formulate algorithm for simple problems
3. Analyze different data types and arrays
4. Perform simple search and sort.
5. Use programming language to solve problems.
TEXT BOOKS

REFERENCES

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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BS7161 BASIC SCIENCES LABORATORY L T P C 0 0 4 2
(Common to all branches of B.E. / B.Tech Programmes)

COURSES OBJECTIVE:
1. To inculcate experimental skills to test basic understanding of physics of materials including properties of matter.
2. To inculcate experimental skills to test basic understanding of thermal and optical properties.
3. To induce the students to familiarize with experimental determination of velocity of ultrasonic waves, band gap determination.
4. To induce the students to familiarize with experimental determination of viscosity of liquids.

PHYSICS LABORATORY: (Any Seven Experiments)
1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of young’s modulus
3. Uniform bending – Determination of young’s modulus
4. Lee’s disc Determination of thermal conductivity of a bad conductor

31
5. Potentiometer-Determination of thermo e.m.f of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire
8. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
10. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Post office box -Determination of Band gap of a semiconductor.
13. Viscosity of liquids - Determination of co-efficient of viscosity of a liquid by Poiseuille’s flow

CHEMISTRY LABORATORY:

(Minimum of 8 experiments to be conducted)

1. Estimation of HCl using Na₂CO₃ as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline/thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics-ester hydrolysis.
14. Determination of CMC.
15. Phase change in a solid.

COURSE OUTCOMES(CO):
Upon Completion of the course, the students will be able to:
1. Use the different measuring devices and meters to record the data with precision
2. Identify the properties of liquids by applying various methods
3. Identify the properties of materials using the principles of optics and thermal physics
4. Apply different methods to record the contents of water sample
5. Record the phase changes of solid

TOTAL: 60 PERIODS

TEXTBOOKS

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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GE7161 COMPUTER PRACTICES LABORATORY L T P C
0 0 4 2

COURSES OBJECTIVES
1. To search, generate and manipulate data.
2. To analyze, present and visualize data.
3. To understand the basic programming constructs and articulate how they are used to develop a program with a desired runtime execution flow.
4. To articulate where computer programs fit in the provision of computer-based solutions to real world problems.
5. To learn to use data structures.

LIST OF EXPERIMENT
1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem-solving using decision making and looping.
6. Simple programming for one dimensional and two-dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions
9. Program using Recursive Function
10. Program using structures and unions.

TOTAL: 60 PERIODS

COURSE OUTCOMES (CO):

1. Write and compile programs using C programs.
2. Write program with the concept of Structured Programming
3. Identify suitable data structure for solving a problem
4. Demonstrate the use of conditional statement.
5. Create applications using user defined data structures and string functions

LABORATORY REQUIREMENTS FOR BATCH OF 30 STUDENTS
30 Systems with C compiler

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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MA7251 MATHEMATICS – II L T P C

(30) 4 0 0 4

(Common to all branches of B.E. /B.Tech. Programmes in II Semester)

COURSE OBJECTIVES

1. To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
2. To develop an understanding of the standard techniques of complex variable theory in particular analytic function and its mapping property.
3. To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
4. To acquaint the students with Differential Equations which are significantly used in Engineering problems.
5. To make the students appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.
UNIT I  MATRICES  12

UNIT II  VECTOR CALCULUS  12
Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green’s, Gauss divergence and Stoke’s theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III  ANALYTIC FUNCTION  12
Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions \( w = \frac{az + 1}{z} \) - Bilinear transformation.

UNIT IV  COMPLEX INTEGRATION  12

UNIT V  LAPLACE TRANSFORMS  12

TOTAL: 60 PERIODS

COURSE OUTCOMES(CO)
Upon successful completion of the course, students should be able to:
1. Evaluate real and complex integrals using the Cauchy integral formula and the residue theorem
2. Appreciate how complex methods can be used to prove some important theoretical results.
3. Evaluate line, surface and volume integrals in simple coordinate systems
4. Calculate grad, div and curl in Cartesian and other simple coordinate systems, and establish identities connecting these quantities
5. Use Gauss, Stokes and Greens theorems to simplify calculations of integrals and prove simple results.

TEXT BOOKS

REFERENCES

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PH7252 MATERIALS SCIENCE FOR TECHNOLOGISTS

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(Common to E&I and Rubber and Plastics Technology Branches)

COURSE OBJECTIVE:
1. To make the students to understand the basics of phase diagrams and various crystal growth techniques
2. To equip the students to have a knowledge on different types of electron theory, basics of applied quantum mechanics and about superconductors
3. To introduce the importance of semiconducting materials, physics of semiconducting materials and applications of semiconductors in device fabrication
4. To familiarize the students to magnetic materials, theory and types of magnetizations, dielectric materials and their application.

5. To provide the students a sound platform towards learning about advanced materials and their applications.

UNIT I MATERIALS PREPARATION AND PROCESSING


UNIT II CONDUCTING MATERIALS


UNIT III SEMICONDUCTING MATERIALS

Origin of band gap in solids (qualitative) - Concept of effective mass of electron and hole – Carrier concentration in an intrinsic semiconductor (derivation) – Fermi level – Variation of Fermi level with temperature – electrical conductivity – Band gap determination – Carrier concentration in n-type and p-type semiconductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Compound semiconductors – Hall effect – Determination of Hall coefficient – Solar cells – LED and photodiode.

UNIT IV MAGNETIC AND DIELECTRIC MATERIALS


UNIT V NEW MATERIALS AND APPLICATIONS

Tomography Scan (CT Scan) - Magnetic Resonance Imaging (MRI) - Performance and Reliability testing.

**TOTAL: 45 PERIODS**

**COURSE OUTCOME (CO):**

Students will be able to

1. Acquire knowledge of phase diagram and important crystal growing techniques.
2. Familiarize with conducting materials, and properties and applications of superconductors.
3. Gain knowledge on semiconducting materials based on energy level diagrams, its types, temperature effect. Also, fabrication methods for semiconductor devices will be understood.
4. Realize with theories of magnetic materials, understand the dielectric behavior of insulating materials and ferroelectric materials. Familiarize with ceramics, FRP, shape memory alloys and important technological applications.

**REFERENCES:**


**MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES**

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**GE7152 ENGINEERING GRAPHICS**

**COURSE OBJECTIVES**

1. To draw free hand sketches of basic geometrical shapes and multiple views of objects.
2. To draw orthographic projections of lines and planes.
3. To draw orthographic projections of solids.
4. To draw the development of surfaces of objects.
5. To draw isometric and perspective views of simple solids.
CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I   PLANE CURVES AND FREE HANDSKETCHING


UNIT II   PROJECTION OF POINTS, LINES AND PLANE SURFACES

Orthographic projection- principles-Principal planes-First angle projection-Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes- Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III   PROJECTION OF SOLIDS

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to both the principal planes by rotating object method and auxiliary plane method.

UNIT IV   PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES

Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

UNIT V   ISOMETRIC AND PERSPECTIVE PROJECTIONS

Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method and vanishing point method.

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY)

Introduction to drafting packages and demonstration of their use.
COURSE OUTCOMES (CO):
On completion of the course the student will be able to
1. Perform free hand sketching of basic geometrical shapes and multiple views of objects.
2. Draw orthographic projections of lines, planes and solids.
3. Obtain development of surfaces.
4. Prepare isometric and perspective views of simple solids.
5. Comprehend the different methods of Engineering drawing and apply suitably.

TEXT BOOK:

REFERENCES:

Publication of Bureau of Indian Standards:

Special points applicable to University Examinations on Engineering Graphics:
1. There will be five questions, each of either-or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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GE7251 ENVIRONMENTAL SCIENCE AND ENGINEERING

COURSE OBJECTIVES:
1. To study the nature and facts about environment.
2. To finding and implementing scientific, technological, economic and political solutions to environmental problems.
3. To study the interrelationship between living organism and environment.
4. To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
5. To study the dynamic processes and understand the features of the earth’s interior and surface.
6. To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.
Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7
UNIT V  HUMAN POPULATION AND THE ENVIRONMENT

TOTAL : 45 PERIODS

COURSE OUTCOMES(CO):
1. Have public awareness of environment at infant stage.
2. Suggest solutions to control pollution
3. Analyze the impact of deforestation.
4. Appreciate concepts and methods from ecological and physical sciences and their application in environmental problem solving.
5. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.

TEXTBOOKS:

REFERENCES:

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COURSE OBJECTIVES
1. To introduce basic concepts of AC and DC circuits and to explore the basics of R.L, C circuits.
2. To introduce various network theorems.
3. To introduce the concept of transient analysis of first and second order linear circuits.
4. To make the students understand the concept of resonance in Series and Parallel circuits.
5. To introduce the concept of two port networks and the analysis of three-phase balanced and unbalanced circuits.

UNIT I D.C and A.C CIRCUIT FUNDAMENTALS 8

UNIT II STEADY STATE ANALYSIS OF NETWORKS 10

UNIT III TRANSIENT ANALYSIS OF FIRST AND SECOND ORDER LINEAR CIRCUITS 9

UNIT IV RESONANCE AND COUPLED CIRCUITS 8

UNIT V THREE PHASE CIRCUITS AND TWO PORT NETWORKS 10
Three phase balanced and unbalanced voltage sources and loads: - Line voltage, Phase voltage, Phasor diagram, power and Power factor in three -phase circuit. Analysis with star and delta balanced and unbalanced loads. Network terminals and ports: - Z-parameters, T-equivalent of
reciprocal network, Y-parameter, π-equivalent of reciprocal networks, h-parameters and g-parameters.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)
At the end of the course, the students will
1. Ability to systematically obtain the equations that characterize the performance of an electric circuit as well as solving both single phase and three-phase circuits.
2. Ability to reduce complex network into simplified network.
3. Ability to determine the time & frequency responses of RL, RC and RLC circuits.
4. Ability to obtain the circuit parameters, current, voltage and power of a network.
5. Ability to use the software tools such as Pspice, Matlab, Circuit Wizard, etc. for solving complex networks.
6. Ability to identify, formulate, and solve engineering problems in the area circuits and systems.

TEXT BOOKS

REFERENCES

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COURSE OBJECTIVES
1. To introduce the representation and classification of continuous-time and discrete-time signals.
2. To impart knowledge on the methods and impact of analog to digital conversion and digital to analog conversion.
3. To teach the analysis of CT and DT systems through various transform techniques such as Laplace transform, Fourier transform and Z-transform.
4. To familiarize the concept of random signals and their statistical properties.

UNIT I  INTRODUCTION TO CT SIGNALS AND SYSTEMS  9
Introduction to signals and systems and their classifications. Definition of CT signal, Representation of elementary CT signals: – Impulse, Pulse, Step, Ramp, Exponential, Sinusoidal. Classification of CT signals: – periodic and a-periodic, power and energy, deterministic and random signals. Definition of CT system, Classification and characterization with examples: – Static & dynamic, causal & non causal, linear & non linear, time variant & time invariant, stable & unstable, FIR & IIR.

UNIT II  ANALYSIS OF CT SIGNALS AND SYSTEMS  9
Time domain analysis:-solutions of differential equation. Fourier series and Fourier transform analysis of signals, spectrum of CT signals, Laplace Transform analysis of signals and systems, Analysis of random signals.

UNIT III  DISCRETIZATION AND SIGNAL RECONSTRUCTION  9
Discretization of signals: sample and hold circuit, Sampling:- Sampling theorem, selection of sampling rate, Types of sampling, Aliasing:- Aliasing effects, Anti-aliasing filter, Quantization:- Quantization errors due to truncation and rounding in fixed and floating point representations, signal reconstruction:-Interpolation using zero-order hold & first order hold.

UNIT IV  CLASSIFICATION AND ANALYSIS OF DISCRETE TIME SIGNALS  9

UNIT V  TRANSFORM TECHNIQUES FOR DT SIGNALS AND SYSTEMS  9

TOTAL : 45 PERIODS
COURSE OUTCOMES (COs)
At the end of the course, the student will be able to:

1. Ability to remember the fundamentals of CT and DT signals and Systems
2. Ability to understand the classifications of CT and DT signals and Systems
3. Ability to apply the mathematical tools for characterizing various CT and DT signals and Systems
4. Ability to analyze the given signal or system in time as well as frequency domain
5. Ability to evaluate the characteristics of a given CT or DT system
6. Ability to solve complex problems in the analysis of CT and DT signals and Systems

TEXT BOOKS
2. Tarun Kumar Rawat, Signals and Systems, Oxford University Press, 2010

REFERENCES

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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GE7162  ENGINEERING PRACTICES LABORATORY  
(Common to all Branches of B.E. / B.Tech. Programmes)  
L T P C  
0 0 4 2

COURSE OBJECTIVES
To provide exposure to the students with hands-on experience on various Basic Engineering Practices in Civil, Mechanical, Electrical and Electronics Engineering. 37

GROUP – A (CIVIL & ELECTRICAL)
CIVIL ENGINEERING PRACTICES 15
PLUMBING
• Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches.
• Laying pipe connection to the suction side of a pump.
• Laying pipe connection to the delivery side of a pump.
• Practice in connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.
WOOD WORK
• Sawing, planning and making joints like T-Joint, Mortise and Tenon joint and Dovetail joint.
STUDY
• Study of joints in door panels and wooden furniture
• Study of common industrial trusses using models.

ELECTRICAL ENGINEERING PRACTICES 15
• Basic household wiring using Switches, Fuse, Indicator and Lamp etc.,
• Stair case light wiring
• Tube – light wiring
• Preparation of wiring diagrams for a given situation.
• Study of Iron-Box, Fan Regulator and Emergency Lamp

GROUP – B (MECHANICAL AND ELECTRONICS) MECHANICAL ENGINEERING PRACTICES 15 WELDING
• Arc welding of Butt Joints, Lap Joints, and Tee Joints
• Gas welding Practice.
• Basic Machining - Simple turning, drilling and tapping operations.
• Study and assembling of the following:
  a. Centrifugal pump
  b. Mixie
  c. Air Conditioner.

DEMONSTRATION ON FOUNDRY OPERATIONS.

ELECTRONIC ENGINEERING PRACTICES 15
• Soldering simple electronic circuits and checking continuity.
• Assembling electronic components on a small PCB and Testing.
• Study of Telephone, FM radio and Low Voltage Power supplies.

