ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
B.E. INSTRUMENTATION AND CONTROL ENGINEERING
REGULATIONS – 2017
CHOICE BASED CREDIT SYSTEM

Educational Objectives
Bachelor of Instrumentation and Control Engineering curriculum is designed to prepare the graduates having attitude and knowledge to

1. Have successful technical and professional careers in their chosen fields such as Process Control, Electronics & Information Technology.
2. Engross in life long process of learning to keep themselves abreast of new developments in the field of Electronics & Instrumentation

Programme Outcomes
The graduates will have the ability to

a. Apply the Mathematical knowledge and the basics of Science and Engineering to solve the problems pertaining to Electronics and Instrumentation Engineering.
b. Identify and formulate Instrumentation Engineering problems from research literature and be able to analyze the problem using first principles of Mathematics and Engineering Sciences.
c. Come out with solutions for the complex problems and to design system components or process that fulfill the particular needs taking into account public health and safety and the social, cultural and environmental issues.
d. Draw well-founded conclusions applying the knowledge acquired from research and research methods including design of experiments, analysis and interpretation of data and synthesis of information and to arrive at significant conclusion.
e. Form, select and apply relevant techniques, resources and Engineering and IT tools for Engineering activities like electronic prototyping, modeling and control of systems/processes and also being conscious of the limitations.
f. Understand the role and responsibility of the Professional Instrumentation Engineer and to assess societal, health, safety issues based on the reasoning received from the contextual knowledge.
g. Be aware of the impact of professional Engineering solutions in societal and environmental contexts and exhibit the knowledge and the need for sustainable Development.
h. Apply the principles of Professional Ethics to adhere to the norms of the engineering practice and to discharge ethical responsibilities.
i. Function actively and efficiently as an individual or a member/leader of different teams and multidisciplinary projects.
j. Communicate efficiently the engineering facts with a wide range of engineering community and others, to understand and prepare reports and design documents; to make effective presentations and to frame and follow instructions.
k. Demonstrate the acquisition of the body of engineering knowledge and insight and Management Principles and to apply them as member / leader in teams and multidisciplinary environments.
l. Recognize the need for self and life-long learning, keeping pace with technological challenges in the broadest sense.

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## ENGINEERING SCIENCES (ES)

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OBJECTIVES:

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY & FRIENDS
12

UNIT II GENERAL READING AND FREE WRITING
12
Reading - comprehension-pre-reading-post reading - comprehension questions (multiple choice questions and/or short questions/open-ended questions) - inductive reading - short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts) - register. Writing - paragraph writing - topic sentence - main ideas - free writing, short narrative descriptions using some suggested vocabulary and structures. Listening - telephonic conversations. Speaking - sharing information of a personal kind - greeting - taking leave - Language development - prepositions, conjunctions. Vocabulary development - guessing meanings of words in context.

UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT
12
Reading - short texts and longer passages (close reading) Writing - understanding text structure - use of reference words and discourse markers - coherence - jumbled sentences. Listening - listening to longer texts and filling up the table - product description - narratives from different sources. Speaking - asking about routine actions and expressing opinions. Language development - degrees of comparison - pronouns - direct vs indirect questions. Vocabulary development - single word substitutes - adverbs.

UNIT IV READING AND LANGUAGE DEVELOPMENT
12
Reading - comprehension-reading longer texts - reading different types of texts - magazines Writing - letter writing, informal or personal letters - e-mails - conventions of personal email. Listening - listening to dialogues or conversations and completing exercises based on them. Speaking - speaking about oneself - speaking about one’s friend. Language development - Tenses - simple present - simple past - present continuous and past continuous. Vocabulary development - synonyms - antonyms - phrasal verbs.
UNIT V EXTENDED WRITING

Reading- longer texts - close reading – Writing- brainstorming - writing short essays – developing an outline-identifying main and subordinate ideas- dialogue writing - Listening – listening to talks-conversations- Speaking – participating in conversations- short group conversations - Language development-modal verbs- present/ past perfect tense - Vocabulary development-collocations-fixed and semi-fixed expressions

OUTCOMES: At the end of the course, learners will be able to:
• Read articles of a general kind in magazines and newspapers.
• Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
• Comprehend conversations and short talks delivered in English
• Write short essays of a general kind and personal letters and emails in English.

TEXT BOOKS:

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

- The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I  DIFFERENTIAL CALCULUS  12
Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

UNIT II  FUNCTIONS OF SEVERAL VARIABLES  12

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

TOTAL : 60 PERIODS

OUTCOMES:

After completing this course, students should demonstrate competency in the following skills:

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.
TEXT BOOKS:

2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES:


PH8151 ENGINEERING PHYSICS

OBJECTIVES:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I PROPERTIES OF MATTER

UNIT II WAVES AND FIBER OPTICS

UNIT III THERMAL PHYSICS
UNIT IV QUANTUM PHYSICS

UNIT V CRYSTAL PHYSICS
Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

OUTCOMES:
Upon completion of this course,
- the students will gain knowledge on the basics of properties of matter and its applications,
- the students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- the students will get knowledge on advanced physics concepts of quantum theory and its applications in tunnelling microscopes, and
- the students will understand the basics of crystals, their structures and different crystal growth techniques.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

UNIT I WATER AND ITS TREATMENT 9

UNIT II SURFACE CHEMISTRY AND CATALYSIS 9

UNIT III ALLOYS AND PHASE RULE 9

UNIT IV FUELS AND COMBUSTION 9

UNIT V ENERGY SOURCES AND STORAGE DEVICES 9
Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor -
solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H₂-O₂ fuel cell.

**OUTCOMES:**
- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

**TEXT BOOKS:**

**REFERENCES:**

**GE8151 PROBLEM SOLVING AND PYTHON PROGRAMMING**

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**COURSE OBJECTIVES:**
- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures — lists, tuples, dictionaries.
- To do input/output with files in Python.

**UNIT I ALGORITHMIC PROBLEM SOLVING**
Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

**UNIT II DATA, EXPRESSIONS, STATEMENTS**
Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.
UNIT III   CONTROL FLOW, FUNCTIONS
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV   LISTS, TUPLES, DICTIONARIES
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V   FILES, MODULES, PACKAGES
Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

COURSE OUTCOMES:
Upon completion of the course, students will be able to
- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

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 FREEHAND SKETCHING

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE
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 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 one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES
Sectioning of above 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.

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 - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

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

- familiarize with the fundamentals and standards of Engineering graphics
- perform freehand sketching of basic geometrical constructions and multiple views of objects.
- project orthographic projections of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- visualize and to project isometric and perspective sections of simple solids.
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.

GE8161 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY

COURSE OBJECTIVES:
- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.
LIST OF PROGRAMS
1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton’s method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED
Python 3 interpreter for Windows/Linux

COURSE OUTCOMES:
Upon completion of the course, students will be able to
- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

TOTAL :60 PERIODS

BS8161 PHYSICS AND CHEMISTRY LABORATORY (Common to all branches of B.E. / B.Tech Programmes) L T P C 0 0 4 2

OBJECTIVES:
- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)
1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young’s modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser (b) Determination of acceptance angle in an optical fiber.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

TOTAL: 30 PERIODS
OUTCOMES:
Upon completion of the course, the students will be able to
  • apply principles of elasticity, optics and thermal properties for engineering applications.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

OBJECTIVES:

  • To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
  • To acquaint the students with the determination of molecular weight of a polymer by viscometry.

1. Estimation of HCl using Na$_2$CO$_3$ 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-Phenantroline / 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.
16. Conductometric titration of strong acid vs strong base.

OUTCOMES:

  • The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

TOTAL: 30 PERIODS

TEXTBOOKS:

OBJECTIVES: The Course prepares second semester engineering and Technology students to:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

UNIT I INTRODUCTION TECHNICAL ENGLISH


UNIT II READING AND STUDY SKILLS


UNIT III TECHNICAL WRITING AND GRAMMAR


UNIT IV REPORT WRITING


UNIT V GROUP DISCUSSION AND JOB APPLICATIONS


TOTAL: 60 PERIODS
OUTCOMES: At the end of the course learners will be able to:

- Read technical texts and write area-specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

TEXT BOOKS:


REFERENCES

2. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007

Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.

MA8251 ENGINEERING MATHEMATICS – II

OBJECTIVES:

- This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT I MATRICES


UNIT II VECTOR CALCULUS

Gradient and directional derivative – Divergence and curl - Vector identities – 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 FUNCTIONS
Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions \( w = z + c, \frac{1}{z}, \frac{1}{z^2} \) - Bilinear transformation.

UNIT IV    COMPLEX INTEGRATION

UNIT V    LAPLACE TRANSFORMS

TOTAL: 60 PERIODS

OUTCOMES:
After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

TEXT BOOKS:

REFERENCES:
PH8253 PHYSICS FOR ELECTRONICS ENGINEERING
(Common to BME, ME, CC, ECE, EEE, E&I, ICE)
L T P C
3 0 0 3

OBJECTIVES:
- To understand the essential principles of Physics of semiconductor device and Electron transport properties. Become proficient in magnetic, dielectric and optical properties of materials and nano devices.

UNIT I ELECTRICAL PROPERTIES OF MATERIALS

UNIT II SEMICONDUCTOR PHYSICS

UNIT III MAGNETIC AND DIELECTRIC PROPERTIES OF MATERIALS

UNIT IV OPTICAL PROPERTIES OF MATERIALS

UNIT V NANOELECTRONIC DEVICES

TOTAL : 45 PERIODS
OUTCOMES:
At the end of the course, the students will able to
- gain knowledge on classical and quantum electron theories, and energy band structures,
- acquire knowledge on basics of semiconductor physics and its applications in various devices,
- get knowledge on magnetic and dielectric properties of materials,
- have the necessary understanding on the functioning of optical materials for optoelectronics,
- understand the basics of quantum structures and their applications in spintronics and carbon electronics..