TOTAL : 60 PERIODS

COURSE OUTCOMES
1. Ability to fabricate carpentry components and to lay pipe connections including plumbing works.
2. Ability to use welding equipment to join the structures
3. Ability to do wiring for electrical connections and to fabricate electronics circuits.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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EI7211 CIRCUIT SIMULATION LABORATORY L T P C

0 0 4 2

COURSE OBJECTIVES
1. To learn and practice generation and characterization of continuous and discrete time signals
2. To analyze time and frequency response of DT signals
3. To explore various network theorems using simulation software.

LIST OF EXPERIMENT 2
1. Generation of Continuous Time (CT) and Discrete Time (DT) signals
   (i) Standard signals: – impulse, step, ramp, exponential
   (ii) Periodic and a-periodic signals (iii) Deterministic and random signals
2. CT and DT system characterization:
   (i) Linearity
   (ii) Time invariance
   (iii) Causality
   (iv) Stability
3. Time response & Frequency response of DT systems
4. Discretization and Reconstruction of signals
   (i) Sampling and aliasing effects (ii) A/D conversion (iii) D/A conversion
5. Statistical analysis of random signals
6. Verification Kirchhoff’s laws, Thevenin’s and Norton’s theorems.

7. Verification of Superposition, Maximum Power transfer and Reciprocity theorems.


10. Determination of self and mutual inductances and coupling coefficient of coupled coils.

11. Power and power factor measurement in three phase circuits by two wattmeter method.

12. Determination of Z, Y and h parameters of a two port network.

TOTAL : 60 PERIODS

COURSE OUTCOMES

At the end of the course, the students

1. Generate / characterize CT and DT signals using simulation software tools

2. Analyze CT and DT systems using software simulation tools and determine the response of systems using Time and Frequency domain analysis

3. Verify the network theorems by simulating the electrical circuits and determine the

4. Determine Z, Y and h parameters of a two port network and also verify the transient response and frequency response of circuits through simulation

5. Perform simulation studies on resonant circuits, coupled coils and three phase circuits

6. Design DT system for a given set of specifications using software tool such as Matlab

7. Design electric circuits for a given set of specifications using software tool such as Proteus

8. Perform hardware experiments in electric circuit analysis and verify the results against simulation results

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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COURSE OBJECTIVES:
The basic concepts and tools of the subject covered are:
1. Solving systems of linear equations, Matrix operations.
2. Vector spaces and subspaces; linear independence and span of a set of vectors, basis and dimension; the standard bases for common vector spaces.
3. Inner product spaces: Cauchy-Schwarz inequality, orthonormal bases, the Gramm Schmidt procedure, orthogonal complement of a subspace, orthogonal projection.
4. Linear Transformations: kernel and range of a linear transformation, the Rank- Nullity Theorem, linear transformations and matrices, change of basis, similarity of matrices.
5. Eigenvalues and eigenvectors, diagonalizability of a real symmetric matrix, canonical forms.

UNIT I VECTOR SPACES
Vector spaces – Subspaces – Linear combinations and Linear system of equations – Linear independence and Linear dependence – Bases and Dimensions.

UNIT II LINEAR TRANSFORMATION AND DIAGONALIZATION
Linear transformation - Null spaces and Ranges - Dimension theorem - Matrix representation of a Linear transformations - Eigenvalues and eigenvectors - Diagonalizability.

UNIT III INNER PRODUCT SPACES
Inner product, norms - Gram-Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation.

UNIT IV NUMERICAL SOLUTION OF LINEAR SYSTEM OF EQUATIONS

UNIT V NUMERICAL SOLUTION OF EIGENVALUE PROBLEMS AND GENERALISED INVERSES

TOTAL: 60 PERIODS
COURSE OUTCOMES
1. The students can able to solve system of linear equations, to use matrix operations and vector spaces using algebraic methods.
2. Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions.
3. Apply numerical methods to obtain approximate solutions to mathematical problems.
4. Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
5. Analyse and evaluate the accuracy of common numerical methods.

TEXT BOOKS:

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COURSE OBJECTIVES
1. To provide knowledge in the specific area of electrical measuring instruments. Emphasis is laid on the meters used to measure current, voltage, resistance, inductance and capacitance.
2. To have an adequate knowledge in the measurement techniques for power and energy.
3. Elaborate discussion about potentiometer and to impart knowledge on various instrument transformers and to understand the calibration of various meters.
4. In-depth understanding and idea of analog and digital instruments.
5. Detailed study of display and recording devices.

UNIT I MEASUREMENT OF ELECTRICAL PARAMETERS

UNIT II POWER AND ENERGY MEASUREMENTS

UNIT III POTENTIOMETERS AND INSTRUMENT TRANSFORMERS

UNIT IV ANALOG AND DIGITAL INSTRUMENTS

UNIT V DISPLAY AND RECORDING DEVICES

TOTAL : 45 PERIODS
COURSE OUTCOMES (COs)
1. An ability to compare the working principles, merits, demerits and errors of different types of electrical instruments and can understand about different instruments that are used for measurement purpose.
2. An ability to choose suitable AC and DC bridge for measuring R, L, C and frequency for the required specifications
3. An ability to apply knowledge of electronic instrumentation for measurement of electrical quantities.
4. Able to apply the principles and practices for instrument design and development to real world problems.
5. Ability to analyze and store the signals using various display and recording devices.
6. Ability to suggest the kind of instrument appropriate for typical measurements.

TEXT BOOKS:

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COURSE OBJECTIVES
1. To impart basic knowledge on different AC& DC Machines.
2. To introduce the concept of special machines and to motivate the students to solve simple/complex problems related to AC& DC machines.
3. Enable the student to choose machines for specific applications.
4. Make the students familiar with the testing and controlling of different machines.

UNIT I       MAGNETIC CIRCUITS AND TRANSFORMERS  

UNIT II      POLYPHASE INDUCTION MOTOR

UNIT III     DC MACHINES

UNIT IV      SYNCHRONOUS MACHINES

UNIT V       SPECIAL MACHINES

TOTAL : 45 PERIODS

Course Outcomes (COs)
1. Remember the basic concepts and terms of electrical machines.
2. Apply the basic concepts associated with DC and AC electrical machines to test and control the machines.
3. Interpret the performance characteristics of machines.
4. Select suitable machines for carrying out interdisciplinary projects.
5. Apply the knowledge on various machines to choose appropriate machines for specific application useful for society.
6. Understand the working of new machines and to learn their concepts.

**TEXT BOOKS:**

**REFERENCES:**
3. NPTEL Video Lecture series on “Electrical Machines I” and “Electrical Machines II” by Dr. Krishna Vasudevan, IIT Madras.

**MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES**

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**EI7303**  
**ELECTRONICS FOR ANALOG SIGNAL PROCESSING I**  
**L T P C**  
**4 0 0 4**  

**COURSE OBJECTIVES**
1. To introduce the students to the construction, operation, characteristics and applications of various semiconductor diodes and transistors.
2. To impart knowledge on different types of configurations and biasing circuits for BJT and FET.
3. To impart knowledge on single & multi-stage amplifiers, power amplifiers and oscillators.
4. To enable the students to analyze a given BJT / FET amplifier circuit for voltage gain, current gain, input impedance, output impedance and bandwidth.
5. To enable the students to design transistor amplifiers and oscillators for a given set of specifications.

UNIT I  SEMICONDUCTOR DIODES  12
PN junction diode: Forward and reverse characteristics, Applications in Rectifier, Switching, Clipper, Clamper and Protection circuits - Zener diode: Forward and reverse characteristics, Application as voltage regulator, Introduction to special diodes: Schottky diode, Varactor diode, Laser diode, Photodiode – UJT characteristics and application as relaxation oscillator, Thyristors: Characteristics and applications of SCR, DIAC and TRIAC.

UNIT II  BJT AMPLIFIERS  12

UNIT III  FET AMPLIFIERS  12

UNIT IV  MULTISTAGE AND FEEDBACK AMPLIFIERS  12

UNIT V  OSCILLATORS AND POWER AMPLIFIERS  12

TOTAL : 60 PERIODS

COURSE OUTCOMES (COs)
1. Ability to acquire basic knowledge on the working of various semiconductor devices.
2. Ability to design and analyze PN junction diode, BJT and MOSFET devices under various conditions.
3. To develop competence in frequency response analysis of BJT and FET devices.

Attested

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4. To develop design competence in the area of multistage and feedback amplifiers.
5. To make the students understand the concept of various power amplifiers and tuned amplifiers.
6. Ability to design transistor amplifiers and oscillators for a given set of specifications.

TEXT BOOKS:

REFERENCES:
6. NPTEL video lectures on “Electronics for Analog Signal Processing I” by Prof. K.R.K. Rao, IITM.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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EI7304 FUNDAMENTALS OF PNEUMATICS AND HYDRAULICS L T P C
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COURSE OBJECTIVES
1. To introduce the fundamentals of hydraulic and pneumatic systems and their applications.
2. To provide knowledge about the components involved in hydraulic and pneumatic systems.
3. To select the control strategy for hydraulic and pneumatic systems.
4. To gain basic safety precaution for hydraulic and pneumatic systems.
5. To understand the concept of interfacing these systems with PLC and various microcontrollers.

UNIT I FLUID POWER PRINCIPLES AND FUNDAMENTALS

UNIT II HYDRAULIC SYSTEM AND COMPONENTS

UNIT III CONTROL OF HYDRAULIC SYSTEMS

UNIT IV PNEUMATIC SYSTEM
- Compressors – Filter, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators – Introduction to Fluidics – Pneumatic logic circuits AND, OR, MEMORY, etc.

UNIT V ELECTRO HYDRAULIC AND ELECTROPNEUMATIC CIRCUITS

TOTAL : 45 PERIODS

COURSE OUTCOMES:
The students will be able to
1. Acquire the knowledge on principles and applications of fluid power.
2. Acquire knowledge on working principle of pump, actuators, control elements of fluid power system
3. Understand the principles of accumulators and circuits.
4. Design circuit for typical applications like material handling, press, shaping, milling, grinding.
5. Design electro pneumatics and PLC Circuits.

**TEXT BOOKS:**

**REFERENCES:**

**MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES**

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**EI7305**

**INSTRUMENT TRANSDUCERS**

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**COURSE OBJECTIVES**

1. Get to know the methods of measurement, classification of transducers and to analyze error.
2. To understand the behavior of transducers under static and dynamic conditions and hence to model the transducer.
3. Get exposed to different types of resistive transducers and their application areas.
4. To acquire knowledge on capacitive and inductive transducers.
5. To gain knowledge on variety of transducers and get introduced to MEMS and Smart transducers.
UNIT I  SCIENCE OF MEASUREMENTS AND CLASSIFICATION OF TRANSUDCERS  12
Units and standards – Static calibration – Classification of errors, Limiting error and probable 
error – Error analysis – Statistical methods – Odds and uncertainty – Classification of 
transducers – Selection of transducers.

UNIT II  CHARACTERISTICS OF TRANSUDCERS  12
Static characteristics: Accuracy, precision, resolution, sensitivity, linearity, span and range. 
Dynamic characteristics: Mathematical model of transducer, Zero, I and II order transducers, 
Response to impulse, step, ramp and sinusoidal inputs.

UNIT III  VARIABLE RESISTANCE TRANSUDCERS  12
Principle of operation, construction details, characteristics and applications of potentiometer, 
strain gauge, resistance thermometer, Thermistor, hot-wire anemometer, piezo-resistive sensor 
and humidity sensor.

UNIT IV  VARIABLE INDUCTANCE AND VARIABLE CAPACITANCE TRANSUDCERS  12
Inductive transducers – Principle of operation, construction details, characteristics and 
applications of LVDT, Induction potentiometer – Variable reluctance transducers – Synchros – 
Microsyn – Principle of operation, construction details, characteristics of Capacitive transducers 
– Different types & Signal Conditioning – Applications: Capacitor microphone, Capacitive 
pressure sensor, Proximity sensor.

UNIT V  OTHER TRANSUDCERS  12
Piezoelectric transducer – Hall Effect transducer – Magneto elastic sensor – Digital transducers – 
Fiber optic sensors – Thick & Thin Film sensors (Bio sensor & Chemical Sensor) – 
Environmental Monitoring sensors (Water Quality & Air pollution) – Introduction to MEMS – 
Introduction to Smart transducers and its interface standard (IEEE 1451).

TOTAL : 60 PERIODS

COURSE OUTCOMES (COs)
1. Ability to apply the Mathematical knowledge, science and Engineering fundamentals
2. To solve the problems pertaining to measurement applications and to perform error/ 
uncertainty analysis.
3. Ability to understand transduction principles and select suitable transducer for specific 
application.
4. Ability to determine the static and dynamic characteristics of various transducers.
5. Ability to design signal conditioning circuits for resistive, inductive and capacitive 
transducers.

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6. Ability to select and apply application specific transducer for engineering problems.

**TEXT BOOKS:**

**REFERENCES:**

**MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES**

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**EI7311 ELECTRICAL MACHINES LABORATORY**

**COURSE OBJECTIVES**
1. To obtain the no load characteristics of D.C and A.C machines.
2. To obtain the load characteristics of D.C and A.C machines.
3. To find out regulation characteristics of A.C. generator and Transformer.
4. To obtain the speed characteristics of D.C motor.
5. To obtain the control of special machines like stepper motor.

**LIST OF EXPERIMENTS**
1. Open circuit and load characteristics of self excited DC generator.
2. Open circuit and load characteristics of separately excited DC generator.
3. Speed control of separately excited DC shunt motor.
4. Load test on DC shunt and series motors.
5. Regulation of three-phase alternator.
7. Load test on single phase transformer.
8. No load and Blocked rotor test on three phase induction motor.
9. Load test on single phase induction motor.
11. Study of AC drives.
12. Study of DC drives.

TOTAL: 60 PERIOD

COURSE OUTCOMES
1. Ability to obtain the dynamic characteristics of electrical machines.
2. Ability to understand the concepts of no-load and full-load tests of DC and AC machines.
3. Ability to perform the efficiency and load test on single-phase transformer.
4. Ability to control the speed of the DC motor.
5. Acquire knowledge of AC drives and DC drives.
6. Ability to prepare the reports of the experiments carried out in the laboratory.
7. Ability to carry out the experiments in batches to motivate the team work.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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EI7312 ELECTRONICS FOR ANALOG SIGNAL PROCESSING LABORATORY

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COURSE OBJECTIVES
1. To facilitate the students to study the characteristics of various semiconductor devices.
2. To provide practical knowledge on the analysis of rectifiers, regulators, amplifiers and oscillators.
3. To enable the students to design rectifiers, regulators, amplifiers and oscillators for a given set of specifications.
4. To impart hands-on training to the students on e-CAD tools used for designing electronic circuits.

LIST OF EXPERIMENTS
2. (a) PN junction diode characteristics and application as a rectifier.
   (b) Zener diode characteristics and application as a regulator.
3. Characteristics of BJT amplifier in CE configuration and determination of h-parameters.
5. Characteristics of UJT and application as a relaxation oscillator.
6. Characteristics of SCR and application as a controlled rectifier.
7. Design of Voltage divider bias for BJT and FET circuits for a given operating point.
10. Design of Wien Bridge oscillator and Colpitts oscillator circuits.
12. Simulation of at least four of the above experiments using e-CAD tools.

TOTAL : 60 PERIODS

COURSE OUTCOMES (COs):
1. Gain knowledge on the proper usage of various electronic equipment and simulation tools for design and analysis of electronic circuits.
2. Get hands-on experience in studying the characteristics of semiconductor devices.
3. Ability to analyze various electronic circuits such as diode rectifiers, controlled rectifiers, voltage regulators, transistor amplifiers and oscillators.
4. Ability to present the results in oral form as well as in written form as a report.
5. Ability to interpret the results and draw meaningful conclusions.
6. Ability to work as a member of a team while carrying out experiments.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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OBJECTIVES:
1. To provide the necessary basic concepts in probability and random processes and apply them in random signals, linear systems etc. in communications engineering.
2. The students will have an exposure of various distributions.

UNIT I RANDOM VARIABLES
Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions - Functions of a random variable.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III RANDOM PROCESSES

UNIT IV CORRELATION AND SPECTRAL DENSITIES

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS
Linear time invariant system – System transfer function – Linear systems with random inputs – Autocorrelation and Cross-correlation functions of input and output - White noise.

TOTAL : 60

PERIODS

COURSE OUTCOMES(CO):
1. Students will be able characterize probability models using probability mass (density) functions & cumulative distribution functions
2. Students will be able to describe a random process in terms of its mean and correlation functions.
3. Students will demonstrate knowledge in special processes like Poisson, Renewal processes.
TEXTBOOKS:

REFERENCES:

EI7401 | DIGITAL PRINCIPLES AND APPLICATIONS | LT P C
3 0 0 3

COURSE OBJECTIVES
1. To study various number systems, Boolean expressions and simplifications.
2. To study, analyze and design of the combinational logic circuits for arithmetic operations.
3. To study, analyze and design of sequential circuits, registers and counters.
4. To study, analyze and design asynchronous sequential circuits and to know the functions of ASM charts.
5. To learn memory components, PLA, PAL and the basic of HDL.

UNIT I | BOOLEAN ALGEBRA AND LOGIC GATES | 9

UNIT II | COMBINATIONAL LOGIC | 9
UNIT III SYNCHRONOUS SEQUENTIAL LOGIC

UNIT IV ASYNCHRONOUS SEQUENTIAL LOGIC
Analysis and design of asynchronous sequential circuits – Reduction of state and flow tables – Race-free state assignment – Arithmetic State Machines: Introduction, components, features, examples.

UNIT V MEMORY AND PROGRAMMABLE LOGIC DEVICES

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)
1. An ability to compare the working principles, merits, demerits and errors of different types of electrical instruments and can understand about different instruments that are used for measurement purpose.
2. An ability to choose suitable AC and DC bridge for measuring R, L, C and frequency for the required specifications
3. An ability to apply knowledge of electronic instrumentation for measurement of electrical quantities.
4. Able to apply the principles and practices for instrument design and development to real world problems.
5. Ability to analyze and store the signals using various display and recording devices.
6. Ability to suggest the kind of instrument appropriate for typical measurements.

TEXT BOOKS:
REFERENCES:

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EI7402 ELECTRONICS FOR ANALOG SIGNAL PROCESSING II LT P C 4 0 0 4

COURSE OBJECTIVES

1. To introduce the basics of operational amplifiers, their characteristics and their configurations.
2. To impart knowledge about the concepts and applications of timer, PLL, ADC and DAC.
3. To enable the students to analyze the given integrated circuit and evaluate the output.
4. To enable the students to design signal conditioning circuits using operational amplifiers.
5. To enable the students to design multi-vibrator circuits using OPAMP / Timer for switching applications.

UNIT I OPERATIONAL AMPLIFIERS 12
UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIER
Differentiator and Integrator: ideal and practical circuits, V to I and I to V converters - Instrumentation amplifier circuit analysis, Instrumentation amplifier IC – Active Filters: Low pass, High pass, Band pass and Band reject filters – Comparator, Schmitt trigger, Multivibrators, Triangular wave generator, Sine wave generator, Function generator - Clipper and Clamper – Log and Antilog amplifiers.

UNIT III TIMER AND PHASE LOCKED LOOP

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS

UNIT V SPECIAL FUNCTION IC’S

COURSE OUTCOMES (COs)
1. Ability to acquire knowledge on the fundamentals of operational amplifiers and their configurations.
2. Ability to acquire knowledge on linear and non-linear applications of operational amplifiers
3. To enable the students to design signal conditioning circuits using operational amplifiers.
4. To impart knowledge about the concept and applications of 555 timer IC and PLL.
5. Ability to recommend the appropriate A/D and D/A converters for signal processing applications.
6. To make the students understand the concept of analog multipliers, Audio and video amplifiers and voltage regulators.

TEXT BOOKS:
REFERENCES:
4. NPTEL video lectures on “Electronics for Analog Signal Processing II” by Prof. K.R.K. Rao, IITM.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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EI7403 FUNDAMENTALS OF THERMODYNAMICS AND FLUID MECHANICS

COURSE OBJECTIVES
1. To understand the basic laws of thermodynamics.
2. To make the students to familiarize with the concepts, laws and methodologies for the analysis of gas turbines and compressors.
3. To understand the basic concepts of fluid mechanics.
4. To explore the working principle of different types of pumps and Hydraulic turbines.

UNIT I BASIC CONCEPTS AND LAWS OF THERMODYNAMICS
UNIT II INTRODUCTION TO APPLICATIONS OF THERMODYNAMICS  9
Air standard cycles – Thermodynamics assumption – Otto cycle, diesel cycle and Brayton cycle standard efficiency, mean effective pressure and power Air compressors: classification, single and multistage compressors, inter-cooler in compression process.
Refrigerators: classification, vapour compression and absorptions systems, Eco-friendly refrigerants.
Heat Transfer: introduction to modes of heat transfer with examples.

UNIT III BASIC CONCEPT OF FLUID MECHANICS & FLOW OF FLUIDS  9
Fluid: Properties and types.
Pressure: laws of pressure, types of pressure, pressure measurement using manometers and mechanical gauges. Viscosity: Kinematic and dynamic viscosity.
Fluid kinematics and dynamics – Types of fluid flow – velocity – rate equation of continuity – energy of a liquid in motion – head of a liquid – Bernoulli’s theorem

UNIT IV DIMENSIONAL AND MODEL ANALYSIS  9
Dimension – need for dimensional analysis, Rayleigh’s and Buckingham’s method applied to flow problems, limitation of dimensional analysis.
Model analysis – similitude, dimensionless numbers and their significance, similarity laws, model studies, limitation of scale models.

UNIT V HYDRAULIC MACHINES  9
Introduction and classification of hydraulic machines. Reciprocating pump: constructional details, working principle, co-efficient of discharge, slip, power required.
Centrifugal pump: classification and working principle, specific speed.
Turbines: classification, working principle of a Pelton wheel turbine.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)
1. Ability to understand and apply the basic laws of thermodynamics and fluid mechanics for different applications.
2. Ability to use the basic concepts and methodologies for the analysis of gas turbine and compressors.
3. Ability to understand the need of dimensional and model analysis.
4. Ability to understand the working principle of different types of pumps and hydraulic turbines.
5. Acquire knowledge on the various types of fluid machines.
TEXT BOOKS:

REFERENCES:

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EI7404 INDIUSTRIAL INSTRUMENTATION I

COURSE OBJECTIVES
1. To make students understand the physical principles and operation of industrial instruments for force, torque, speed, acceleration, vibration, density, viscosity, humidity, moisture, temperature, and pressure.
2. To make students understand the significance, limitations and applications of each industrial instrument.
3. To make students gain knowledge in solving numerical problems related to industrial instruments.
4. To make students design signal conditioning and compensation circuits for industrial instruments.
5. To make students capable to select a industrial instruments for a particular application.
UNIT I MEASUREMENT OF FORCE, TORQUE AND SPEED

Different types of load cells: Hydraulic, Pneumatic, Strain gauge, Magneto-elastic and Piezoelectric load cells - Different methods of torque measurement: Strain gauge, Relative angular twist. Speed measurement: Capacitive tacho, Drag cup type tacho, D.C and A.C tacho generators - Stroboscope.

UNIT II MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY

Accelerometers: LVDT, Piezoelectric, Strain gauge and Variable reluctance type accelerometers - Mechanical type vibration instruments - Seismic instruments as accelerometer – Vibration sensor - Calibration of vibration pickups - Units of density and specific gravity – Baume scale and API scale – Densitometers: Pressure type densitometers, Float type densitometers, Ultrasonic densitometer and gas densitometer.

UNIT III MEASUREMENT OF VISCOSITY, HUMIDITY AND MOISTURE


UNIT IV TEMPERATURE MEASUREMENT


UNIT V PRESSURE MEASUREMENT

Units of pressure – Manometers: Different types, Elastic type pressure gauges: Bourdon tube, Bellows, Diaphragms and Capsules - Electrical methods: Elastic elements with LVDT and strain gauges - Capacitive type pressure gauge - Piezo resistive pressure sensor-Resonator pressure sensor - Measurement of vacuum: McLeod gauge, Thermal conductivity gauge, lionization gauges, Cold cathode type and hot cathode type – Pressure gauge selection, installation and calibration using dead weight tester.

TOTAL : 45 PERIODS
COURSE OUTCOMES (COs)
1. Ability to understand the construction and working of instruments used for measurement of force, torque, speed, acceleration, vibration, density, viscosity, humidity, moisture, temperature and pressure.
2. Ability to analyze and select suitable sensor for the given industrial application
3. Understand the concept of calibration of instruments
4. Ability to design signal conditioning circuits and compensation schemes for measuring instruments.
5. Ability to apply the acquired knowledge in instrumentation design, installation and commissioning of measuring instruments

TEXT BOOKS:

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COURSE OBJECTIVES

1. To introduce the students to the principles of analog and digital communication.
2. To impart knowledge on the modulation and demodulation techniques, pulse communication systems and digital data transmission techniques.
3. To facilitate the students in analyzing the performance of transmitters and receivers.
4. To familiarize the students with the principles of multi-user communication systems.

UNIT I AMPLITUDE AND FREQUENCY MODULATION 9

UNIT II PULSE AND SPREAD SPECTRUM MODULATION 9
Pulse Modulation: Sampling theorem, Principles of PAM, PPM, PWM, PCM, DPCM, DM and ADM, Quantization noise in PCM. Spread spectrum modulation: Pseudo noise sequence, Direct sequenced spread spectrum, Frequency hopping spread spectrum.

UNIT III BASEBAND PULSE TRANSMISSION 9
Baseband coding techniques: Polar / Bipolar, RZ/NRZ and Manchester - M-ary PAM transmission, Baseband receiver: Error probability, Optimum and matched filter techniques, Optimum linear receiver, Probability of error.

UNIT IV PASSBAND DIGITAL TRANSMISSION 9
Digital modulation systems: Pass band transmission model, Asynchronous transmission, ASK, BFSK, BPSK and QPSK - Coherent reception - Signal space representation - Probability of error - Comparison of data transmission systems.

UNIT V COMMUNICATION SYSTEMS 9
Concept of multiplexing: FDM and TDM. Multiple Access: FDMA, TDMA and CDMA. Telephone switching - Mobile telephonic communication - Satellite communication - Radar system - Microwave communication.

TOTAL: 45 PERIODS

COURSE OUTCOMES (COs):
1. Understand the principles of modulation and demodulation techniques.
2. Classify the types of analog, pulse and digital modulation schemes.
3. Explain the baseband coding techniques.
4. Demonstrate the different types of multiplexing schemes used in communication systems.
5. Analyze various band-pass signaling schemes and compare their performance.
6. Describe the basic components of different communication systems.

TEXT BOOKS:

REFERENCES:

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COURSE OBJECTIVES

1. To design, implement and verify digital combinational circuits such as adders, decoders, encoders, magnitude comparators and multiplexers.
2. To design and analyze sequential logic circuits such as counters and shift registers.
3. To understand the principles of HDL and verify the operation of logic circuits through simulation.

LIST OF EXPERIMENTS

1. (a) Verification of logic gates – NAND, NOR, AND, OR, XOR, XNOR and NOT.
   (b) Study of flip-flops – SR, JK, D and T flip-flops.
2. Realization of Boolean expressions using gates.
3. Design of code converter, Encoder and Decoder using gates.
4. Implementation of Combinational logic circuits using MUX and Decoder ICs.
5. Design of Adders using gates and parallel adder using IC.
6. Implementation of Asynchronous counters with 7-segment display.
7. Implementation of Synchronous counters with 7-segment display.
8. Implementation of universal shift registers using flip-flops and IC.
9. Simulation of combinational logic circuits using HDL.
10. Simulation of sequential logic circuits using HDL.
11. Porting of combinational and sequential logic circuits into FPGA/CPLD.
12. Design of combinational / sequential logic circuit for instrumentation application such as Alarm / Interlock.