TEXT BOOKS:

REFERENCES

BE8252 BASIC CIVIL AND MECHANICAL ENGINEERING L T P C
4 0 0 4

OBJECTIVES:
- To impart basic knowledge on Civil and Mechanical Engineering.
- To familiarize the materials and measurements used in Civil Engineering.
- To provide the exposure on the fundamental elements of civil engineering structures.
- To enable the students to distinguish the components and working principle of power plant units, IC engines, and R & AC system.

A – OVERVIEW

UNIT I SCOPE OF CIVIL AND MECHANICAL ENGINEERING 10
Overview of Civil Engineering - Civil Engineering contributions to the welfare of Society – Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering


B – CIVIL ENGINEERING

UNIT II SURVEYING AND CIVIL ENGINEERING MATERIALS 10

UNIT III BUILDING COMPONENTS AND STRUCTURES 15


C – MECHANICAL ENGINEERING

UNIT IV INTERNAL COMBUSTION ENGINES AND POWER PLANTS 15
Classification of Power Plants - Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Working principle of steam, Gas, Diesel, Hydro - electric and Nuclear Power plants — working principle of Boilers, Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 10

OUTCOMES:
On successful completion of this course, the student will be able to
- appreciate the Civil and Mechanical Engineering components of Projects.
- explain the usage of construction material and proper selection of construction materials.
- measure distances and area by surveying
- identify the components used in power plant cycle.
- demonstrate working principles of petrol and diesel engine.
- elaborate the components of refrigeration and Air conditioning cycle.

TOTAL: 60 PERIODS

TEXTBOOKS:

REFERENCES:
OBJECTIVES:

- To introduce electric circuits and its analysis
- To impart knowledge on solving circuit equations using network theorems
- To introduce the phenomenon of resonance in coupled circuits.
- To educate on obtaining the transient response of circuits.
- To introduce Phasor diagrams and analysis of three phase circuits

UNIT I  BASIC CIRCUITS ANALYSIS  6+6

UNIT II  NETWORK REDUCTION AND THEOREMS FOR DC AND AC CIRCUITS  6+6

UNIT III  TRANSIENT RESPONSE ANALYSIS  6+6
L and C elements -Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. sinusoidal input.

UNIT IV  THREE PHASE CIRCUITS  6+6
A.C. circuits – Average and RMS value - Phasor Diagram – Power, Power Factor and Energy.- Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power measurement in three phase circuits.

UNIT V  RESONANCE AND COUPLED CIRCUITS  6+6

TOTAL : 60 PERIODS

OUTCOMES:

- Ability to analyse electrical circuits
- Ability to apply circuit theorems
- Ability to analyse transients

TEXT BOOKS:


REFERENCES


GE8291          ENVIRONMENTAL SCIENCE AND ENGINEERING                      L T P C
                                           3 0 0 3

OBJECTIVES:

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

UNIT I      ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY   14
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 – solid 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
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

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

OUTCOMES:
• Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
• Public awareness of environmental is at infant stage.
• Ignorance and incomplete knowledge has lead to misconceptions
• Development and improvement in std. of living has lead to serious environmental disasters

TEXTBOOKS:

REFERENCES :
OBJECTIVES:
- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 13

Buildings:
(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:
(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:
   Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:
(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:
   Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE 18

Welding:
(a) Preparation of butt joints, lap joints and T-joints by Shielded metal arc welding.
(b) Gas welding practice

Basic Machining:
(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:
(a) Forming & Bending:
(b) Model making – Trays and funnels.
(c) Different type of joints.

Machine assembly practice:
(a) Study of centrifugal pump
(b) Study of air conditioner
Demonstration on:
(a) Smithy operations, upsetting, swaging, setting down and bending. Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III  ELECTRICAL ENGINEERING PRACTICE
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
5. Measurement of energy using single phase energy meter.

IV  ELECTRONICS ENGINEERING PRACTICE
1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
• fabricate carpentry components and pipe connections including plumbing works.
• use welding equipments to join the structures.
• Carry out the basic machining operations
• Make the models using sheet metal works
• Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings
• Carry out basic home electrical works and appliances
• Measure the electrical quantities
• Elaborate on the components, gates, soldering practices.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL
1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools: (a) Rotary Hammer 2 Nos
   (b) Demolition Hammer 2 Nos
   (c) Circular Saw 2 Nos
   (d) Planer 2 Nos
   (e) Hand Drilling Machine 2 Nos
   (f) Jigsaw 2 Nos
MECHANICAL

1. Arc welding transformer with cables and holders  5 Nos.
2. Welding booth with exhaust facility          5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc.  5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.  2 Nos.
5. Centre lathe                2 Nos.
6. Hearth furnace, anvil and smithy tools          2 Sets.
7. Moulding table, foundry tools                       2 Sets.
9. Study-purpose items: centrifugal pump, air-conditioner One each.

ELECTRICAL

1. Assorted electrical components for house wiring                          15 Sets
2. Electrical measuring instruments                             10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp      1 each
4. Megger (250V/500V)                                   1 No.
5. Power Tools: (a) Range Finder                    2 Nos
(b) Digital Live-wire detector                            2 Nos.

ELECTRONICS

1. Soldering guns                      10 Nos.
2. Assorted electronic components for making circuits             50 Nos.
3. Small PCBs                                  10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply

EE8261 ELECTRIC CIRCUITS LABORATORY  L  T  P  C
0 0 4 2

OBJECTIVES:
- To simulate various electric circuits using Pspice/ Matlab/e-Sim / Scilab
- To gain practical experience on electric circuits and verification of theorems.

LIST OF EXPERIMENTS
1. Simulation and experimental solving of electrical circuit problems using Kirchhoff’s voltage and current laws.
2. Simulation and experimental solving of electrical circuit problems using Thevenin’s theorem.
5. Simulation and experimental verification of Maximum Power transfer Theorem.

6. Study of Analog and digital oscilloscopes and measurement of sinusoidal voltage, frequency and power factor.

7. Simulation and Experimental validation of R-C electric circuit transience.

8. Simulation and Experimental validation of frequency response of RLC electric circuit.


10. Design and Simulation of parallel resonant circuits.

11. Simulation of three phase balanced and unbalanced star, delta networks circuits.

TOTAL: 60 PERIODS

OUTCOMES:
- Understand and apply circuit theorems and concepts in engineering applications.
- Simulate electric circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
2. Function Generator (1 MHz) - 10 Nos.
4. Oscilloscope (20 MHz) - 10 Nos.
5. Digital Storage Oscilloscope (20 MHz) – 1 No.
6. 10 Nos of PC with Circuit Simulation Software (min 10 Users) (e-Sim / Scilab/ Pspice / Matlab /other Equivalent software Package) and Printer (1 No.)
7. AC/DC - Voltmeters (10 Nos.), Ammeters (10 Nos.) and Multi-meters (10 Nos.) 8 Single Phase Wattmeter – 3 Nos.
8. Decade Resistance Box, Decade Inductance Box, Decade Capacitance Box Each - 6 Nos.
9. Circuit Connection Boards - 10 Nos.

Necessary Quantities of Resistors, Inductors, Capacitors of various capacities (Quarter Watt to 10 Watt)

MA8353 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

OBJECTIVES:
- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.
UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12
Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange’s linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES 12

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12
Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT IV FOURIER TRANSFORMS 12

UNIT V Z-TRANSFORMS AND DIFFERENCE EQUATIONS 12

TOTAL: 60 PERIODS

OUTCOMES:
Upon successful completion of the course, students should be able to:

- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS:

REFERENCES:
EC8353   ELECTRON DEVICES AND CIRCUITS       L  T  P  C
                                                   3  0  0  3

OBJECTIVES:
The student should be made to:
- Understand the structure of basic electronic devices.
- Be exposed to active and passive circuit elements.
- Familiarize the operation and applications of transistor like BJT and FET.
- Explore the characteristics of amplifier gain and frequency response.
- Learn the required functionality of positive and negative feedback systems.

UNIT I   PN JUNCTION DEVICES                    9
PN junction diode –structure, operation and V-I characteristics, diffusion and transition capacitance -
Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes, Zener
diodecharacteristics- Zener Reverse characteristics – Zener as regulator

UNIT II  TRANSISTORS AND THYRISTORS            9
BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristors and IGBT -
Structure and characteristics.

UNIT III  AMPLIFIERS                          9
BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –
MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response-
High frequency analysis.

UNIT IV  MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER   9
BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET
input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods,
power amplifiers –Types (Qualitative analysis).

UNIT V   FEEDBACK AMPLIFIERS AND OSCILLATORS    9
Advantages of negative feedback – voltage / current, series , Shunt feedback –positive feedback –
Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

TOTAL : 45 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to:
- Explain the structure and working operation of basic electronic devices.
- Able to identify and differentiate both active and passive elements
- Analyze the characteristics of different electronic devices such as diodes and
  transistors
- Choose and adapt the required components to construct an amplifier circuit.
- Employ the acquired knowledge in design and analysis of oscillators
TEXT BOOKS:

REFERENCES:

EE8351 DIGITAL LOGIC CIRCUITS

OBJECTIVES:
- To study various number systems and simplify the logical expressions using Boolean functions
- To study combinational circuits
- To design various synchronous and asynchronous circuits.
- To introduce asynchronous sequential circuits and PLDs
- To introduce digital simulation for development of application oriented logic circuits.

UNIT I NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES 6+6
Review of number systems, binary codes, error detection and correction codes (Parity and Hamming code) - Digital Logic Families - comparison of RTL, DTL, TTL, ECL and MOS families - operation, characteristics of digital logic family.