TOTAL: 60 PERIODS

COURSE OUTCOMES (COs)

1. Apply Boolean theorems for simplifying logical expressions.
2. Design and analyze the combinational logic circuits and sequential logic circuits.
3. Employ the logic circuits (combinational / sequential) for instrumentation applications.
4. Interpret the results of analysis and draw meaningful conclusions.
5. Present the results in oral form as well as in written form as a report.
6. Understand the principles of HDL and verify the operation of logic circuits through simulation.
MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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EI7412 SENSORS AND SIGNAL CONDITIONING CIRCUITS LABORATORY

COURSE OBJECTIVES
1. To make the students aware of basic concepts of measurement and operation of different types of transducers.
2. To make the students conscious about static and dynamic characteristics of different types of transducer.

LIST OF EXPERIMENTS
1. Static and Dynamic characteristics of Thermocouple (J,K,E) with and without thermowell.
2. Static and Dynamic characteristics of RTD and Thermistor.
5. Sensitivity analysis of strain gauge bridges (quarter, half and full).
6. a. Static characteristic of flapper-nozzle system.
    b. Loading effect on resistive potentiometer.
7. Characteristic of seismic type accelerometer.
8. Measurement of inductance (Anderson), capacitance (Schering) and resistance (Kelvin double) using bridges.
    b. Design and testing of Instrumentation amplifier.
10. Design of cold junction compensation for Thermocouples and lead wire compensations for RTD.
11. Design of signal conditioning circuits for high output impedance sensor (pH).
12. PC Based Data Acquisition system.

TOTAL: 60 PERIODS
COURSE OUTCOMES (COs)
1. Ability to understand the concept of LabVIEW based Data Acquisition Systems.
2. Ability to perform the measurement error, uncertainty and sensitivity analysis.
3. Ability to evaluate the static and dynamic characteristics of measuring instruments.
4. Acquire knowledge of importance in calibration for special transducers.
5. Ability to interface and analysis of different signal conditioning units.
6. Ability to design and experimentation on various measuring instruments.
7. Ability to work as a member of a team while carrying out experiments.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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EI7501   CONTROL SYSTEMS  LT P C
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COURSE OBJECTIVES
1. To make the students familiarize about various representations of systems.
2. To develop linear models mainly state variable model and Transfer function model from Non Linear systems.
3. To make the students analyze linear systems in time domain and frequency domain.
4. To train the students to design compensator for system(s) using time and frequency domain techniques.

UNIT I MODELING OF LINEAR TIME IN Variant SYSTEM (LTIV)
Control system: Open loop and Closed loop – Feedback control system characteristics – First principle modeling: Mechanical, Electrical and Hydraulic systems – Transfer function representations: Block diagram and Signal flow graph.

UNIT II STATE SPACE MODEL OF LTIV AND LTV SYSTEMS
UNIT III TIME DOMAIN AND STABILITY ANALYSIS


UNIT IV FREQUENCY DOMAIN ANALYSIS


UNIT V DESIGN OF FEED BACK CONTROL SYSTEM

Design specifications – Lead, Lag and Lag-lead compensators using Root locus and Bode plot techniques – Introduction to Non-linear system.

TOTAL : 60 PERIODS

COURSE OUTCOMES (COs)
1. Ability to develop various representations of system based on the knowledge of Mathematics, Science and Engineering fundamentals.
2. Ability to do time domain and frequency domain analysis of various models of linear system.
3. Ability to come out with solution for complex control problem.
4. Ability to interpret characteristics of the system to develop mathematical model.
5. Ability to design appropriate controller for the given specifications.

TEXT BOOKS:

REFERENCES:
MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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EI7502 FUNDAMENTALS OF DATA STRUCTURES AND ALGORITHMS   LT P C  
3 0 0 3

COURSE OBJECTIVES

1. To provide an introduction to computer algorithms and data structures, with an emphasis on foundational material.
2. To have a good understanding of the fundamental data structures used in computer science
3. To have a good understanding of how several fundamental algorithms work, particularly those concerned with sorting, searching and graph manipulation
4. To analyze the space and time efficiency of most algorithms
5. To design new algorithms or modify existing ones for new applications and reason about the efficiency of the result

UNIT I ARRAYS AND LINKED LISTS  
Linear arrays: Representation of linear arrays, insertion and deletion in linear arrays - Multidimensional arrays: Representation of n-dimensional arrays in memory – Linked list: Representation in memory, List traversal, Insertions and deletions – Sorted linked list: Searching, insertion and deletion – Introduction to doubly linked list, circular and header linked lists.

UNIT II STACKS AND QUEUES  
Stack: Representation of stack with arrays and linked lists, Simple applications, Recursive functions and its implementations – Queues: Representation of queue with arrays and linked lists, Implementation of Circular queue and Priority queue, Representation of double ended queues.

UNIT III TREES  
Binary Trees: Types of binary trees, Representation of binary trees in memory, Recursive and nonrecursive traversals – Binary Search Tree: Search, insertion and deletion – Representation of AVL tree – Heap Tree: Search, insertion and deletion – Construction of a minimum weighted
path length tree – Conversion of general tree to binary tree representation – Thread representation in binary trees.

UNIT IV GRAPHS 9

UNIT V SEARCHING AND SORTING 9

TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES (COs)
After completion the above subject, students will be able to understand
1. A comprehensive understanding of fundamentals data structures
2. Implement and compare the fundamental data structures
3. Develop programs on their own for advanced data structures
4. Correlate the use of data structures in real life situations
5. Confidence to develop programs for complex problems with improved performance
MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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EI7503 INDUSTRIAL INSTRUMENTATION II LT P C 3 0 0 3

COURSE OBJECTIVES

1. To make students understand the various measuring techniques for flow and level
2. To make students understand different type of transmitters.

UNIT I VARIABLE HEAD TYPE FLOWMETERS 9

UNIT II QUANTITY METERS, AREA FLOW METERS AND MASS FLOW METERS 9

UNIT III ELECTRICAL TYPE FLOW METERS 9
UNIT IV  LEVEL MEASUREMENT

UNIT V  TRANSMITTERS

COURSE OUTCOMES
1. Ability to understand the working principle of measuring instruments for flow and level.
2. Potential to identify and select the appropriate instrument for a given process measurement problem.
3. Select and use appropriate concepts and methods to solve problems effectively.
4. Competent to demonstrate the installation procedure for different measuring instruments.
5. Ability to calibrate measuring instruments.
6. Expertise to choose appropriate field transmitter for sensing different parameter in industrial environment.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
**EI7504 MICROPROCESSORS, MICROCONTROLLERS AND APPLICATIONS**

**COURSE OBJECTIVES**
1. To get familiarized with architecture, addressing modes and instructions of 8085 & 8086 microprocessor.
2. To get exposed to high Performance and advanced architectures.
3. To gain knowledge on essential peripherals and the associated interfacing ICs.
4. To get acquainted with 8-bit microcontroller and be able to program in assembly and C language.
5. To design microcontroller based system/application.

**UNIT I ARCHITECTURE OF 8085/8086 PROCESSOR**

**UNIT II ADVANCED ARCHITECTURES**

**UNIT III PERIPHERALS AND THEIR INTERFACING**
Programmable Peripheral Interface (8255) - Keyboard display controller (8279) – ADC – DAC Interface – Programmable Timer Controller (8254) – Programmable interrupt controller (8259) – Serial Communication Interface (8251) – DMA Controller (8257).
UNIT IV MICROCONTROLLER ARCHITECTURE & PROGRAMMING


UNIT V 8051: INTERFACING AND SYSTEM DESIGN


TOTAL: 45 PERIODS

COURSE OUTCOMES (COs)

1. Ability to understand the architectural features and instruction set of microprocessors and microcontrollers.
2. Ability to effectively utilize the gained fundamental knowledge to get updated over the state-of-the-art Microprocessor technology.
3. Ability to configure and utilize the services of various peripheral devices associated with microprocessors and microcontrollers.
4. Ability to interface real world field devices with microcontrollers with the purpose of designing embedded systems for process control applications.
5. Ability to provide suitable software solutions for embedded applications.
6. Ability to adopt best practices in system design to meet the requirements of the given real-world problem

TEXT BOOKS:


REFERENCES:


MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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EI7511      DATA STRUCTURES LABORATORY LT P C

COURSE OBJECTIVES
1. To understand and implement basic data structures using C / C++
2. To apply linear and non-linear data structures in problem solving

LIST OF EXPERIMENTS
1. Implementation of selection sort, bubble sort and insertion sort.
2. Implementation of binary search and interpolation search.
3. Implementation of merge sort algorithm.
4. Implementation of quick sort algorithm.
5. Conversion of infix expression into postfix expression.
7. Implementation of insertion and deletions in a linked list.
8. Implementation of linear queue with a linked list.
10. Implementation of priority queues.
11. Implementation of binary search tree; traversals; sorting.
12. Implementation of heap sort from heap tree.

**COURSE OUTCOMES (COs)**

After completion the above subject, students will be able to understand

1. A comprehensive understanding of fundamentals data structures
2. Implement and compare the fundamental data structures
3. Develop programs on their own for advanced data structures
4. Correlate the use of data structures in real life situations
5. Confidence to develop programs for complex problems with improved performance

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**EI7512 MICROPROCESSOR AND INTERFACING LABORATORY**

**LTP C 0 0 4 2**

**COURSE OBJECTIVES**

1. To develop skill in program writing for 8085, 8086 processors and 8051 microcontroller.
2. To gain Practical knowledge on interfacing hardware and associated software.
3. To get trained to Programming and interfacing using simulators.
4. To get exposed to programming and interfacing using ARM7, ARM11, MSP430, and PIC microcontroller.

**LIST OF EXPERIMENTS**

**ASSEMBLY LANGUAGE PROGRAMMING**

1. a) Understanding the instruction set of 8085 μp.
   b) PROGRAMMING using Arithmetic, Logical instructions of 8085 microprocessor.
2. a) Understanding the instruction set of 8086 μp.
   b) Programming using String manipulation instructions (Compare & Scan) of 8086 microprocessor.
3. a) Understanding the instruction set of 8051 μc.
b) Programming using Arithmetic, Logical and Bit manipulation instructions of 8051 microcontroller

SIMULATION EXPERIMENTS
4. Turbo assembler Programming (using arithmetic, logical, string instructions) of 8086.
5. Interfacing Keyboard / LCD with µc.
6. Interfacing ADC/DAC/ stepper motor with µc.

Hardware based Experiments using 8085 / 8086 / 8051 / ARM7 / ARM11 / MSP430 and PIC MICROCONTROLLER
7. Interfacing ADC and DAC with µp / µc.
8. Data transfer between computer and µp / µc.
9. a) Interfacing Keypad (4 x 4) with µp / µc.
    b) Interfacing LCD with µp / µc.
    10. I²C based RTC/ EEPROM/ 7-Segment display Interface with µp / µc.
11. Interfacing limit Switches/ Push buttons/ Solenoid valves/ Pumps with µp / µc.
12. a) Realization of PID algorithm in µp / µc.
    b) µp / µc based control of temperature / Level process.

TOTAL : 60 PERIODS

COURSE OUTCOMES (COs)

1. Ability to apply the acquired knowledge over the architectural features and instruction set of microprocessors and microcontrollers to come up with the right solution for a given task.
2. Ability to acquire real world signals using suitable data converters for process control applications.
3. Ability to interface real world field devices with microprocessors and microcontrollers with the purpose of designing embedded systems for Industrial automation.
4. Ability to effectively utilize various engineering design tools to perform real time simulation, PCB design for electronic prototyping and embedded system design.
5. Ability to analyze the requirements of a given application and use appropriate communication protocols.
6. Ability to analyze the given problem in hand and come up with suitable embedded solution.
7. Ability to demonstrate the acquired skills in multidisciplinary environments as a team member/leader.
8. Ability to professionally document the results obtained through experimental analysis.
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EI7601 DISCRETE TIME SIGNAL PROCESSING

LT P C
4 0 0 4

COURSE OBJECTIVES
1. To introduce the basic concepts of Digital Signal processing.
2. To make the students familiarize various mathematical tools for analyzing Discrete Time Systems.
3. To make the students design Digital Filters based on the Filter specifications.
4. To provide the exposure to the architectures of DSP processors.
5. To implement various algorithms in DSP for solving Real-time problem.

UNIT I INTRODUCTION 12
Digital signal processing: Block diagram, advantages and applications, Linear and circular convolution, convolution techniques for long duration sequence, autocorrelation and cross correlation, aliasing effects in time domain – Review of DTFS, DTFT and Z-Transform.

UNIT II DFT AND FFT 12
DFT properties, magnitude and phase representation – Direct computation of DFT – FFT: Radix 2 DIT & DIF algorithms, computational complexity, DFT and IDFT using FFT algorithms.

UNIT III DIGITAL IIR FILTERS 12

Attested

Director
UNIT IV  DIGITAL FIR FILTERS  12

UNIT V  FINITE WORD LENGTH EFFECTS AND DSP PROCESSORS  12
Finite word length Effect – Fixed and floating point number representation, Quantization errors – Finite word length effects in IIR and FIR filters – Introduction to DSP architectures – addressing modes and Instruction set.

TOTAL : 60 PERIODS

COURSE OUTCOMES (COs)
1. Ability to remember the fundamentals of deterministic / stochastic processes, filters and adaptive signal processing,
2. Ability to understand the various types of digital filters used for signal processing
3. Ability to apply the mathematical tools such as DFT and FFT algorithms for discrete time signal processing
4. Ability to analyze the digital filter characteristics in time and frequency domains
5. Ability to evaluate the characteristics of any given system to design digital filters with required specifications
6. Ability to solve complex problems in Digital Filter Design and systems for Discrete Time Signal Processing

TEXT BOOKS:

REFERENCES:
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EI7602 PROCESS CONTROL LT P C

COURSE OBJECTIVES

1. To introduce technical terms and nomenclature associated with Process control domain.
2. To familiarize the students with characteristics, selection, sizing of control valves.
3. To introduce students to the fundamentals of system identification.
4. To provide an overview of the features associated with Industrial type PID controller.
5. To make the students understand the various PID tuning methods.
6. To elaborate different types of control schemes such as cascade control, feed-forward control and Model Based control schemes.