UNIT II COMBINATIONAL CIRCUITS 6+6
Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps - simplification and implementation of combinational logic – multiplexers and de multiplexers - code converters, adders, subtractors, Encoders and Decoders.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 6+6
Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering - counters - asynchronous and synchronous type - Modulo counters - Shift registers - design of synchronous sequential circuits – Moore and Melay models- Counters, state diagram; state reduction; state assignment.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABILITY LOGIC DEVICES 6+6
Asynchronous sequential logic circuits-Transition tability, flow tability-race conditions, hazards & errors in digital circuits; analysis of asynchronous sequential logic circuits-
introduction to Programmability Logic Devices: PROM – PLA –PAL, CPLD-FPGA.

UNIT V VHDL

TOTAL : 60 PERIODS

OUTCOMES:

- Ability to design combinational and sequential Circuits.
- Ability to simulate using software package.
- Ability to study various number systems and simplify the logical expressions using Boolean functions
- Ability to design various synchronous and asynchronous circuits.
- Ability to introduce asynchronous sequential circuits and PLDs
- Ability to introduce digital simulation for development of application oriented logic circuits.

TEXT BOOKS:

REFERENCES

EI8351 ELECTRICAL MEASUREMENTS

OBJECTIVES:

- To introduce the meters used to measure current & voltage.
- To have an adequate knowledge in the measurement techniques for power and energy, power and energy meters are included.
- To provide Elaborate discussion about potentiometer & instrument transformers.
- To provide Detailed study of resistance measuring methods.
- To provide Detailed study of inductance and capacitance measurement.

UNIT I MEASUREMENT OF VOLTAGE AND CURRENT
UNIT II MEASUREMENT OF POWER AND ENERGY 6+6

UNIT III POTentiometers & Instrument Transformers 6+6
DC potentiometer:– Basic circuit, standardization – Laboratory type (Crompton’s) – AC potentiometer:-Drysdale (polar type) type – Gall-Tinsley (coordinate) type – Limitations & applications – Instrument Transformer:-C.T and P.T construction, theory, operation and characteristics.

UNIT IV RESISTANCE MEASUREMENT 6+6

UNIT V IMPEDANCE MEASUREMENT 6+6

TOTAL:60 PERIODS

COURSE OUTCOMES
At the end of the course, the student should have the:
1. Ability to measure current and voltage,
2. Ability to understand AC and DC measurements.
3. Ability to measure power and calibration of energy meters.
4. Ability to measure current and voltage using potentiometric method.
5. Ability to understand the resistance measurement
6. Ability to use bridge circuit to measure resistance, inductance and capacitance.

TEXT BOOKS
2. H.S. Kalsi, Electronic Instrumentation, McGraw-Hill Education, New Delhi, 2010

REFERENCES
COURSE OBJECTIVES

- Get to know the methods of measurement, classification of transducers and to analyze error.
- To understand the behavior of transducers under static and dynamic conditions and hence to model the transducer.
- Get exposed to different types of resistive transducers and their application areas.
- To acquire knowledge on capacitive and inductive transducers.
- To gain knowledge on variety of transducers and get introduced to MEMS and Smart transducers.

UNIT I SCIENCE OF MEASUREMENTS AND CLASSIFICATION OF TRANSDUCERS

UNIT II CHARACTERISTICS OF TRANSDUCERS

UNIT III VARIABLE RESISTANCE TRANSDUCERS
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 TRANSDUCERS

UNIT V OTHER TRANSDUCERS

COURSE OUTCOMES
At the end of the course, the student should have the ability:

1. Ability to apply the mathematical knowledge and science & engineering fundamentals gained to solve problems pertaining to measurement applications.
2. Ability to analyze the problems related to sensors & transducers.
3. Ability to select the right sensor/transducer for a given application.
4. Ability to determine the static and dynamic characteristics of transducers using software packages.
5. Ability to understand fiber optic sensor and applications.
6. Ability to understand smart transducer and its standard.

TEXT BOOKS

REFERENCES

CS8392 OBJECT ORIENTED PROGRAMMING L T P C 3 0 0 3

OBJECTIVES:
- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of packages, inheritance and interfaces
- To define exceptions and use I/O streams
- To develop a java application with threads and generics classes
- To design and build simple Graphical User Interfaces

UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 10

UNIT II INHERITANCE AND INTERFACES 9
Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning -inner classes, ArrayLists - Strings

UNIT III EXCEPTION HANDLING AND I/O 9
UNIT IV            MULTITHREADING AND GENERIC PROGRAMMING             8
Differences between multi-threading and multitasking, thread life cycle, creating threads,
synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic

UNIT V              EVENT DRIVEN PROGRAMMING                     9
Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and
images - Basics of event handling - event handlers - adapter classes - actions - mouse events -
AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text
–Menus – Dialog Boxes.

COURSE OUTCOMES:
Upon completion of the course, students will be able to:
- Develop Java programs using OOP principles
- Develop Java programs with the concepts inheritance and interfaces
- Build Java applications using exceptions and I/O streams
- Develop Java applications with threads and generics classes
- Develop interactive Java programs using swings

TEXT BOOKS
   Hall, 2013.

REFERENCES
3. Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition,

EI8361            MEASUREMENTS AND TRANSDUCERS LABORATORY
L T P C
0 0 4 2

COURSE OBJECTIVES
- To make the students aware of basic concepts of measurement and operation of different
types of transducers.
- To make the students conscious about static and dynamic characteristics of different types
of transducer.
- To make the students to analyze step response of RTD
- To the student to measure resistance using bridge circuits
- To make the students to calibrate the electrical instruments
LIST OF EXPERIMENTS

1. Displacement versus output voltage characteristics of a potentiometric transducer.
2. Characteristics of Strain gauge and Load cell.
5. Step response characteristic of RTD and thermocouple.
6. Temperature measurements using RTD with three and four leads.
7. Wheatstone and Kelvin’s bridge for measurement of resistance.
8. Schering Bridge for capacitance measurement and Anderson Bridge for inductance measurement.

Minimum of ten experiments to be offered from the list. Additional one or two experiments can be framed beyond the list or curriculum

TOTAL : 60 PERIODS

COURSE OUTCOMES (COs)
1. Understand the concepts of measurement, error and uncertainty.
2. Understand the static and dynamic characteristics of measuring instruments.
3. Gain knowledge about the principle of operation and characteristics of different types of resistance, capacitance and inductance transducers.
4. Acquire knowledge of analyzing different stages of signal conditioning units.
5. Ability to interpret the results and draw meaningful conclusions.
6. Ability to work as a member of a team while carrying out experiments.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
Experimental setup for
Measurement of Linear displacement using Potentiometer
Strain gauge and Load cell characterisation and application
LVDT characterisation and application
Hall Effect characterisation and application
Measurement of Angular displacement
Muffle furnace
Thermistor characterisation and application
Various types of Thermocouple and RTD characterisation and application
Measurement of power and energy
Sufficient number of power supply, Galvanometer, Bread board, Multimeter, resistors, Decade Capacitance box, Decade resistance box, Decade Inductance box, CRO.
COURSE OBJECTIVES

- To build software development skills using Java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, ArrayList, exception handling and file processing.
- To develop applications using generic programming and event handling.

List of experiments

1. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e., domestic or commercial). Compute the bill amount using the following tariff.
   - If the type of the EB connection is domestic, calculate the amount to be paid as follows:
     - First 100 units - Rs. 1 per unit
     - 101-200 units - Rs. 2.50 per unit
     - 201-500 units - Rs. 4 per unit
     - > 501 units - Rs. 6 per unit
   - If the type of the EB connection is commercial, calculate the amount to be paid as follows:
     - First 100 units - Rs. 2 per unit
     - 101-200 units - Rs. 4.50 per unit
     - 201-500 units - Rs. 6 per unit
     - > 501 units - Rs. 7 per unit

2. Develop a Java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa), time converter (hours to minutes, seconds and vice versa) using packages.

3. Develop a Java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10% of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.

4. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.

5. Write a program to perform string operations using ArrayList. Write functions for the following:
   a. Append - add at end
   b. Insert - add at particular index
   c. Search
   d. List all strings starts with given letter

6. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area() that prints the area of the given shape.

7. Write a Java program to implement user defined exception handling.

8. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.
9. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.

10. Write a java program to find the maximum value from the given type of elements using a generic function.

11. Design a calculator using event-driven programming paradigm of Java with the following options.

   a) Decimal manipulations
   b) Scientific manipulations

12. Develop a mini project for any application using Java concepts.

COURSE OUTCOMES
Upon completion of the course, the students will be able to

- Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.
- Develop and implement Java programs with arraylist, exception handling and multithreading.
- Design applications using file processing, generic programming and event handling.

MA8491 NUMERICAL METHODS

OBJECTIVES:

- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real life situations.
- To acquaint the student with understanding of numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.
- To understand the knowledge of various techniques and methods of solving various types of partial differential equations.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

UNIT II INTERPOLATION AND APPROXIMATION 12
Interpolation with unequal intervals - Lagrange’s interpolation – Newton’s divided difference interpolation – Cubic Splines - Difference operators and relations - Interpolation with equal intervals - Newton’s forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 12

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS
Finite difference methods for solving second order two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace’s and Poisson’s equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL : 60 PERIODS

OUTCOMES:
Upon successful completion of the course, students should be able to:

- Understand the basic concepts and techniques of solving algebraic and transcendental equations.
- Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations.
- Apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXTBOOKS:

REFERENCES:
COURSE OBJECTIVES

- To introduce the principles of operations of DC machines as motor and generator
- To introduce the principles of operations of Transformers
- To introduce the principles of operations of Induction machines
- To introduce the principles of operations of Synchronous machines
- To introduce other special machines

UNIT I  D.C. MACHINES  9

UNIT II  TRANSFORMERS  9

UNIT III  SYNCHRONOUS MACHINES  9

UNIT IV  THREE PHASE INDUCTION MOTORS  9
Induction motor-principle of operation, Types - Torque-slip characteristics - Starting methods and Speed control of induction motors.

UNIT V  SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES  9

TOTAL: 45 PERIODS

COURSE OUTCOMES
At the end of the course, the student should have the:

1. Ability to acquire knowledge to solve problems associated with DC and AC Machines.
2. Ability to test and control different machines based on the familiarity of basic concepts and working principle.
3. Ability to choose appropriate machines for a given application while carrying out projects.
4. Ability to apply the knowledge gained to choose appropriate machines for specific application useful for the society.
5. Ability to know about the latest developments related to machines and to learn their concepts even after the completion of the course.
6. Ability to acquire knowledge of stepper motor.
TEXT BOOKS

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

EI8452 INDUSTRIAL INSTRUMENTATION - I LT P C 3 0 0 3

COURSE OBJECTIVES
- To introduce the measurement techniques of force, torque and speed.
- To introduce the measurement techniques of acceleration, Vibration and density
- To introduce the measurement Viscosity, Humidity and moisture.
- To introduce the temperature measurement techniques
- To introduce the pressure measurement techniques

UNIT I MEASUREMENT OF FORCE, TORQUE AND SPEED 8
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 8
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 12

UNIT V PRESSURE MEASUREMENT 9
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, ionization gauges, Cold cathode type and hot cathode type – Pressure gauge selection, installation and calibration using dead weight tester.

TOTAL : 45 PERIODS

COURSE OUTCOMES
At the end of the course, the student will have the:

1. Ability to understand the construction and working of instruments used for measurement of force, torque, speed, acceleration, vibration, density, viscosity, humidity, moisture, temperature.
2. Ability to select instruments according to the application.
3. Ability to understand the concept of calibration of instruments and gain knowledge about temperature measurement devices.
4. Ability to design signal conditioning circuits and compensation schemes for temperature measuring instruments.
5. Ability to understand the working of instruments used for measurement of pressure.
6. Ability to measure fiber optic sensor to measure temperature.

TEXT BOOKS

REFERENCES

EE8451 LINEAR INTEGRATED CIRCUITS AND APPLICATIONS  

OBJECTIVES:
To impart knowledge on the following topics
• Signal analysis using Op-amp based circuits.
• Applications of Op-amp.
• Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
• IC fabrication procedure.

UNIT I IC FABRICATION
IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance, FETs and PV Cell.

UNIT II CHARACTERISTICS OF OPAMP
Ideal OP-AMP characteristics, DC characteristics, AC characteristics, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting Amplifiers, summer, differentiator and integrator-V/I & I/V converters.

UNIT III APPLICATIONS OF OPAMP
Instrumentation amplifier and its applications for transducer Bridge, Log and Antilog Amplifiers- Analog multiplier & Divider, first and second order active filters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit—D/A converter (R- 2R ladder and weighted resistor types), A/D converters using opamps.

UNIT IV SPECIAL ICs
Functional block, characteristics of 555 Timer and its PWM application - IC-566 voltage controlled oscillator IC; 565-phase locked loop IC, AD633 Analog multiplier ICs.

UNIT V APPLICATION ICs
AD623 Instrumentation Amplifier and its application as load cell weight measurement - IC voltage regulators –LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply - LM317, 723 Variable voltage regulators, switching regulator- SMPS - ICL 8038 function generator IC.

TOTAL : 45 PERIODS
OUTCOMES:

- Ability to acquire knowledge in IC fabrication procedure
- Ability to analyze the characteristics of Op-Amp
- To understand the importance of Signal analysis using Op-amp based circuits.
- Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
- To understand and acquire knowledge on the Applications of Op-amp
- Ability to understand and analyse, linear integrated circuits their Fabrication and Application.

TEXT BOOKS:

REFERENCES

IC8451 CONTROL SYSTEMS

COURSE OBJECTIVES
- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
- To introduce stability analysis and design of compensators
- To introduce state variable representation of physical systems

UNIT I SYSTEMS AND REPRESENTATION
UNIT II  TIME RESPONSE 9
Time response: – Time domain specifications – Types of test input – I and II order system response –
Error coefficients – Generalized error series – Steady state error – Root locus construction– Effects of

UNIT III  FREQUENCY RESPONSE 9
Frequency response: – Bode plot – Polar plot – Determination of closed loop response from open
loop response - Correlation between frequency domain and time domain specifications

UNIT IV  STABILITY AND COMPENSATOR DESIGN 9
Characteristics equation – Routh Hurwitz criterion – Nyquist stability criterion- Performance criteria –
Effect of Lag, lead and lag-lead compensation on frequency response-Design of Lag, lead and lag-
lead compensator using bode plots.

UNIT V  STATE VARIABLE ANALYSIS 9
Concept of state variables – State models for linear and time invariant Systems – Solution of state
and output equation in controllable canonical form – Concepts of controllability and observability.

TOTAL (L: 45+T:30): 75 PERIODS

COURSE OUTCOMES
At the end of the course, the student should have the :

• Ability to develop various representations of system based on the knowledge of
  Mathematics, Science and Engineering fundamentals.
• Ability to do time domain and frequency domain analysis of various models of linear
  system.
• Ability to interpret characteristics of the system to develop mathematical model.
• Ability to design appropriate compensator for the given specifications.
• Ability to come out with solution for complex control problem.
• Ability to understand use of PID controller in closed loop system.

TEXT BOOKS

REFERENCES
6. NPTEL Video Lecture Notes on “Control Engineering ”by Prof. S. D. Agashe, IIT
   Bombay.
OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study the various analog and digital modulation techniques
- To study the principles behind information theory and coding
- To study the various digital communication techniques

UNIT I  ANALOG MODULATION  9

UNIT II  PULSE MODULATION  9
Low pass sampling theorem – Quantization – PAM – Line coding – PCM, DPCM, DM, and ADPCM And ADM, Channel Vocoder - Time Division Multiplexing, Frequency Division Multiplexing

UNIT III  DIGITAL MODULATION AND TRANSMISSION  9
Phase shift keying – BPSK, DPSK, QPSK – Principles of M-ary signaling M-ary PSK & QAM – Comparison, ISI – Pulse shaping – Duo binary encoding – Cosine filters – Eye pattern, equalizers

UNIT IV  INFORMATION THEORY AND CODING  9
Measure of information – Entropy – Source coding theorem – Shannon–Fano coding, Huffman Coding, LZ Coding – Channel capacity – Shannon-Hartley law – Shannon's limit – Error control codes – Cyclic codes, Syndrome calculation – Convolution Coding, Sequential and Viterbi decoding

UNIT V  SPREAD SPECTRUM AND MULTIPLE ACCESS  9
PN sequences – properties – m-sequence – DSSS – Processing gain, Jamming – FHSS – Synchronisation and tracking – Multiple Access – FDMA, TDMA, CDMA,

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Apply analog and digital communication techniques.
- Use data and pulse communication techniques.
- Analyze Source and Error control coding.

TEXT BOOKS:
2. S. Haykin “Digital Communications” John Wiley 2005

REFERENCES:
2. H P Hsu, Schaum Outline Series – “Analog and Digital Communications” TMH 2006
COURSE OBJECTIVES

1. To facilitate the students to study the characteristics of various semiconductor devices.
2. To provide practical knowledge on the analysis of regulators, amplifiers and oscillators.
3. To obtain the no load and load characteristics of D.C machines.
4. To obtain the speed characteristics of D.C motor.
5. To find out regulation characteristics of Transformer.

LIST OF EXPERIMENTS FOR DEVICES LAB

1. Simulation and experimental Characterisation of Semiconductor diode and Zener diode.
2. Simulation and experimental Characterisation of a NPN Transistor under common emitter configurations.
3. Simulation and experimental Characterisation of FET and JFET (Draw the equivalent circuit)
4. Simulation and experimental Characterisation of UJT and generation of saw tooth waveforms.
5. Simulation and experimental Characterisation of RC and LC phase shift oscillators.
7. Simulation of passive filters.
8. Simulation of Single Phase half-wave and full wave rectifiers with inductive and capacitive filters.
9. Characteristics of SCR and application as a controlled rectifier.

Minimum of five experiments to be offered from the list. Additional one or two experiments can be framed beyond the list or curriculum.

LIST OF EXPERIMENTS FOR MACHINES LAB

1. Open circuit characteristics of D.C. shunt generator.
2. Load characteristics of D.C. shunt generator.
3. Load test on D.C. shunt motor.
4. Speed control of D.C. shunt motor.
5. Open circuit and short circuit tests on single phase transformer (Determination of equivalent circuit parameters).

Minimum of five experiments to be offered from the list. Additional one or two experiments can be framed beyond the list or curriculum.

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 voltage regulators, transistor amplifiers and oscillators.
4. Ability to make use of basic concepts to obtain the no load and load characteristics of D.C machines.
5. Analyze and draw conclusion from the characteristics obtained by conducting experiments on machines.
6. Ability to carry out the Experiments in batches to motivate the Team work.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
FOR DEVICES LAB:

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name of the Equipment / Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Circuit Simulation Software ( 5 Users ) (Pspice / Matlab /other Equivalent software Package) with PC.</td>
</tr>
<tr>
<td>2.</td>
<td>Sufficient number of power supply, Galvanometer, Bread board, Multimeter, resistors, Decade Capacitance box, Decade resistance box, Decade Inductance box, CRO.</td>
</tr>
<tr>
<td>3.</td>
<td>Semiconductor devices like Diode, Zener Diode, NPN Transistors, JFET, and UJT.</td>
</tr>
</tbody>
</table>

FOR MACHINES LAB:

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name of the Equipment / Components</th>
<th>Quantity Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>DC Shunt Motor with Loading Arrangement</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>Single Phase Transformer</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>Single Phase Induction Motor with Loading Arrangement</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Single Phase Auto Transformer</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>Single Phase Resistive Loading Bank</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td>Sufficient number of Ammeters, Voltmeters, (or multimeters), switches, tachometers, Wattmeters.</td>
<td>2</td>
</tr>
</tbody>
</table>

EE8461 LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY

OBJECTIVES:
- To learn design, testing and characterizing of circuit behavior with digital and analog ICs.