UNIT I PROCESS DYNAMICS 12


UNIT II CONTROL VALVE 12

UNIT III CONTROL ACTIONS


UNIT IV PID CONTROLLER TUNING – SINGLE LOOP REGULATORY CONTROL & ENHANCEMENT TO SINGLE LOOP REGULATORY CONTROL


UNIT V MODEL BASED CONTROL SCHEMES & INTRODUCTION TO MULTI-LOOP REGULATORY CONTROL & CASE STUDIES


TOTAL: 60 PERIODS

COURSE OUTCOMES (COS)

1. Ability to understand technical terms associated with Process control domain.
2. Ability to develop models using first principles approach for processes such as level, flow, temperature and pressure as well as analyze models.
3. Ability to recommend the right type of control valve along with its characteristics for a given application.
4. Ability to size a control valve following the procedure outlined in the ISA S 75.01 standard.
5. Ability to design & implement a suitable control scheme for a given process and validate through simulations.
6. Ability to analyze various control schemes and recommend the right control strategy for a given application.
7. Ability to use appropriate software tools (Example: MATLAB/SCILAB) for analysis, design and implementation of Process Control System.
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EI7603 PROJECT MANAGEMENT AND FINANCE LT P C 3 0 0 3

COURSE OBJECTIVES
1. To outline the need for project management.
2. To outline the importance of finance and accounting.
3. To demonstrate knowledge and understanding of the engineering and management principles.
4. To function effectively as an individual, and as a member or leader in diverse teams.

UNIT I PROJECT MANAGEMENT, PROJECT SELECTION AND PROJECT 9
UNIT II       PROJECT IMPLIMENTATION, MONITORING AND CONTROL       9

UNIT III       PROJECT EVALUATION, AUDITING AND OTHER RELATED TOPICS IN PROJECT MANAGEMENT       9
Project Evaluation – Project auditing – Phase of project audit – Project closure reports, computers, e-markets in Project Management.

UNIT IV       FINANCE AND ACCOUNTING       9

UNIT V       WORKING CAPITAL MANAGEMENT AND CAPITAL BUDGETING       9

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. Selecting the project and identify the easy method to manage project within finance.
2. Implementing the role and responsibility by selecting suitable method in the project management.
3. The project work manage and carried out by the engineer within the finance.
4. Performance analysis on the project has been manage within the finance.
5. Demonstrate budget with the working capital and apply them with suitable methods.

TEXT BOOKS:

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HS7551

EMPLOYABILITY SKILLS

COURSE DESCRIPTION
This course aims to help the students acquire the employability skills necessary for the workplace situations. It also attempts to meet the expectations of the employers by giving special attention to language skills, presentation skills, group discussion skills and soft skills. This will be achieved through expert guidance and teaching activities focusing on employability skills.

COURSE OBJECTIVES
1. To enhance the employability skills of students with a special focus on presentation skills, group discussion skills and interview skills
2. To help them improve their reading skills, writing skills, and soft skills necessary for the workplace situations
3. To make them employable graduates

UNIT I READING AND WRITING SKILLS
Reading: skimming & scanning strategies – note making skills – interpreting visual material (charts & tables) – critical reading – fast reading necessary for reading letters & files - preparing job applications - writing covering letter and résumé - applying for jobs online - email etiquette – writing official letters (placing an order, letters to consumers, etc. ) writing reports – collecting, analyzing and interpreting data.

UNIT II SOFT SKILLS

UNIT III PRESENTATION SKILLS
Preparing slides with animation related to the topic – organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation
practice— presenting the visuals effectively – 5 minute presentation.

UNIT IV GROUP DISCUSSION SKILLS
Participating in group discussions – understanding group dynamics - brainstorming the topic — questioning and clarifying – GD strategies (expressing opinions, accepting or refusing others opinions, turn taking) – activities to improve GD skills – viewing recorded GD - mock GD.

UNIT V INTERVIEW SKILLS
Interview etiquette – dress code – body language – mock interview —attending job interviews – answering questions confidently – technical interview – telephone/Skype interview - practice in different types of questions – one to one interview & panel interview – FAQs related to job interview Emotional and make presentations and participate in group discussions with high level of self-confidence. • Students will be able to perform well in the interviews • They will have adequate reading and writing skills needed for workplace situations

REFERENCES:
5. Van Emden, cultural intelligence.

TOTAL :45 PERIODS

COURSE OUTCOMES (CO)
After completion the above subject
1. Students will be able to make presentations with high level of self-confidence.
2. Students will be able to participate in group discussions with confidence.
3. Students will have a good soft skill capability.
4. Students will be able to perform well in the interviews.
5. They will have adequate reading and writing skills needed for workplace situations.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES
COURSE OBJECTIVES
1. To make the students aware about calibration of meters, sensors and transmitters.
2. To make the students conscious about the working and operation of different types of analytical Instruments.
3. To identify, formulate, and analyze problems regarding sensors and transmitter
4. To use research-based knowledge and research methods for interpretation of data from sensors.

LIST OF EXPERIMENTS
1. a) Testing of pressure gauge using dead weight tester.
b) Level measurement using d/p transmitter including elevation consideration.
2. a) Calibration of thermocouple and RTD using temperature calibrator.
b) Calibration of temperature transmitter using multifunction calibrator.
3. Calibration of ammeter, voltmeter and wattmeter using multifunction calibrator.
4. a) Calibration and configuration of smart transmitter using HART communicator.
b) Calibration and configuration of transmitters using loop calibrator.
8. Interfacing Different types of flow meter with PC using DAQ.
10. a) Temperature Measurement using IR Thermometer.
b) Measurement of Level and Pressure using fiber optics system.
11. a) Testing of Rotameter.
b) Installation of d/p based level Transmitter.

TOTAL : 60 PERIODS

COURSE OUTCOMES
1. Ability to determine the time response and frequency response of given systems such as mechanical, electrical, hydraulic systems using suitable tools.
2. Ability to design, realize and validate lag / lead / lag-lead compensators for a given single input and single output system.
3. Ability to analyze and design control scheme for an open loop unstable system and MIMO system.
4. Ability to determine the static and dynamic characteristics of torque, speed, density and level measuring instruments.
5. Ability to quantify uncertainty associated with measuring instruments.
6. Ability to interface field instruments with PC using DAQ cards.
7. Ability to configure smart transmitters using HART communicator.
8. Ability to communicate efficiently the engineering facts and function actively and efficiently as an individual or a member/leader of different teams and multidisciplinary projects.

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**EI7612 PROCESS CONTROL LABORATORY**

**COURSE OBJECTIVES**

To impart theoretical and practical skills in
1. Process Identification
2. Tuning of PID controller including Auto-tuning
3. PID Enhancements (Cascade and Feed-forward Control Schemes) and
4. Design and Implementation of basic and advanced Control schemes using the facilities available in the Process Control lab.

**LIST OF EXPERIMENTS**

**Simulation Based Experiments**

1. Interpretation of P & ID (ISA S5.1)

2. Simulation of Lumped/ Distributed Parameter System.


5. Design and Implementation of Feed forward and Cascade control schemes on the simulated model of a Typical Industrial Process.

6. (i) Analysis of MIMO system.
   (ii) Design and implementation of Multi-loop PID schemes on the simulated model of a Typical Industrial Process.

**Hardware Based Experiments (Experiments Carried out On the Skid Mounted Plants)**

7. (i) Study of a Process Control Training plant.
   (ii) Determination of characteristics of a Pneumatically Actuated Control valve (with and without Positioner).

8. Design and implementation of ON-OFF controller for the Temperature Process.

9. Control of flow process using industrial type PID controller.

10. PC based control of level process.

11. On-line monitoring and control of a pilot plant using an industrial type distributed control system.

12. Design and implementation of advanced control scheme (adaptive controller or model predictive Control scheme) on the skid mounted pilot plant.

**TOTAL : 60 PERIODS**

**COURSE OUTCOMES(COs)**

1. Ability to work and measure parameter of flow/ level / temperature / pressure from SKID mounted pilot plant.
2. Ability to analyze, design suitable control schemes for industrial type process.
3. Ability to design ON-OFF, feed forward, cascade and multiloop PID controllers for the typical industrial process.
4. Ability to use appropriate software tools for design, analysis and implementation of control scheme.
5. Ability to experimentally measure industrial process parameters (such as flow, viscosity and humidity) and physiological parameters of the human body.
6. Ability to configure and interface different field devices with PC.
7. Ability to select, design, install and operate field devices for measurement of flow, temperature and pressure through a typical industrial case study(combustion process).
8. Ability to experimentally verify electrical safety of an instrument.
9. Ability to communicate efficiently the engineering facts and function actively and efficiently as an individual or a member/leader of different teams and multidisciplinary projects.
MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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EI7701  COMPUTER CONTROL OF PROCESSES  LT P C  4 0 0 4

COURSE OBJECTIVES
1. To represent the linear time invariant System in discrete State Space form.
2. To analyze the controllability, observability and stability of a Discrete Time System.
3. To estimate model parameters from input/output measurements.
4. To design Digital Controllers.
5. To design controllers for multi-loop and multivariable systems.

UNIT I  DISCRETE STATE-VARIABLE TECHNIQUE  12
State equation of discrete time system with sample and hold – State transition equation – Methods of computing the state transition matrix – Decomposition of discrete time transfer functions – State diagram representations of Discrete time systems - Controllability and observability of linear time invariant discrete time system – Stability tests of discrete time system – State Observer.

UNIT II  SYSTEM IDENTIFICATION  12

UNIT III  DIGITAL CONTROLLER DESIGN  12
UNIT IV  MULTI-LOOP REGULATORY CONTROL


UNIT V  MULTI-VARIABLE REGULATORY CONTROL


TOTAL : 60 PERIODS

COURSE OUTCOMES (COs)
1. Understand and apply the basics of discrete systems to find the solutions for problems.
2. Build mathematical models by parametric and non-parametric methods using software tools.
3. Obtain the controllability, observability and stability of discrete time systems.
4. Understand the performance of MIMO system.
5. Develop multi-loop and multivariable control for real-time MIMO system.
6. Design digital controllers for a process.

TEXT BOOKS:

REFERENCES:
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EI7702          LOGIC AND DISTRIBUTED CONTROL SYSTEM          LT P C
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COURSE OBJECTIVES
1. To give an overview of the automation technologies such as PLCs, SCADA and DCS used in industries.
2. To provide a fundamental understanding of the different languages used for PLC programming.
3. To provide insight into some of the advanced principles those are evolving for present and future automation.

UNIT I PLC & SCADA
PLC: Evolutions of PLCs – Programmable Controllers – Architecture, I/O modules – Comparative study of Industrial PLCs. SCADA: Remote terminal units- Master station - Communication architectures.

UNIT II BASICS OF PLC PROGRAMMING (LADDER)

UNIT III PLC PROGRAMMING (OTHER LANGUAGES)
Functional block programming - Sequential function chart – Instruction list – Structured text programming – PLC controlled sequential Process Examples.

UNIT IV DISTRIBUTED CONTROL SYSTEM
DCS: Evolution & types – Hardware architecture – Field control station – Interfacing of conventional and smart field devices (HART and FF enabled) with DCS Controller – Communication modules – Operator and Engineering Human interface stations – Study of any one DCS available in market.
UNIT V ADVANCED TOPICS IN AUTOMATION

Introduction to Networked Control systems – Plant wide control – Internet of things – Cloud based Automation – OLE for Process Control – Safety PLC – Case studies: PLC - SCADA - DCS.

TOTAL : 45 PERIODS

Course Outcomes (CO)
1. Able to gain understanding/knowledge on field devices, I/O modules, Industrial controllers like PLC, SCADA and DCS of Industrial Automation system
2. Able to formulate a discrete control problem and arrive at developing a control solution by PLC ladder program and other programming languages
3. Able to synthesize the solution for complex problems and provide alternate solutions by means of other programming languages of PLC
4. Able to identify an application that requires Distributed control system and provide an integrated solution using DCS
5. Able to select and apply appropriate technique for Automation by learning advanced topics in Automation.

TEXT BOOKS:

REFERENCES:
4. NPTEL Notes on, “Programmable Logic Control System” by Department of Electrical Engg., IIT Kharagpur.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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EI7711 INDUSTRIAL AUTOMATION LABORATORY

COURSE OBJECTIVES
To teach the importance of measurement for monitoring, control and to impart theoretical and practical skills in
1. Sensor Data acquisition, Data analysis, Data processing and Data visualization.
2. Interfacing Conventional and Smart Field Devices (Transmitters & Control Valves) with Industrial Type Programmable Logic Controller and Distributed Control System
3. Understanding the Instruction set of Programmable Logic Controller.
4. Programming of Industrial Type Programmable Logic Controller (Ladder Logic, Function Block Programming, Sequential Function Chart and Instruction List)

LIST OF EXPERIMENTS
1. Interfacing Level Transmitter and Control Valve with Personal Computer.

2. (i) Study of PLC Field Device Interface Modules (AI, AO, DI, DO Modules) (ii) Interfacing Analog/Digital Input/output Devices with Industrial Type PLC
3. Simple exercises using the Instruction Set of an Industrial Type PLC.

4. PLC Exercises-I (Hardware Implementation)
   i. Filling/draining control operation. ii. Reversal of DC motor direction.

5. PLC Exercises-II (Hardware Implementation)
   Traffic light control.
   Alarm Annunciator Sequence.

6. Control of Level Process using an Industrial Type PLC


9. (i) Study of DCS Field Device Interface Modules (AI, AO, DI, DO, H1 Modules)
    (ii) Interfacing Analog/Digital Input/Output Devices with an Industrial Type DCS

10. Implementation of Feedback Control Scheme in DCS using IEC 61131-3 Function Block Programming method.
11. (i) Interfacing HART and FF enabled Field Devices with Industrial Type DCS.
   (ii) Demonstration of PID Control in Field Devices.
12. Interfacing Wireless HART enabled Field Devices with DCS.

**TOTAL : 60 PERIODS**

**COURSE OUTCOMES (COs)**
1. Gain hands on experience in working with Industrial Automation Systems (Industrial Type DCS & PLC)
2. Be able to Configure Function Blocks and develop Feedback Control Schemes.
3. Ability to monitor and control a pilot plant using Industrial Type DCS/PLC
4. Be able to analyze & interpret results and draw meaningful conclusions.
5. Be able to present the results in written and oral forms.
6. Ability to work as a member in a group.

**MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES**

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**EI7712 INSTRUMENTATION SYSTEM DESIGN LABORATORY**

**COURSE OBJECTIVES**
1. To impart knowledge on the design of signal conditioning circuits for the measurement of Level, temperature etc.
2. To develop the skills needed to design, fabricate and test Analog/ Digital PID controller, Data Loggers and Alarm Annunciator.
3. To develop various modules for final year project as per industrial standards and practices.
4. To make the student familiarize with the design of orifice and control valve sizing.

**LIST OF EXPERIMENTS**
10. Development of Software Program for sizing Control Valve.
(b) Preparation of Project Scheduling, Installation Procedure and Safety Regulations

TOTAL : 60 PERIODS

COURSE OUTCOMES (COs)
1. Ability to carry out the design and fabrication of conventional and smart transmitters for key process variables such as flow, level, pressure and temperature.
2. Potential to realize On/Off controllers, PID controllers and PLC.
3. Proficient to design data loggers and alarm circuits for an industrial application requirement.
4. Able to develop software programs for sizing control valve, orifice and rotameter.
5. Capable of preparing documentation for Instrumentation projects.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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EI7713 MINI PROJECT/INDUSTRIAL TRAINING (6 WEEKS-DURING SUMMER VACATION)/INTERNSHIP LT P C 0 0 6 3

COURSE OBJECTIVES

The student should be made to:
1. To use the knowledge acquired in various subjects of Electronics and Instrumentation Engineering and carry out Mini Project. This will motivate students to come up with new designs, Fabrication, developing algorithms and software programs expressing their ideas in a novel way.
2. learn methodology to select a good project and able to work in a team leading to development of hardware/software product.
3. prepare a good technical report.
4. Gain Motivation to present the ideas behind the project with clarity.
5. Get exposure to work in an industrial environment.

MINI PROJECT
To identify a topic of interest in consultation with Faculty/Supervisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design/fabrication or develop codes/programs to achieve the objectives. Demonstrate the novelty of the project through the results and outputs.

The progress of the mini project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The evaluation will be made based on this report and a viva-voce examination, conducted internally by a 3-member committee appointed by Head of the Department.

(OR)

INDUSTRIAL TRAINING/INTERNSHIP (6 WEEKS – DURING SUMMER VACATION)

The student may undergo Industrial Training/Internship and the credits earned will be indicated in the mark sheet. If the student earns three credits in Industrial Training/Internship, the student may drop one professional Elective. In such cases Industrial Training/Internship needs to be undergone continuously from one organization only. The student is allowed to undergo a maximum of 6 weeks Industrial Training/Internship during the entire duration of study.

The Industrial Training/Internship shall carry 100 marks and shall be evaluated through continuous assessment only. The progress of the Industrial Training/Internship is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. At the end of industrial training/internship, the student shall submit a brief report on the training undergone and a certificate from the organization concerned. The evaluation will be made based on this report and a viva-voce Examination, Conducted internally by a three member Departmental Committee constituted by the Head of the Department. Certificate (issued by the organization)) submitted by the student shall be attached to the mark list and sent to Additional Controller of Examination by the Head of the Department.

TOTAL : 90 PERIODS
COURSE OUTCOMES (COs)
1. At the end of the course, the student should be able to:
2. Select a good project and able to work in a team leading to development of hardware/software product.
3. Prepare a good technical report and able to present the ideas with clarity.
4. Gain Knowledge on various terminologies related to industrial environment.
5. Able to work efficiently as a member of different teams related to multidisciplinary projects.
6. Acquire skills to communicate efficiently and gain management skills related to industry / research organizations.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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EI7811 PROJECT WORK

COURSE OBJECTIVES
The student should be made to:
1. Learn methodology to select a good project and able to work in a team leading to development of hardware/software product.
2. Prepare a good technical report.
3. Gain Motivation to present the ideas behind the project with clarity.

A Project topic must be selected either from research literature or the students themselves may propose suitable topics in consultation with their guides. The aim of the project work is to deepen Comprehension of principles by applying them to a new problem which may be the design/fabrication of Sensor/Activator/Controller, a research investigation, a computer or management project or a design problem.

The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department.

A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

TOTAL : 300 PERIODS

COURSE OUTCOMES (COs)
1. Ability to find solution for complex engineering problems applying the engineering knowledge.
2. Ability to formulate and analyze complex engineering problem.
3. Select and apply software tools required to solve the formulated problem
4. Ability to identify and find solution to societal issues
5. Ability to work as a member in a team
6. Ability to find solutions to the formulated problem using multidisciplinary engineering knowledge
7. Ability to communicate the engineering activity and to do effective documentation of the work carried out
8. Ability to use the knowledge obtained from project to engage in life-long learning

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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EI7001 ADVANCED TOPIC IN PID CONTROL L T P C 3 0 0 3

COURSE OBJECTIVES
1. To provide an overview of the features associated with Industrial type PID controller.
2. To make the students understand the various PID Controller Design methods and about PID stabilization for Linear Time-invariant models.
3. To develop the skills needed to design adaptive and non-linear PID control schemes.
4. To provide basic knowledge about Fractional-order systems and Fractional-order- controller and to lay the foundation for the systematic approach to Design controller for fractional order systems.

UNIT I INTRODUCTION 9

UNIT II PID CONTROLLER DESIGN 9
UNIT III  PID STABILIZATION  

UNIT IV  ADAPTIVE/NON-LINEAR PID CONTROL SCHEMES  
Gain Scheduled PID Controller - Self-tuning PI/PID Controller – PID Types Fuzzy Logic Controller – Predictive PID Control.

UNIT V  INTRODUCTION TO FRACTIONAL ORDER SYSTEM AND FRACTIONAL ORDER PID CONTROLLER  

TOTAL: 45 PERIODS

COURSE OUTCOMES (COs)

1. Ability to determine the advanced Features supported by the Industrial Type PID Controller.
2. Ability to Design, tune and implement P/PI/PID Controllers to achieve desired Performance for various processes.
3. Ability to analyse the stability and robustness of closed loop system with PID controller.
4. Ability to design and implement adaptive PID controllers and Non-linear PID Control schemes.
5. Ability to Analyze Fractional-order systems, Fractional-order- controller and Design controller for fractional order systems

TEXT BOOKS:

REFERENCES:
EI7002 ANALYTICAL INSTRUMENTS L T P C 3 0 0 3

COURSE OBJECTIVES
1. To understand the theory and operational principles of instrumental methods for identification and quantitative analysis of chemical substances by different types of spectroscopies.
2. To impart fundamental knowledge on gas chromatography and liquid chromatography.
3. To integrate a fundamental understanding of the underlining principles of physics as they relate to specific instrumentation used for gas analyzers and pollution monitoring instruments.
4. To impart knowledge on the important measurement in many chemical processes and laboratories handling liquids or solutions.
5. To understand the working principle, types and applications of NMR and Mass spectroscopy.

UNIT I SPECTROPHOTOMETRY

UNIT II CHROMATOGRAPHY

UNIT III INDUSTRIAL GAS ANALYZERS AND POLLUTION MONITORING INSTRUMENTS
Gas analyzers – Oxygen, NO2 and H2S types, IR analyzers, 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.
UNIT IV  pH METERS AND DISSOLVED COMPONENT ANALYZERS 9

UNIT V  NUCLEAR MAGNETIC RESONANCE AND MASS SPECTROMETRY 9

TOTAL: 45 PERIODS

COURSE OUTCOMES (COs)
1. On completion of this course, the students will be able to, understand the working principle behind different analytical methods in the industry.
2. Understand the basic operation of different analytical instruments and their applications.
3. Appreciate the strengths and limitations of various analytical instruments
4. Develop critical thinking for interpreting analytical data.
5. Select an appropriate analytical instrument for an industrial requirement.
6. Apply the theoretical knowledge gained to solve numerical problems related to analytical instrumentation.

TEXT BOOKS:

REFERENCES:
4. NPTEL lecture notes on, “Modern Instrumental methods of Analysis” by Dr.J.R. Mudakavi, IISC, Bangalore.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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**EI7003 APPLIED SOFT COMPUTING**

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**COURSE OBJECTIVES**

1. Get familiarized with different architectures and training algorithms of neural networks.
2. Get exposed to the various neural modeling and control techniques with case study using simulation tool box.
4. Able to design and implement the fuzzy logic controller with case study using simulation tool box.
5. Capable of designing hybrid control schemes, selected optimization algorithms with case study using simulation tool box.

**UNIT I ARTIFICIAL NEURAL NETWORK (ANN)**


**UNIT II NEURAL NETWORKS FOR MODELING AND CONTROL**


**UNIT III FUZZY SET THEORY**


**UNIT IV FUZZY LOGIC FOR MODELING AND CONTROL**

Modeling of non-linear systems using fuzzy models: TSK model – Fuzzy logic controller: Fuzzification, Knowledge base, Decision making logic, Defuzzification – Adaptive fuzzy
systems – Case Study – Familiarization with fuzzy logic toolbox.

UNIT V  HYBRID CONTROL SCHEMES

TOTAL : 45 PERIODS

TEXT BOOKS :

REFERENCES:

COURSE OUTCOMES (COs)
1. Be able to gain knowledge on various neural network architectures and training algorithms and summarize their merits and limitations.
2. Be able to select proper architecture, training algorithm, parameters of neural network for modeling and control of non-linear systems.
3. Be able to design and develop fuzzy logic controller for a given application.
4. Be able to apply Engineering fundamentals to use hybrid schemes and obtain solution for complex engineering problems.
5. Be able to formulate the optimization problem and able to simulate using selected optimization algorithms such as GA, PSO, SVM.
6. Be able to systematically carryout the process modeling and controller design using soft computing techniques using modern IT tool boxes for appropriate case studies.

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E17004  BIOMEDICAL INSTRUMENTATION  L T P C

COURSE OBJECTIVES

• To make students understand various physiological signal measurements, Identification and classification.
• To make students understand various Biomedical Instruments used for Bio-potential measurement and non-electrical parameter measurement.
• To make students familiarized with the medical imaging and understanding the concept of assisting and therapeutic devices.

UNIT BASIC CONCEPTS OF MEDICAL INSTRUMENTATION


UNIT II ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS


UNIT III NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES

finger-tip oximeter – ESR, GSR measurements.

UNIT IV MEDICAL IMAGING SYSTEMS

UNIT V LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES (COs)
1. Ability to compare and analyze the operation of different medical devices.
2. Ability to measure, detect and analyze the bio-signals.
3. Ability to select and apply the appropriate medical instruments for measurement.
4. Ability to design medical devices for diagnosis and therapeutic applications.
5. Ability to analyze simple bio-sensing and transduction problems.
6. Ability to apply safety standards and select disposal method and procedures for electrical diagnostic equipment.
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EI7005 FAULT DETECTION AND DIAGNOSIS LT P C 3 0 0 3

COURSE OBJECTIVES

1. To give an overview of different Fault Detection and Diagnosis methods.
2. To present an overview of various types of fault detection schemes using Limit Checking, Parameter estimation methods, Principle Component Analysis.
3. To impart knowledge and skills needed to design and detect sensor and actuators faults using structured residual approach as well as directional structured residual approach.
4. To impart knowledge and skills needed design and detect faults in sensor and actuators using GLR and MLR based Approaches.
5. To impart knowledge and skills needed to detect and quantify and compensate stiction in Control valves.

UNIT I INTRODUCTION & ANALYTICAL REDUNDANCY CONCEPTS 9

UNIT II FAULT DETECTION AND DIAGNOSIS USING LIMIT CHECKING AND PROCESS IDENTIFICATION METHODS 9

UNIT III FAULT DETECTION AND DIAGNOSIS USING PARITY EQUATIONS 9
Introduction to parity equation implementation and alternative representation - Directional Specifications: Directional specification with and without disturbances – Parity Equation Implementation.

UNIT IV   FAULT DIAGNOSIS USING STATE ESTIMATORS

UNIT V   CASE STUDIES

TOTAL:45 PERIODS

TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES (COs)
1. Ability to explain different approaches to Fault Detection and Diagnosis.
3. Ability to design and detect sensor and actuators faults using structured residual approach as well as directional structured residual approach.
4. Ability to design and detect faults in sensor and actuators using GLR and MLR based Approaches.
5. Ability to detect and quantify and compensate stiction in Control valves.
## MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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### E17006 FIBRE OPTICS AND LASER INSTRUMENTATION

#### COURSE OBJECTIVES

1. To discuss about theory behind light propagation in optical fibers, types of optical fibers, dispersion characteristics for various types of optical fibers and attenuation measurement system.
2. To provide an overview of recent advances in fiber optic sensor technology.
3. To provide knowledge on principle of laser generation, laser system and its types.
4. To emphasize how lasers have been used for industrial applications.
5. To acquaint the students with fundamentals of holography.

#### UNIT I OPTICAL FIBER AND THEIR PROPERTIES


#### UNIT II INDUSTRIAL APPLICATION OF OPTICALFIBER

Fiber optic sensors – Fiber optic instrumentation system for measurement of fiber characteristics – Different types of modulators – Interferometric method for measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain – fiber optic gyroscope – Polarization Maintaining fibers.

#### UNIT III LASER FUNDAMENTALS


#### UNIT IV INDUSTRIAL APPLICATION OF LASERS

120
Laser for measurement of distance, length, velocity, acceleration, current, voltage and Atmospheric effect – Material processing – Laser heating, welding, melting and trimming of material – Material Removal and vaporization.

UNIT V    HOLOGRAM AND MEDICAL APPLICATIONS

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES (COs):
1. Ability to utilize the principles of light transmission, characteristics and losses in optical fibers for measurement applications.
2. Ability to apply the concepts of optical fibers for its use in sensor development as well as important applications in production, manufacturing and industrial applications.
3. Ability to compare the lasing theory of various laser generation systems.
4. Ability to design laser systems for measurement of physical quantities and for industrial applications.
5. Ability to select lasers for a specific Industrial and medical application.
6. Ability to apply the principles of lasers for creating new sensors and measurement systems.