LIST OF EXPERIMENTS
1. Implementation of Boolean Functions, Adder and Subtractor circuits.
2. Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa
3. Parity generator and parity checking
4. Encoders and Decoders
5. Counters: Design and implementation of 3-bit modulo counters as synchronous and asynchronous types using FF IC's and specific counter IC.
6. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitability IC's.
7. Study of multiplexer and de multiplexer
8. Timer IC application: Study of NE/SE 555 timer in Astability, Monostability operation.
10. Voltage to frequency characteristics of NE/SE 566 IC.

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course, the student should have the:
- Ability to understand and implement Boolean Functions.
- Ability to understand the importance of code conversion
- Ability to Design and implement 4-bit shift registers
- Ability to acquire knowledge on Application of Op-Amp
- Ability to Design and implement counters using specific counter IC.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS: (3 per Batch)

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name of the equipments / Components</th>
<th>Quantity Required</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dual ,(0-30V) variability Power Supply</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>CRO</td>
<td>9</td>
<td>30MHz</td>
</tr>
<tr>
<td>3</td>
<td>Digital Multimeter</td>
<td>10</td>
<td>Digital</td>
</tr>
<tr>
<td>4</td>
<td>Function Generator</td>
<td>8</td>
<td>1 MHz</td>
</tr>
<tr>
<td>5</td>
<td>IC Tester (Analog)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Bread board</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Computer (PSPICE installed)</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Consumabilitys (sufficient quantity)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IC 741/ IC NE555/566/565</td>
</tr>
<tr>
<td>2</td>
<td>Digital IC types</td>
</tr>
<tr>
<td>3</td>
<td>LED</td>
</tr>
<tr>
<td>4</td>
<td>LM317</td>
</tr>
<tr>
<td>5</td>
<td>LM723</td>
</tr>
<tr>
<td>6</td>
<td>ICSG3524 / SG3525</td>
</tr>
<tr>
<td>7</td>
<td>Transistor – 2N3391</td>
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<tr>
<td></td>
<td></td>
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<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>8</td>
<td>Diodes, IN4001, BY126</td>
</tr>
<tr>
<td>9</td>
<td>Zener diodes</td>
</tr>
<tr>
<td>10</td>
<td>Potentiometer</td>
</tr>
<tr>
<td>11</td>
<td>Step-down transformer 230V/12-0-12V</td>
</tr>
<tr>
<td>12</td>
<td>Capacitor</td>
</tr>
<tr>
<td>13</td>
<td>Resistors 1/4 Watt Assorted</td>
</tr>
<tr>
<td>14</td>
<td>Single Strand Wire</td>
</tr>
</tbody>
</table>

**EI8551**  
**ANALYTICAL INSTRUMENTS**  
**LT P C**  
3 0 0 3

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

**UNIT I  SPECTROPHOTOMETRY**  
9

**UNIT II  CHROMATOGRAPHY**  
9

**UNIT III  INDUSTRIAL GAS ANALYZERS AND POLLUTION MONITORING INSTRUMENTS**  
9
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

UNIT V NUCLEAR MAGNETIC RESONANCE AND MASS SPECTROMETRY

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)
1. Ability to understand the fundamental principles of selective analytical instruments used in medical diagnosis, quality assurance & control and research studies.
2. Ability to assess and suggest a suitable analytical method for a specific purpose, and evaluate sensitivity, important sources of interferences and errors, and also suggest alternative analytical methods for quality assurance.
3. Ability to critically evaluate the strengths and limitations of the various instrumental methods.
4. Ability to develop critical thinking for interpreting analytical data.
5. Ability to understand the working principle, types and applications of NMR and Mass spectroscopy.

TEXT BOOKS:

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

- To introduce variable head type flow meters
- To introduce quantity meters, air flow meters and mass flow meters
- To educate on electrical type flow meters
- To educate on the level measurement techniques
- To educate on Viscosity, Humidity and Moisture content

UNIT I  VARIABLE HEAD TYPE FLOWMETERS  9
Expression for flow rate through restriction (compressible and incompressible flow) - Orifice plate: different types of orifice plates – Cd variation – pressure tappings – Venturi tube – Flow nozzle – Dall tube – Pitot tube: combined pitot tube, averaging pitot tube – Installation and applications of head flow meters

UNIT II  QUANTITY METERS, AREA FLOW METERS AND MASS FLOW METERS  9
Positive displacement flow meters:


UNIT III  ELECTRICAL TYPE FLOW METERS  9

UNIT IV  LEVEL MEASUREMENT  9

UNIT V  TRANSMITTERS  9

TOTAL : 45 PERIODS
COURSE OUTCOMES (COs)
At the end of the course, the student will have the:
1. Ability to understand the construction, installation and working of different variable head
   type flow meters.
2. Able to understand the construction, working and calibration of different quantity
   flow meters, variable area flow meters, mass flow meters, electrical type, open
   channel and solid flow meters.
3. Ability to gain knowledge about the construction, working and calibration of
   different type of transmitters.
4. Ability to choose appropriate flow meters or level sensor for an application.

TEXT BOOKS:

REFERENCES:
   New Delhi, 2009.
   IIT Madras.

EI8553 PROCESS CONTROL

COURSE OBJECTIVES
- To introduce technical terms and nomenclature associated with Process control
  domain.
- To familiarize the students with characteristics, selection, sizing of control valves.
- To provide an overview of the features associated with Industrial type PID controller.
- To make the students understand the various PID tuning methods.
- To elaborate different types of control schemes such as cascade control, feed-forward control and Model Based control schemes.

UNIT I PROCESS MODELLING AND DYNAMICS
Need for process control – Mathematical Modeling of Processes: Level, Flow, Pressure and
Thermal processes – Continuous and batch processes – Self regulation – Servo and regulatory
operations – Lumped and Distributed parameter models – Heat exchanger – CSTR –
Linearization of nonlinear systems.

UNIT II FINAL CONTROL ELEMENTS
Actuators: Pneumatic and electric actuators – Control Valve Terminology - Characteristic of
Control Valves: Inherent and Installed characteristics - Valve Positioner – Modeling of a
Pneumatically Actuated Control Valve – Control Valve Sizing: ISA S 75.01 standard flow
equations for sizing Control Valves – Cavitation and flashing – Control Valve selection
UNIT III CONTROL ACTIONS
6+6


UNIT IV PID CONTROLLER TUNING 6+6

PID Controller Design Specifications: Criteria based on Time Response and Criteria based Frequency Response - PID Controller Tuning: Z-N and Cohen-Coon methods, Continuous cycling method and Damped oscillation method, optimization methods, Auto tuning – Cascade control – Feed-forward control

UNIT V MODEL BASED CONTROL SCHEMES 6+6


TOTAL : 60 PERIODS

COURSE OUTCOMES (COs)

- Ability to understand technical terms and nomenclature associated with Process control domain.
- Ability to build models using first principles approach as well as analyze models.
- Ability to Design, tune and implement PID Controllers to achieve desired performance for various processes.
- Ability to Analyze Systems and design & implement control Schemes for various Processes.
- Ability to Identify, formulate and solve problems in the Process Control Domain.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
To impart knowledge on the following Topics
- Architecture of μP8085 & μC 8051
- Addressing modes & instruction set of 8085 & 8051.
- Need & use of Interrupt structure 8085 & 8051.
- Simple applications development with programming 8085 & 8051

UNIT I  8085 PROCESSOR  9

UNIT II  PROGRAMMING OF 8085 PROCESSOR  9
Instruction -format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up tability - Subroutine instructions - stack.

UNIT III  8051 MICRO CONTROLLER  9

UNIT IV  PERIPHERAL INTERFACING  9
Study on need, Architecture, configuration and interfacing, with ICs: 8255, 8259, 8254, 8279, - A/D and D/A converters &Interfacing with 8085& 8051.

UNIT V  MICRO CONTROLLER PROGRAMMING & APPLICATIONS  9
Simple programming exercises- key board and display interface –Control of servo motor-stepper motor control- Application to automation systems.

TOTAL :  45 PERIODS

OUTCOMES:
- Ability to acquire knowledge in Addressing modes & instruction set of 8085 & 8051.
- Ability to need & use of Interrupt structure 8085 & 8051.
- Ability to understand the importance of Interfacing
- Ability to explain the architecture of Microprocessor and Microcontroller.
- Ability to write the assembly language programme.
- Ability to develop the Microprocessor and Microcontroller based applications.

TEXT BOOKS:
REFERENCES

EI8093 UNIT OPERATION AND CONTROL LT P C
3 0 0 3

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

UNIT I MECHANICAL OPERATIONS- I
OPERATIONS ON SOLIDS: General Characteristics of solids; Storage and conveying of solids:bunkers, silos, bins and hoppers, transport of solids in bulk, conveyor selection, different types of conveyors; Estimation of particle size;Screening methods and equipment; Adjusting particle size:methods of size reduction, classification of equipment, crushers, grinders; size enlargement; Principle of granulation, briquetting, pelletisation and flocculation; Mixing: mixing of powders; Separation: Electrostatic and magnetic separators, applications.

UNIT II MECHANICAL OPERATIONS-II
OPERATIONS ON FLUIDS: Transport of fluids; Mixing and agitation: Mixing of liquids, selection of suitable mixers; Separation: Gravity settling, sedimentation, thickening, double cone classifier, centrifugal separation; Cyclones - Operation, equipment, control and applications.

UNIT III HEAT TRANSFER- I AND ITS APPLICATIONS
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
Theory of evaporation; single effect and multiple effect evaporators; Crystallization; nucleation and growth, classification of crystallizers; Drying: classification of Dryers, batch and continuous dryers, dryers for solids and slurries and cooling Towers, Refrigeration.
UNIT V  CASE STUDY

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:

REFERENCES:

EI8561  INDUSTRIAL INSTRUMENTATION LABORATORY  L T P C
0 0 4 2

COURSE OBJECTIVES
1. To impart an adequate knowledge and expertise to handle equipment generally available in an industry
2. To make the students aware about calibration of meters, sensors and transmitters.
3. To make the students conscious about the working and operation of different types of analytical Instruments.
4. To identify, formulate, and analyze problems regarding sensors and transmitter

LIST OF EXPERIMENTS
1. Measurement of speed, torque and vibration
2. Calibration of ammeter, voltmeter and wattmeter using multifunction calibrator
3. Calibration of pressure gauge using dead weight tester.
5. Measurement of flow using
   a) Discharge coefficient of orifice plate
b) Calibration of Rotameter.

7. Measurement of temperature using IR thermometer and IC sensor
10. Standardization and measurement of pH values of different solutions
11. Measurement and analysis of ECG and pulse rate.

**Minimum of ten experiments to be offered from the list. Additional one or two experiments can be framed beyond the list or curriculum**

**COURSE OUTCOMES (COs)**
1. Ability to experimentally measure industrial process parameters such as flow, level, temperature, pressure and viscosity.
2. Ability to measure and analyze pH, conductivity, UV absorbance and transmittance.
3. Ability to measure and analyze physiological parameters such as BP, ECG and pulse rate.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**
1. Orifice plate 1
2. Dead weight tester with pressure gauge 1
3. Torque trainer 1
4. Saybolt Viscometer 1
5. Vacuum gauge 1
6. DP transmitter 1
7. UV – Visible spectrophotometer 1
9. pH meter 1
10. Conductivity meter 1
11. ECG trainer 1
12. Pulse rate trainer 1
13. tacho meter

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**EE8681 MICROPROCESSORS AND MICROCONTROLLERS**

**LABORATORY**

**OBJECTIVES:**
- To provide training on programming of microprocessors and microcontrollers and understand the interface requirements.
- To simulate various microprocessors and microcontrollers using KEIL or Equivalent simulator.

**LIST OF EXPERIMENTS**
1. Simple arithmetic operations: addition / subtraction / multiplication / division.
2. Programming with control instructions:
   (i) Ascending / Descending order, Maximum / Minimum of numbers.
   (ii) Programs using Rotate instructions.
   (iii) Hex / ASCII / BCD code conversions.
3 Interface Experiments: with 8085  
   (i) A/D Interfacing. &  D/A Interfacing.  
4 Traffic light controller.  
5 I/O Port / Serial communication  
6 Programming Practices with Simulators/Emulators/open source  
7 Read a key ,interface display  
8 Demonstration of basic instructions with 8051 Micro controller execution, including:  
   (i) Conditional jumps & looping  
   (ii) Calling subroutines.  
9 Programming I/O Port and timer of  8051  
   (i) study on  interface with A/D & D/A  
   (ii) Study on interface with DC & AC motors  
10 Application hardware development using embedded processors.  

TOTAL: 60 PERIODS  

OUTCOMES:  
- Ability to understand and apply computing platform and software for engineering problems.  
- Ability to programming logics for code conversion.  
- Ability to acquire knowledge on A/D and D/A.  
- Ability to understand basics of serial communication.  
- Ability to understand and impart knowledge in DC and AC motor interfacing.  
- Ability to understand basics of software simulators.  

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:  

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Description of Equipment</th>
<th>Quantity required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>8085 Microprocessor Trainer with Power Supply</td>
<td>15</td>
</tr>
<tr>
<td>2.</td>
<td>8051 Micro Controller Trainer Kit with power supply</td>
<td>15</td>
</tr>
<tr>
<td>3.</td>
<td>8255 Interface boards</td>
<td>5</td>
</tr>
<tr>
<td>4.</td>
<td>8251 Interface boards</td>
<td>5</td>
</tr>
<tr>
<td>5.</td>
<td>8259 Interface boards</td>
<td>5</td>
</tr>
<tr>
<td>6.</td>
<td>8279 Keyboard / Display Interface boards</td>
<td>5</td>
</tr>
<tr>
<td>7.</td>
<td>8254 timer/ counters</td>
<td>5</td>
</tr>
<tr>
<td>8.</td>
<td>ADC and DAC cards</td>
<td>5</td>
</tr>
<tr>
<td>9.</td>
<td>AC &amp; DC motor with Controller s</td>
<td>5</td>
</tr>
<tr>
<td>10.</td>
<td>Traffic Light Control Systems</td>
<td>5</td>
</tr>
</tbody>
</table>
OBJECTIVES:

i. To provide knowledge on design state feedback control and state observer.
ii. To provide knowledge in phase plane analysis.
iii. To give basic knowledge in describing function analysis.
iv. To study the design of optimal controller.
v. To study the design of optimal estimator including Kalman Filter

UNIT I STATE VARIABLE ANALYSIS 6+6
Introduction- concepts of state variables and state model-State model for linear continuous time systems, Diagonalisation- solution of state equations- Concepts of controllability and observability.

UNIT II STATE VARIABLE DESIGN 6+6

UNIT III SAMPLED DATA ANALYSIS 6+6
Introduction spectrum analysis of sampling process signal reconstruction difference equations The Z transform function, the inverse Z transform function, response of Linear discrete system, the Z transform analysis of sampled data control systems, response between sampling instants, the Z and S domain relationship. Stability analysis and compensation techniques.

UNIT IV NON LINEAR SYSTEMS 6+6

UNIT V OPTIMAL CONTROL 6+6

TOTAL: 60 PERIODS

OUTCOMES:

i. Able to design state feedback controller and state observer.
ii. Able to understand and analyse linear and nonlinear systems using phase plane method.
iii. Able to understand and analyse nonlinear systems using describing function method.
iv. Able to understand and design optimal controller.
v. Able to understand optimal estimator including Kalman Filter.
vi. Ability to apply advanced control strategies to practical engineering problems.

TEXT BOOKS:
REFERENCES:

EI8651 LOGIC AND DISTRIBUTED CONTROL SYSTEM LT P C 3 0 0 3

COURSE OBJECTIVES
- To give an overview of the automation technologies such as PLCs, SCADA and DCS used in industries.
- To provide a fundamental understanding of the different languages used for PLC Programming
- 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 (COs)
- Ability to understand all the important components such as PLC, SCADA, DCS, I/O modules and field devices of an industrial automation system.
- Ability to develop PLC program in different languages for industrial sequential
applications.

- Able to select and use most appropriate automation technologies for a given application.
- Ability to gain knowledge on the recent developments in industrial automation.

TEXT BOOKS:

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

CS8391 DATA STRUCTURES 

OBJECTIVES:
- To understand the concepts of ADTs
- To Learn linear data structures – lists, stacks, and queues
- To understand sorting, searching and hashing algorithms
- To apply Tree and Graph structures

UNIT I LINEAR DATA STRUCTURES – LIST 9
Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation — singly linked lists- circularly linked lists- doubly-linked lists – applications of lists – Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

UNIT II LINEAR DATA STRUCTURES – STACKS, QUEUES 9

UNIT III NON LINEAR DATA STRUCTURES – TREES 9
UNIT IV NON LINEAR DATA STRUCTURES - GRAPHS 9
Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal –
Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Applications of graphs.

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES 9
Searching- Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort - Shell
Extendible Hashing.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Implement abstract data types for linear data structures.
- Apply the different linear and non-linear data structures to problem solutions.
- Critically analyze the various sorting algorithms.

TEXT BOOKS:

REFERENCES:

EI8092 THERMAL POWER PLANT INSTRUMENTATION 3 0 0 3

COURSE OBJECTIVES
- To make the students familiarize about various power generation methods.
- To identify various parameters in thermal power plant
- To impart knowledge about the different types of controls and control loops.
- To familiarize the student with the methods of monitoring different parameters like speed, vibration
  of turbines and their control.

UNIT I POWER GENERATION METHODS 9
Brief survey of methods of power generation: hydro, thermal, nuclear, solar and wind power –
importance of instrumentation in power generation – thermal power plants: building blocks, details of
boiler processes P&I diagram of boiler – cogeneration.

UNIT II MEASUREMENTS IN POWER PLANTS 9
Electrical measurements: current, voltage, power, frequency, power factor – non electrical
parameters: flow of feed water, fuel, air, steam pressure and steam temperature – smoke density
measurement – Flue gas oxygen analyzer – pollution monitoring instruments.
UNIT III  FURNACE CONTROL
Coal handling: Pulverizers - Furnace Draught: natural draught, forced draught, induced draught, power requirements for draught systems - Combustion control: Fuel/Air ratio, combustion efficiency, excess air, parallel and cross limited combustion control- soot-blowing operation.

UNIT IV  BOILER CONTROL
Boiler metal temperature measurement, pressure measuring devices – Boiler feed water processing and control - drum level measurement methods - steam temperature control: main steam and reheat steam temperature control, superheater control, deaerator control – distributed control system in power plants – interlocks in boiler operation.

UNIT V  TURBINE CONTROL
Speed measurement, rotor and casing movement- vibration - shell temperature monitoring and control - steam pressure control - lubricant oil temperature - cooling system.

TOTAL : 45 PERIODS

COURSE OUTCOME:
1. Understanding various power generation process.
2. Identify important parameter to be monitored and controlled in thermal power plant.
3. Knowledge about various building blocks and instruments involved in thermal power plant and its controlling process.