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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COURSE OBJECTIVES
1. To provide wide information dealing with nano material and its necessity.
2. To understand the impact of various steps needed to be followed in nano material preparation.
3. To analyze methods involving preparation of nano scale devices.
4. To provide knowledge about working nature and neighborhood condition regarding the preparation.
5. To Explore the properties of various types of nano materials.

UNIT I INTRODUCTION
Nano scale Science and Technology – Implications for Physics, Chemistry, Biology and Engineering – Classifications of nano structured materials – nano particles – quantum dots, Nano wires – ultrathin films – multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II PREPARATION METHODS
Bottom-up Synthesis – Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Selfassembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES
Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma/reactive ion) etching, Etch resists-dip pen lithography.

UNIT IV PREPARATION ENVIRONMENTS
Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, Chemical purification, chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards.

UNIT V CHARACTERISATION TECHNIQUES

TOTAL: 45 PERIODS
**TEXT BOOKS:**

**REFERENCES:**

**COURSE OUTCOMES (COs)**
1. Ability to utilize the principles of nano science along with the properties of nano materials for the design of novel systems.
2. Ability to select and apply the various techniques for synthesis of nano materials for specified application.
3. Ability to select and apply the various patterning techniques for development of micro and nano scale devices.
4. Ability to analyze the toxic effects of nano materials along with the safety measures for nano technological research.
5. Ability to apply and utilize the instrumentation systems for characterization of nano materials.
6. Will be in a position to learn and keep in pace with recent nanotechnological advancements.

**MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES**

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COURSE OBJECTIVES
1. To introduce the students the method of oil recovery and the steps involved in oil gas production process.
2. To make the students understand the process behavior of some of the important unit operations in petrochemical industry through mathematical model.
3. To familiarize the students to apply knowledge to select the appropriate control strategy for the selective process.
4. To provide information about the most important derivatives obtained from petroleum products.
5. To help the students in understanding selection and maintenance of instruments in petrochemical industry.

UNIT I OIL EXTRACTION AND OIL GAS PRODUCTION
Techniques used for oil discovery – Oil recovery methods – oil rig system - Overview of oil gas production – oil gas separation – Gas treatment and compression – Control and safety systems.

UNIT II IMPORTANT UNIT OPERATIONS IN REFINERY

UNIT III DERIVATIVES FROM PETROLEUM
Derivatives from methane – Methanol Production – Acetylene production - Derivatives from acetylene —Derivatives from ethylene – Derivatives from propylene.

UNIT IV IMPORTANT PETROLEUM PRODUCTS & MEASUREMENTS
BTX from Reformate – Styrene – Ethylene oxide/Ethylene glycol – polyethylene – Polypropylene – PVC production. Parameters to be measured in refinery and petrochemical industry – Selection and maintenance of measuring instruments.

UNIT V SAFETY IN INSTRUMENTATION SYSTEMS

TOTAL : 45 PERIODS
TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES (COs)
1. Gain knowledge on oil gas production process and important unit operations in a refinery
2. Having gained the process knowledge, ability to develop and analyze the process description of selective processes.
3. Able to develop, analyze and select appropriate control strategy for selective unit operations in a refinery.
4. Able to analyze the effect of important process variables which are having effect on yield.
5. Able to understand the onshore and off-shore extraction methods used for extracting crude.
6. Able to classify the hazardous zones for industrial scenario with industrial safety standards.

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COURSE OBJECTIVES

1. To impart basic knowledge on Instrumentation standards.

UNIT I  STANDARDS ORGANIZATION  9

UNIT II  ISA STANDARDS  9

UNIT II  ISA STANDARDS - CONTROL VALVE AND ACTUATOR  9
Control Valve Standards (ISA75): 75.01, 75.04, 75.05, 75.7, 75.11, 75.13, 75.14, 75.23, 75.24, 75.26. Actuator (ISA 96): 96.01, 96.02, 96.03, 96.04.

UNIT IV  ISA STANDARDS - FOSSIL AND NUCLEAR POWER PLANTS  9
Fossil Power Plant Standards (ISA 77): 77.14, 77.22, 77.30, 77.41, 77.42, 77.44, 77.60, 77.70. Nuclear Power Plant Standards (ISA67): 67.01, 67.02, 67.03, 67.04, 67.06.

UNIT V  BS, ISO, IEC, & ANSI  9

TOTAL : 45 PERIODS
TEXT BOOKS:
3. ISA standard 5, “Documentation of Measurement and Control Instruments and Systems”, ISA, North Carolina, USA.
4. ISA standard 12, “Electrical Equipment for Hazardous Locations”, ISA, North Carolina, USA.
5. ISA standard 20, “Instrument Specification Forms”, ISA, North Carolina, USA.
6. ISA standard 37, “Measurement Transducers”, ISA, North Carolina, USA.
7. ISA standard 55, “Control Valve Standards”, ISA, North Carolina, USA.
8. ISA standard 67, “Nuclear Power Plant Standards”, ISA, North Carolina, USA.

COURSE OUTCOMES (COs)
1. Ability to understand the role of standards organization.
2. Ability to implement different standards related to installation and control system, programming, documentation, equipment in hazardous area and instrument specification forms.
3. Ability to utilize the different standards related to control valve and actuators.
4. Ability to implement standards related to power plant and nuclear power plant.
5. Ability to select different standards related to orifice sizing, RTD and thermocouples.
6. Ability to compare and select standards related to Process industries.

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COURSE OBJECTIVES
1. To impart knowledge on PIC microcontroller and ARM processor.
2. To introduce the architecture and instruction set of PIC 16F87x.
3. To make them familiar with ports, timer, CCP modules, interrupts, peripherals and
4. interfacing of PIC 16F87x.
5. To introduce the architecture and assembly language programming of ARM LPC 2148.
6. To make them learn the ARM organization and instruction set.

UNIT I PIC INTRODUCTION 9

UNIT II PORTS, COUNTERS, TIMER, CCP MODULE AND INTERRUPTS 9
PIC16F8712C I/O Ports, Counters, Timers CCP Modules – Interrupts.

UNIT III PERIPHERALS AND INTERFACING 9
16F87xI2C Bus Peripherals Chip Access – Analog to Digital Converter – UART.

UNIT IV ARM LPC2148 INTRODUCTION 9

UNIT V ARM LPC2148 ORGANIZATION 9
3-Stage Pipeline ARM Organization – 5-Stage Pipeline ARM Organization – ARM Implementation – ARM Instruction Set.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES:

1. Ability to understand the concept of embedded system and its architectural features.
2. Ability to provide suitable software solutions for embedded applications.
3. Ability to configure and utilize the services of various peripheral devices associated with microprocessors and microcontrollers.
4. Ability to analyze the requirements of a given application and use appropriate communication protocols.
5. Ability to recognize the nuances of various microcontrollers and provide embedded solution with the right choice of microcontroller and the associated peripherals for a given application.
6. Ability to effectively utilize the available resources towards the design and development of embedded systems for real world problems

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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EI7011 MODEL PREDICTIVE CONTROL LT P C 3 0 0 3

COURSE OBJECTIVES

1. To teach the students the general principles of model predictive control scheme.
2. To provide a comprehensive description of model predictive control schemes namely as dynamic matrix control, generalized predictive control scheme and State space based model predictive control scheme.
3. To highlight the key features of MPC for its Industrial Success.
4. To introduce the skills required to formulate both unconstrained and constrained optimal
control schemes.
5. To develop the skills needed to design Model Predictive Control schemes to achieve the desired performance.

UNIT I MODEL PREDICTIVE CONTROL SCHEMES
Introduction to Model Predictive Control - Model Predictive Control Elements - Model Predictive Control Schemes: Dynamic Matrix Control and Model Algorithmic Control – Case Studies

UNIT II GENERALIZED PREDICTIVE CONTROL SCHEME
Generalized Predictive Control Scheme – Simple Implementation of Generalized Predictive Control Scheme for Industrial Processes – Multivariable Generalized Predictive Control Scheme – Case Studies

UNIT III STATE SPACE BASED MODEL PREDICTIVE CONTROL SCHEME
State Space Model Based Predictive Control Scheme - Review of Kalman Update based filters – State Observer Based Model Predictive Control Schemes – Case Studies

UNIT IV CONSTRAINED MODEL PREDICTIVE CONTROL SCHEME
Constraints Handling: Amplitude Constraints and Rate Constraints – Constraints and Optimization – Constrained Model Predictive Control Scheme – Case Studies.

UNIT V ADVANCED TOPICS IN MPC
Robust Model Predictive Control Scheme – Adaptive Model Predictive Control Scheme – Multiple Model based Model Predictive Control Scheme - Fast Methods for Implementing Nonlinear Model Predictive Control Scheme – Case Studies

TOTAL : 45 PERIODS

COURSE OUTCOMES(COs)
1. Ability to explain the advantages and disadvantages of various MPC schemes.
2. Ability to design both unconstrained and constrained model predictive controllers.
3. Ability to explain the advanced Features supported by the MPC Scheme.
4. Ability to Identify, formulate and solve problem in the field of Process Control domain using MPC.
5. Ability to implement MPC algorithms in MATLAB/SCILAB.

TEXT BOOKS:
REFERENCES:

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EI7012       NON-LINEAR CONTROL SYSTEMS                       LT P C

3003

COURSE OBJECTIVES
1. To understand the nature of non-linear systems and to analyze the stability of such systems
2. To develop suitable models of non-linear systems and to develop suitable controllers for such systems
3. To understand the chaotic and bifurcation behavior of non-linear systems
4. To linearize the non-linear systems.

UNIT I   NON-LINEAR SYSTEMS

UNIT II   STABILITY OF NON-LINEAR SYSTEMS

UNIT III  MODELLING AND CONTROL OF NON-LINEAR SYSTEMS
UNIT IV CHAOS AND BIFURCATION BEHAVIOR

UNIT V LINEARIZATION

TOTAL : 45 PERIODS

COURSE OUTCOMES(COs)

1. Ability to apply mathematical knowledge and basics of science and engineering to develop model for non-linear system.
2. Ability to analyze non-linear system based on the first principle model.
3. Ability to come out the solution for complex non-linear system.
4. Ability to develop various control schemes for non-linear systems.
5. Ability to linearize non-linear system for developing linear control

TEXT BOOKS:

REFERENCES:
7. NPTEL Lecture on “Non-linear system Analysis” by Prof. Laxmidhar Behera, IIT Kanpur.
MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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EI7013  NUCLEAR POWER PLANT INSTRUMENTATION  L T P C

COURSE OBJECTIVES

1. To introduce students to the fundamentals of nuclear power reactor.
2. The construction and principle of operation of the different sensing and indicating devices used at nuclear power plants will be explained to students.
3. To study about the various types of Nuclear power Reactor.
4. To characterize radioactive wastes based on the analysis of radioactive waste generation.
5. To elaborate different types of control schemes involved in nuclear power plant.

UNIT I  FUNDAMENTAL CONSIDERATIONS IN NUCLEAR POWER REACTOR  9

UNIT II  MEASURING INSTRUMENTS AND ANALYZER IN NUCLEAR POWER PLANT  9

UNIT III  TYPES OF NUCLEAR POWER REACTOR  9

instrumentation: Temperature Sensing, Pressure Sensing and transmitting, Flow Sensing, Level

Attested

[Signature]

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025
UNIT IV  NUCLEAR WASTE DISPOSAL AND REACTOR SAFETY  

UNIT V  MODELING AND CONTROL OF NUCLEAR POWER REACTOR  
Multipoint Kinetics modeling of Large reactors: Introduction, Derivation of Multipoint Kinetics model, Selection of suitable nodalization scheme, Application to the AHWR Thermal hydraulics model, Coupled Neutronics –Thermal Hydraulics model – Reactor Stability Analysis – Control of Nuclear Power: General features of Reactor control, Methods of control, control loops , Effectiveness of control rods, Output Feedback control design - Direct block diagonalization and composite control of Three time scale systems – Design of Fast output sampling controller for Three time scale systems.

TOTAL : 45 PERIODS

Course Outcomes

1. Be able to recognize and recall the basics of nuclear reactor terminology, definitions, and concepts associated with nuclear reactor physics.
2. Be able to understand and select appropriate instrument from the types of radiation measurement equipment and nuclear power plant instrumentation.
3. Be able to identify and summarize the specific features of different types of nuclear reactors.
4. Be able to understand the role and responsibility of effective nuclear waste disposal.
5. Be able to apply their mathematical knowledge and engineering principles to model the nuclear reactor and able to control the reactor.
6. Be able to carry out necessary simulation of models of different types of Nuclear reactors and design appropriate controllers using modern IT tools

TEXT BOOKS:

REFERENCES:
4. NPTEL Video Lectures on “Nuclear Reactors and Safety - An Introduction” by Dr. G. Vaidyanathan.
5. NPTEL Video Lectures on “Nuclear Science & Engineering” by Dr. Santanu Ghosh.
6. NPTEL Video Lectures on “Nuclear Reactor Technology” by Dr. K.S. Rajan.
7. NPTEL Video Lectures on “Nuclear Physics: Fundamentals and Applications” by Prof. H.C. Verma

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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EI7014 \hspace{1cm} OPTIMAL CONTROL \hspace{1cm} LT P C

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COURSE OBJECTIVES

1. To impart knowledge and skills needed to design Linear Quadratic Regulator for Timeinvariant and Time-varying Linear system (Continuous time and Discrete-time systems)
2. To introduce concepts needed to design optimal controller using Dynamic Programming Approach and H-J-B equation.
3. To introduce concepts needed to design optimal controller in the presence of state constraints and time optimal controller.
4. To give exposure to different type of optimal control problems such as time-optimal, fuel optimal, energy optimal control problems.

UNIT I \hspace{1cm} CALCULUS OF VARIATIONS AND OPTIMAL CONTROL \hspace{1cm} 9

UNIT II  LINEAR QUADRATIC OPTIMAL CONTROL SYSTEM


UNIT III  DISCRETE TIME OPTIMAL CONTROL SYSTEMS

Variational calculus for Discrete time systems – Discrete time optimal control systems: Fixed-final state and open-loop optimal control and Free-final state and open-loop optimal control - Discrete time linear state regulator system – Steady state regulator system.