TEXT BOOKS

REFERENCES

CS8381 DATA STRUCTURES LABORATORY  L T P C
0 0 4 2

OBJECTIVES
• To implement linear and non-linear data structures
• To understand the different operations of search trees
• To implement graph traversal algorithms
• To get familiarized to sorting and searching algorithms

1. Array implementation of Stack and Queue ADTs
2. Array implementation of List ADT
3. Linked list implementation of List, Stack and Queue ADTs
4. Applications of List, Stack and Queue ADTs
5. Implementation of Binary Trees and operations of Binary Trees
6. Implementation of Binary Search Trees
7. Implementation of AVL Trees
9. Graph representation and Traversal algorithms
10. Applications of Graphs
11. Implementation of searching and sorting algorithms
12. Hashing – any two collision techniques

TOTAL : 60 PERIODS

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

- Write functions to implement linear and non-linear data structure operations
- Suggest appropriate linear / non-linear data structure operations for solving a given problem
- Appropriately use the linear / non-linear data structure operations for a given problem
- Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval

EI8661 PROCESS CONTROL LABORATORY LT P C
0 0 4 2

OBJECTIVES:
1. To experimentally verify the process control concepts on the selected process control loops.
2. To impart theoretical and practical skills in process identification and PID controller tuning
3. To make the students aware of basic and advanced control schemes

LIST OF EXPERIMENTS:

Simulation Based Experiments
1. Simulation of lumped /distributed parameter system
2. Mathematical model of a typical industrial process using nonparametric identification methods
3. Tuning of PID Controller for mathematically described processes
4. PID Enhancements (Cascade and Feed-forward Control Schemes)
5. Design and Implementation of Multi-loop PID Controller on the simulated model of a typical industrial process.
6. Study of AC and DC drives.

Hardware based experiments
1. Characteristics of Pneumatically Actuated Control Valve (with and without Positioner).
2. Study and control of flow process using Compact Flow Control Unit.
3. Control of Level and Pressure using Process Control Training Plant.
4. Design and implementation of ON/OFF Controller for the Temperature Process.
5. Design and implementation of Interacting and non-interacting system
6. Design and implementation of adaptive or model predictive control schemes
Minimum of ten experiments to be offered from the list. Additional one or two experiments can be framed beyond the list or curriculum

OUTCOMES:
1. Ability to understand and analyze process control engineering problems.
2. Be able to build dynamic models using input – output data of a process
3. Ability to working with real time control loops(flow/level/temperature/pressure)
4. Get exposed to simulation tools such as MATLAB/LABVIEW/ASPEN
5. Ability to learn and implement simple adaptive and model based control schemes

TOTAL : 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. Flow process station with all accessories
2. Analog / Digital PID controller
3. Control valve setup (with position for varying ΔP across the valve)
4. Flow meter
5. Level process station with all accessories
6. Temperature process station with all accessories
7. Pressure process station with all accessories
8. Personal computer-15 nos
9. MATLAB software
10. Two tank system with following accessories.

HS8581 PROFESSIONAL COMMUNICATION

OBJECTIVES: The course aims to:
- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

UNIT I
Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

UNIT II
Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

UNIT III
Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -- questioning and clarifying —GD strategies- activities to improve GD skills
UNIT IV
Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview & panel interview – FAQs related to job interviews

UNIT V
Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes.

OUTCOMES: At the end of the course Learners will be able to:
• Make effective presentations
• Participate confidently in Group Discussions.
• Attend job interviews and be successful in them.
• Develop adequate Soft Skills required for the workplace

Recommended Software
1. Open Source Software
2. Win English

REFERENCES:

EI8751 INDUSTRIAL DATA NETWORKS LT P C
3 0 0 3

OBJECTIVES:
• To educate on the basic concepts of data networks
• To introduce the basics of internetworking and serial communications
• To provide details on HART and Field buses
• To educate on MODBUS, PROFIBUS and other communication protocol
• To introduce industrial Ethernet and wireless communication

UNIT I  DATA NETWORK FUNDAMENTALS  9
Networks hierarchy and switching – Open System Interconnection model of ISO - Data link control protocol - Media access protocol - Command / response - Token passing -CSMA/CD, TCP/IP
UNIT II  INTERNET WORKING and RS 232, RS485  
Bridges - Routers - Gateways - Standard ETHERNET and ARCNET configuration special requirement for networks used for control - RS 232, RS 485 configuration Actuator Sensor (AS) – interface, Devicenet

UNIT III  HART AND FIELD BUS  

UNIT IV  MODBUS AND PROFIBUS PA/DP/FMS AND FF  
MODBUS protocol structure - function codes – troubleshooting Profibus, Introduction, Profibus protocol stack, Profibus communication model - communication objects - system operation - troubleshooting - review of foundation fieldbus - Data Highway

UNIT V  INDUSTRIAL ETHERNET AND WIRELESS COMMUNICATION  
Industrial Ethernet, Introduction, 10 Mbps Ethernet, 100 Mbps Ethernet - Radio and wireless communication, Introduction, components of radio link - radio spectrum and frequency allocation - radio MODEMs-Introduction to wireless HART and ISA100.

TOTAL : 45 PERIODS

OUTCOMES: Students will have the
- Ability to define basic concepts of data communication and its importance.
- Ability to explain the various internetworking devices involved in industrial networks.
- Ability to explain the various serial communication used in process industries.
- Ability to illustrate, compare & explain the working of HART and Field bus used in process digital communication.
- Ability to summarize the operation of MODBUS, PROFIBUS protocol & its applications.
- Ability to explain and adopt the different Industrial Ethernet protocol and usage of wireless communication in process applications.

TEXT BOOKS:

REFERENCES

TOTAL :45. PERIODS
COURSE OBJECTIVES

- To introduce the students the method of oil recovery and the steps involved in oil gas production process.
- To make the students understand the process behavior of some of the important unit operations in petrochemical industry through mathematical model.
- To familiarize the students to apply knowledge to select the appropriate control strategy for the selective process.
- To provide information about the most important derivatives obtained from petroleum products.
- 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

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 mathematical model of selective processes.
3. Able to develop, analyze and select appropriate control strategy for selective unit operations in a refinery.
4. Gain knowledge on the most important chemical derivatives obtained from petroleum products.
5. Understand safety instrumentation followed in process industries.
TEXT BOOKS:

REFERENCES:

EC8093 DIGITAL IMAGE PROCESSING LT P C
3 0 0 3

OBJECTIVES:

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

UNIT I DIGITAL IMAGE FUNDAMENTALS

UNIT II IMAGE ENHANCEMENT

UNIT III IMAGE RESTORATION
UNIT IV  IMAGE SEGMENTATION

UNIT V  IMAGE COMPRESSION AND RECOGNITION
Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course, the students should be able to:
- Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
- Operate on images using the techniques of smoothing, sharpening and enhancement.
- Understand the restoration concepts and filtering techniques.
- Learn the basics of segmentation, features extraction, compression and recognition methods for color models.

TEXT BOOKS:

REFERENCES

EI8761  INDUSTRIAL AUTOMATION LABORATORY  LT P C
0 0 4 2

OBJECTIVES:
To impart practical skills in
1. Programming of PLC and DCS.
2. Sensor data acquisition, data processing and visualization
3. Interfacing the various field devices with PLC
LIST OF EXPERIMENTS:

1. Study of PLC field device interface modules (AI,AO,DI,DO modules)
2. Programming Logic Gates Function in PLC
3. Implementing Mathematical Operations in PLC
4. Programming Jump-to-subroutine & return operations in PLC
5. PLC Exercises:- 1. Traffic Light Control and Filling/Draining Control Operation
6. PLC Exercise: 1. Reversal of DC Motor Direction 2. ON/OFF Controller for Thermal Process
7. PC based control of Level Process
8. On-line Monitoring and Control of a Pilot plant using DCS
9. PLC based Control of Flow Process
10. Study of Foundation Fieldbus /IOT/Wireless HART Enabled Transmitter

TOTAL: 60 PERIODS

OUTCOMES:

1. Ability to understand and Programming of PLC, SCADA and DCS
2. Ability to working with industrial automation system
3. Be able to design and implement control schemes in PLC & DCS
4. Ability to interface field devices with PLC & DCS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Programmable Logic controller 5 Nos.
2. Programmable Logic controller Software 10 User License
3. DAQ card 2 Nos.
5. Traffic Light Controller 2 Nos
6. DC Motor 5 Nos
7. Personal computer- 10 Nos
8. DCS along with Interface modules 1 set
10. Smart Transmitter - 1 No.
OBJECTIVES:

1. To obtain adequate knowledge in design of various signal conditioning circuits and instrumentation systems.
2. To impart design knowledge of controller, control valve and transmitter.
3. To acquire the knowledge of piping diagram of industrial standard
4. To make the students aware of industry project, planning and scheduling.

LIST OF EXPERIMENTS:

1. Design of Instrumentation amplifier.
2. Design of active filters – LPF, HPF and BPF
3. Design of regulated power supply and design of V/I and I/V converters.
5. Design of signal conditioning circuit for strain gauge and RTD.
6. Design of orifice plate and rotameter.
7. Design of Control valve (sizing and flow-lift characteristics)
8. Design of PID controller (using operational amplifier and microprocessor)
9. Design of a multi-channel data acquisition system
10. Design of multi range DP transmitter
12. Preparation of documentation of instrumentation project and project scheduling for the above case study. (Process flow sheet, instrument index sheet and instrument specifications sheet, job scheduling, installation procedures and safety regulations).