UNIT IV  PONTRYAGIN MINIMUM PRINCIPLE & DYNAMIC PROGRAMMING


UNIT V  CONSTRAINED OPTIMAL CONTROL SYSTEMS


TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)

1. Ability to apply mathematical knowledge to develop optimal control scheme
2. Ability to design Linear Quadratic Regulator for Time-invariant and Time-varying linear system (Continuous time and Discrete-time systems).
3. Ability to design optimal controller using Dynamic Programming Approach and H-J-B equation.
4. Ability to design optimal controller in the presence of state constraints.
5. Ability to solve different type of optimal control problems such as time-optimal, fuel optimal and energy optimal control problems.

TEXT BOOKS:

REFERENCES:
EI7015  POWER ELECTRONICS, DRIVES AND CONTROL  L T P C
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COURSE OBJECTIVES
1. Comprehensive introduction to various power electronic devices, their structure, operating principle and characteristics
2. Give exposure to Various topologies, working principle and analysis of controlled rectifiers and ac controllers
3. Detailed knowledge on Classifications, structure, operating principle of dc choppers
4. Introduction to different types of Inverters, their principle of operation and waveform control
5. Overview on dc and ac drives and their control using power electronic circuits.

UNIT I  POWER SEMICONDUCTOR DEVICES AND CHARACTERISTICS  9

UNIT II  CONTROLLED RECTIFIERS AND AC CONTROLLERS  9

UNIT III  DC TO DC CONVERTERS  9
Step up and Step down Chopper – Chopper classification - quadrant of operation – Switching mode Regulators – Buck, Boost, Buck-Boost, and Cuk Regulators.

UNIT IV  INVERTERS  9

UNIT V  DRIVES AND CONTROL  9
Static and Dynamic equations of dc and ac machines – Electrical breaking – Rectifier and
chopper control of DC drives – Principles of v/f control of AC drives – Open loop and Closed loop schemes for DC and AC drives (Block diagram approach only) – Introduction to vector control of AC drives.

TOTAL: 45 PERIODS

COURSE OUTCOMES (COs)

1. Ability to explain various devices and their structure, operating characteristics in the field of electronics.
2. Ability to classify, analyze and design, Controlled rectifier and AC Controllers.
3. Ability to analyze and design of DC to DC and DC to AC converters.
4. Ability to apply power electronic circuits for the control of electric drive applications.
5. Ability to exposure to design and analyze power electronic circuits using simulation software.

TEXT BOOKS:

REFERENCES:

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COURSE OBJECTIVES
1. To make the students aware of basic concepts of safety instrumented system, standards and risk analysis techniques.
2. To make the students understand different layers of protection.
3. To make students conscious about safety instrumentation applications.

UNIT I INTRODUCTION

UNIT II PROTECTION LAYERS AND SAFETY REQUIREMENT SPECIFICATIONS

UNIT III SAFETY INTEGRITY LEVEL (SIL)
Evaluating Risk, Safety Integrity Levels, SIL Determination Method : As Low As Reasonably Practical ( ALARP ), Risk matrix, Risk Graph, Layers Of Protection Analysis ( LOPA ) – Issues related to system size and complexity –Issues related to field device safety – Functional Testing.

UNIT IV SYSTEM EVALUATION

UNIT V CASE STUDY
SIS Design check list - Case Description: Furnace/Fired Heater Safety Shutdown System: Scope

**TOTAL : 45 PERIODS**

**COURSE OUTCOMES (COs)**
1. Ability to analyse the role of safety instrumented system in the industry.
2. Ability to Identify and analyse the hazards.
3. Ability to determine the safety integrity level for an application.
4. Ability to characterize the safety environment in industry.
5. Ability to analyse the failure modes, failure rates and MTBF using various reliability engineering tools.
6. Ability to apply the design, installation and maintenance procedures for SIS applied to industrial processes.
7. Ability to present the results in written and oral forms.

**TEXT BOOKS:**

**REFERENCES:**

**MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES**

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COURSE OBJECTIVES
1. To elaborate the concept of estimating the state variables of a system using state estimation algorithms.
2. To elaborate the concept of estimating the parameters of the Input-output models using parameter estimation algorithms.
3. To make the student understand the various closed loop system identification techniques.
4. To make the students understand the use of ANN, Fuzzy Logic, ANFIS for modeling of nonlinear system and to get familiarized with the ANN and Fuzzy Logic tool boxes.
5. To provide the background on the practical aspects of conducting experiments for real time system identification.

UNIT I KALMAN UPDATE BASED FILTERS & PARTICLE FILTER 9

UNIT II PARAMETER ESTIMATION METHODS 9

UNIT III CLOSED- LOOP IDENTIFICATION 9

UNIT IV NONLINEAR SYSTEM IDENTIFICATION 9
Modeling of non linear systems using ANN- NARX & NARMAX - Training Feed-forward and Recurrent Neural Networks – TSK model – Adaptive Neuro-Fuzzy Inference System (ANFIS) - Introduction to Support Vector Regression.

UNIT V PRACTICAL ASPECTS OF IDENTIFICATION 9
Practical aspects: experimental design – input design for identification, notion for persistent excitation, drifts and de-trending – outliers and missing data – pre-filtering – robustness – Model validation and Model structure determination – Case studies.

TOTAL : 45 PERIODS
COURSE OUTCOMES (COs)
1. Ability to design and implement state estimation schemes.
2. Ability to develop various models (Linear & Nonlinear) from the experimental data.
3. Be able to select a suitable model and parameter estimation algorithm for the identification of systems.
4. Be able to carry out the verification and validation of identified model.
5. Will gain expertise on using the model for prediction and simulation purposes and for developing suitable control schemes.

TEXT BOOKS:

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COURSE OBJECTIVES

1. Gain knowledge on different types of power plants.
2. Study about the important process variables and their measurements.
3. To understand the important control loops involved in thermal power plants.
4. To analyze the various parameters related to steam turbines.

UNIT I OVERVIEW OF POWER GENERATION


UNIT II MEASUREMENTS IN POWER PLANTS


UNIT III BOILER CONTROL – I


UNIT IV BOILER CONTROL – II


UNIT V TURBINE MONITORING AND CONTROL

Types of steam turbines – impulse and reaction turbines – compounding – Turbine governing system – Speed and Load control – Transient speed rise – Free governor mode operation – Automatic Load Frequency Control – Turbine oil system – Oil pressure drop relay – Oil cooling system – Turbine run up system.

TOTAL : 45 PERIODS
COURSE OUTCOMES (COs)
1. Able to understand and analyze the process diagram of hydral, thermal, nuclear, wind and solar power plants.
2. Will be in a position to select instruments for monitoring various parameters related to thermal power plant.
3. Able to understand the role of various systems present in thermal power plant.
4. Able to Evaluate the appropriate control strategy for control of boiler drum level, superheater and deaerator.
5. Acquire knowledge on combustion control of coal fired boilers and control of steam turbines and associated turbine systems.

TEXT BOOKS:

REFERENCES:

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EI7019 UNIT OPERATIONS AND CONTROL

COURSE OBJECTIVES
1. Study the unit operations involved for transportation, mixing and separation of solids.
2. Study the unit operations involved for transportation, mixing and separation of fluids.
3. Understand the basic operations involved with heat exchangers, Distillation and chemical reactions.
4. Gain knowledge about the operations of evaporators and crystallizers, drying and cooling towers.
5. Gain knowledge on the operation of dryers, distillation column, refrigerators and chemical reactors.
UNIT I  MECHANICAL OPERATIONS- I  9

UNIT II  MECHANICAL OPERATIONS-II  9

UNIT III  HEAT TRANSFER- I AND ITS APPLICATIONS  9
Heat exchangers: Single pass and multi pass heat exchangers, condensers, reboilers Combustion process in thermal power plant, Distillation: Binary distillation, Batch distillation, controls and operations, Chemical reactors.

UNIT IV  HEAT TRANSFER- II  9

UNIT V  CASE STUDY  9
Unit Operations and Control schemes applied to Thermal Power plant, Steel Industry, Paper and Pulp Industry, Leather Industry.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)
1. Apply the knowledge on solids & fluids to handle the raw materials.
2. Select and apply relevant handling techniques to convert the solids and fluids for specific applications.
3. Come out with solutions for simple/complex problems in heat transfer and design the heat exchange equipment for different applications such as distillation, boilers.
4. Able to carry out multidisciplinary projects using heat transfer, mass transfer concepts.
5. Gain ability for lifelong learning of new techniques and developments in various types of unit operations in industries.

TEXT BOOKS:
2. Warren L. McCabe, Julian C. Smith and Peter Harriot, “Unit Operations of Chemical


REFERENCES:

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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EI7071 INDUSTRIAL DATA COMMUNICATION LT P C

3 0 0 3

COURSE OBJECTIVES
1. To give an overview of the Industrial data communications systems.
2. To provide a fundamental understanding of common principles, various standards, protocols.
3. To provide insight into some of the new principles that are evolving for future networks.

UNIT I DATA NETWORK FUNDAMENTALS

UNIT II MODBUS AND HART

UNIT III PROFIBUS AND FF
UNIT IV  
AS – INTERFACE (AS-i), DEVICENET AND INDUSTRIAL ETHERNET


UNIT V  
WIRELESS COMMUNICATION

Wireless sensor networks: Hardware components – energy consumption of sensor nodes – Network architecture – sensor network scenario. Wireless HART – Existing Wireless Options: IEEE 802.15.4 - ISA 100 – Zigbee – Bluetooth – their relevance to industrial applications

COURSE OUTCOMES (COs)
1. Be able to gain knowledge on various Industrial data networking standards their evolution, associated hardware and software
2. Be able to analyse and select proper protocol for device level and control level integration
3. Be able to establish/design networking for process control applications and industrial automation
4. Be able to apply gained knowledge on networking to compare and choose a specific protocol for the given architecture.
5. Be able to infer the requirements of an industry and provide a wired or wireless solution for installing Industrial data network

TEXT BOOKS:

REFERENCES:
5. NPTEL Lecture notes on, “Computer Networks” by Department of Electrical Engg., IIT Kharagpur.
MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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GE7071 DISASTER MANAGEMENT LT P C 3 0 0 3

OBJECTIVES:
1. To provide students an exposure to disasters, their significance and types.
2. To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
3. To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
4. To enhance awareness of institutional processes in the country and
5. To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don’ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9
Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and
Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV  DISASTER RISK MANAGEMENT IN INDIA  9
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V  DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS  9
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
The students will be able to
1. Identify hazards, disaster preparedness, and disaster mitigation techniques.
2. Recognize the role of IT, remote sensing, GIS, and GPS in risk reduction
3. Recognize the various roles played by different stockholders during disasters as well as the disaster management acts and standards.
4. Analyse the DM study as a case study by evaluating the data search, analysis, and presentation.
5. Develop Technological Advancements in Disaster Risk Reduction: Benefits and Issues.

TEXT BOOKS:
REFERENCES
1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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GE7074    HUMAN RIGHTS    LT P C

OBJECTIVES
1. To sensitize the Engineering students to various aspects of Human Rights.

UNIT I

UNIT II

UNIT III
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV
Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V

TOTAL : 45 PERIODS

COURSE OUTCOMES
After completion the above subject, students will be able to understand
1. Engineering students will acquire the basic knowledge of human rights.
2. Will able to know the basics of UN Laws
3. Will able to know the declaration of human rights
4. Will able to know the human rights protection in India
5. Will able to know the evolution concept of human rights

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GE 7351 ENGINEERING ETHICS AND HUMAN VALUES (Common to all branches)

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COURSE OBJECTIVES
1. To emphasise into awareness on Engineering Ethics and Human Values.
2. To understand social responsibility of an engineer.
3. To appreciate ethical dilemma while discharging duties in professional life.
UNIT I HUMAN VALUES

UNIT II ENGINEERING ETHICS

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as experimentation - engineers as responsible experimenters - codes of ethics – Importance of Industrial Standards - a balanced outlook on law – anticorruption- occupational crime the challenger case study.

UNIT IV ENGINEER’S RIGHTS AND RESPONSIBILITIES ON SAFETY

UNIT V GLOBAL ISSUES
Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-Sample code of conduct.

TOTAL : 45 PERIODS

COURSE OUTCOMES(C):
1. Students will have the ability to perform with professionalism, understand their rights, legal, ethical issues and their responsibilities as it pertains to engineering profession with engaging in life-long learning with knowledge of contemporary issues.

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GE7652 TOTAL QUALITY MANAGEMENT

AIM
To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

COURSE OBJECTIVES
1. To understand the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
2. To understand the TQM Principles.
3. To learn and apply the various tools and techniques of TQM.
4. To understand and apply QMS and EMS in any organization.

UNIT I INTRODUCTION
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM– Basic concepts of TQM --Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES
Leadership--The Deming Philosophy, Quality council, Quality statements and Strategic planning-- Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement –
Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal--Continuous process improvement –Juran Trilogy, PDSA cycle, 5s and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I

UNIT IV TQM TOOLS & TECHNIQUES II

UNIT V QUALITY MANAGEMENT SYSTEM

TOTAL: 45 PERIODS

COURSE OUTCOMES(CO):
1. Importance of understanding the quality management and selecting suitable enterprise.
2. Demonstrate the manufacturing enterprise quality, importance in maintaining role and responsibility of managing the quality.
3. Ability to deployment various method in maintaining the quality of the product
4. Ability to gain the knowledge in improving the quality within the finance
5. To maintain the standard of product within the suitable and manage within the environmental condition

TEXT BOOK:

REFERENCES:
GE7072 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT

COURSE OBJECTIVES:

1. To understand the global trends and development methodologies of various types of products and services
2. To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
3. To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them into design specification
4. To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
5. To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT


UNIT II REQUIREMENTS AND SYSTEM DESIGN

Requirement Engineering - Types of Requirements - Requirement Engineering - traceability

UNIT III DESIGN AND TESTING
9

UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT
9

UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY
9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the students will be able to:
1. Define, formulate and analyze a problem
2. Solve specific problems independently or as part of a team
4. Work independently as well as in teams
5. Manage a project from start to finish

TEXTBOOKS:
1. Book specially prepared by NASSCOM as per the MoU.

REFERENCES:

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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