Minimum of ten experiments to be offered from the list. Additional one or two experiments can be framed beyond the list or curriculum

OUTCOMES:

1. Ability to understand design of signal conditioning circuits and instrumentation systems.
2. Ability to design controller, control valve and transmitter.
3. Be able to design and draw the piping diagram for industrial application projects.
4. Be able to design the multi-channel data acquisition system and transmitter

TOTAL: 60 PERIODS
LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

<table>
<thead>
<tr>
<th>Expt. No.</th>
<th>List of equipments</th>
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<tbody>
<tr>
<td>1.</td>
<td>Sufficient number of Monolithic Instrumentation amplifier, Operational amplifiers, IC 7805 and resistors, diodes, capacitors</td>
</tr>
<tr>
<td>2.</td>
<td>Linear control valve, ON/OFF control valve, Air regulator, Rotameter, Pump</td>
</tr>
<tr>
<td>3.</td>
<td>Sufficient number of IC 741, CRO, Bread board, Signal generator (PID) Microprocessor kit with ADC and DAC section</td>
</tr>
<tr>
<td>4.</td>
<td>Any Process station (Temperature or Level) with Corresponding sensors, Data acquisition card, and Storage device (microcontroller/microprocessor)</td>
</tr>
<tr>
<td>5.</td>
<td>Flow process station with DP transmitter</td>
</tr>
<tr>
<td>6.</td>
<td>Loop analyzer</td>
</tr>
<tr>
<td>7.</td>
<td>Thermocouple &amp; RTD</td>
</tr>
<tr>
<td>8.</td>
<td>Bonded strain gauge, Loads,</td>
</tr>
<tr>
<td>9.</td>
<td>orifice plate</td>
</tr>
</tbody>
</table>

IC8811 PROJECT WORK L T P C 0 0 20 10

OBJECTIVES:
- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three 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 based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

OUTCOMES:
- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

TOTAL: 300 PERIODS
COURSE OBJECTIVES

- To provide wide knowledge of semiconductors and solid mechanics to fabricate MEMS devices
- To educate on the rudiments of Micro fabrication techniques
- To educate on applications of MEMS
- To provide wide information dealing with nano material and its necessity
- To analyze methods involving preparation of nano scale devices

UNIT I  OVERVIEW OF MEMS AND MICROSYSTEMS  9

UNIT II  MICROSYSTEM FABRICATION PROCESS  9

UNIT III  POLYMERS AND OPTICAL MEMS  9

UNIT IV  INTRODUCTION TO NANOSCALE ENGINEERING  9

UNIT V  PATTERNING AND PREPARATION METHODS  9
Bottom up Synthesis – Top down Approach : Precipitation, Mechanical Milling, Colloidal routes, Self assembly, Vapour phase deposition, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE, Patterning : Introduction to optical/UV electron beam and X-ray Lithography systems and processes. Clean rooms: specifications and design, air and water purity, requirements for particular processes.

TOTAL :45 PERIODS

COURSE OUTCOMES (COs)

1. Ability to understand the operation of micro devices, micro systems and their applications.
2. Ability to design the micro devices, micro systems using the MEMS fabrication process.
3. Ability to understand the operation of nano devices, nano systems and their applications.
4. Ability to design nano devices, nano systems using the preparation methods.

TEXT BOOKS:

REFERENCES:

EI8077 POWER ELECTRONICS AND DRIVES

LT P C
3 0 0 3

COURSE OBJECTIVES

- Comprehensive introduction to various power electronic devices, their structure, operating principle and characteristics
- Give exposure to Various topologies, working principle and analysis of controlled rectifiers and ac controllers
- Detailed knowledge on Classifications, structure, operating principle of dc choppers
- Introduction to different types of Inverters, their principle of operation and waveform control
- Overview on dc and ac drives and their control using power electronic circuits.

UNIT I POWER SEMICONDUCTOR DEVICES AND CHARACTERISTICS


UNIT II CONTROLLED RECTIFIERS AND AC CONTROLLERS


UNIT III DC TO DC CONVERTERS

Step up and Step down Chopper – Chopper classification - quadrant of operation – Switching mode Regulators – Buck, Boost, Buck-Boost, and Cuk Regulators.

UNIT IV INVERTERS

UNIT V DRIVES AND CONTROL
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.

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, Control rectifier, chopper and inverter.
3. Will have ability to apply power electronic circuits for the control of popular applications.
4. Exposure to design and analyze PE circuit using simulation software.

TEXT BOOKS:

REFERENCES:
5. NPTEL Lecture Series on “Power Electronics” by Dr.B.G.Fernandes, IIT Bombay.

IC8072 SYSTEM IDENTIFICATION

COURSE OBJECTIVES
- To understand the mathematical modelling of systems.
- To observe systems by their behaviour using Parametric Identification methods using online and offline Data’s
- To observe systems by their behaviour using Nonparametric Identification Methods using Online and Offline Data’s
- To estimate and validate the data’s using parametric and recursive estimation methods
- To perform case studies on electromechanical and process control systems

UNIT I NONPARAMETRIC IDENTIFICATION 6+6
Transient and frequency analysis methods, impulse and step response methods, correlation method, spectral analysis.

UNIT II PARAMETRIC IDENTIFICATION 6+6
Steps in identification process, determining model structure and dimension, Linear and nonlinear model structures (ARX, ARMAX, Box-Jenkins, FIR, Output Error models), Input signals: commonly
used signals, spectral properties, and persistent excitation, Residual analysis for determining adequacy of the estimated models.

UNIT III  PARAMETRIC ESTIMATION  6+6
Linear regression, least square estimation, statistical analysis of LS methods, Minimizing prediction error- identifiability, bias, Least squares, relation between minimizing the prediction error and the MLE, MAP, Convergence and consistency, asymptotic distribution of parameter estimates, Instrumental Variable Method.

UNIT IV  RECURSIVE ESTIMATION  6+6
Forgetting Factor method, Kalman Filter interpretation Identification in practice: Aliasing due to sampling, closed loop data, model order estimation, robustness considerations, model validation.

UNIT V  CASE STUDIES  6+6

TOTAL: 60 PERIODS

COURSE OUTCOMES (COs)

1. Be familiar with different model structures, parameterization, identifiability, structure determination and order estimation
2. Be able to perform parameter estimation using different identification techniques
3. Be able to identify plants online using recursive estimation methods
4. Be able to set up an experiment, identify a nominal model, assess the accuracy and precision of this model,
5. Be appropriate design choices to arrive at a validated model.

REFERENCES:


EI8074  COMPUTER NETWORKS  L T P C
2 2 0 3

OBJECTIVES:
The student should be made to:
- Understand the division of network functionalities into layers.
- Be familiar with the components required to build different types of networks
- Be exposed to the required functionality at each layer
- Learn the flow control and congestion control algorithms
• Understand the flow of traditional and Ongoing applications.

UNIT I  FUNDAMENTALS & LINK LAYER  6+6
Building a network – Requirements - Layering and protocols - Internet Architecture – Network software – Performance ; Link layer Services - Framing - Error Detection - Flow control

UNIT II  MEDIA ACCESS & INTERNETWORKING  6+6
Media access control - Ethernet (802.3) - Wireless LANs – 802.11 – Bluetooth - Switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP,ICMP )

UNIT III  ROUTING  6+6
Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM)

UNIT IV  TRANSPORT LAYER  6+6
Overview of Transport layer - UDP - Reliable byte stream (TCP) - Connection management – Flow control - Retransmission – TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements

UNIT V  APPLICATION LAYER  6+6
Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS - SNMP.

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
• Identify the components required to build different types of networks
• Choose the required functionality at each layer for given application
• Identify solution for each functionality at each layer
• Trace the flow of information from one node to another node in the network
• Identify the congestion control and Avoidance
• Learn the tradition applications and web services

TEXT BOOK:

REFERENCES:
OBJECTIVE:
- To give an idea about IPR, registration and its enforcement.

UNIT I  INTRODUCTION
Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II  REGISTRATION OF IPRs
Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III  AGREEMENTS AND LEGISLATIONS

UNIT IV  DIGITAL PRODUCTS AND LAW

UNIT V  ENFORCEMENT OF IPRs
Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL:45 PERIODS

OUTCOME:
- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS

REFERENCES:
OBJECTIVE

- To study the definition of adaptive control and methods of adaptation.
- To study the parameter identification of systems.
- To study the self-tuning of PID controllers based on parameter identification.
- To study the model reference adaptive control.
- To study the practical application through case studies.

UNIT I  INTRODUCTION

UNIT II  PARAMETRIC IDENTIFICATION

UNIT III  SELF-TUNING REGULATOR

UNIT IV  MODEL REFERENCE ADAPTIVE CONTROLLER

UNIT V  TUNING OF CONTROLLERS AND CASE STUDIES

TOTAL : 60 PERIODS

COURSE OUTCOMES
1. Understand the effect of parameter variation and principle of adaptive control schemes.
2. Distinguish different parametric identification methods.
4. Design of model reference adaptive controller
5. Design gain scheduling controller and apply adaptive control schemes for industrial processes.

TEXT BOOKS:

REFERENCES:

EI8072 ADVANCED INSTRUMENTATION SYSTEMS LT P C 3 0 0 3

COURSE OBJECTIVES
• To make the students review the instruments used for measurement of basic process parameters like level, flow, pressure and temperature.
• To explore the various types of analyzers used in industrial applications.
• To make the students to understand the requirement of safety instrumented system, standards and risk analysis techniques
• To make students familiarize with Instrumentation standards such as BS1042, ISA 75, ISA 84 and ISA 88.
• To make students familiarize with Instrumentation Symbols, Abbreviations and Identification for Instruments, Process Flow diagrams, Instrument Loop diagrams, Instrument Hookup diagrams and Piping and Instrumentation Diagrams.

UNIT I MEASUREMENT OF PROCESS PARAMETERS 9
Review the various Measurement techniques of temperature, pressure, flow and level – application - selection of sensors– calibration methods.

UNIT II INSTRUMENTS FOR ANALYSIS 9

UNIT III SAFETY INSTRUMENTATION 9

UNIT IV INSTRUMENTATION STANDARDS 9
Instrumentation Standards - significance of codes and standards – overview of various types - Introduction of various Instrumentation standards – review, interpretation and significance of specific standards - examples of usage of standards on specific applications.

UNIT V DOCUMENTATION IN PROCESS INDUSTRIES 9
COURSE OUTCOMES
Students will be able to

- understand the instrumentation behind flow, level, temperature and pressure measurement
- Acquire basic knowledge on the various types of analyzers used in typical industries.
- Understand the role of Safety instrumented system in the industry.
- Explain Standards for applying Instrumentation in Hazards Locations.
- Design, develop, and interpret the documents used to define instruments and control
- Systems for a typical project, including P&IDs, loop diagrams, specification forms,
- Instrument lists, logic diagrams, installation details, and location plans

TEXT BOOKS

REFERENCE BOOKS

EE8071 APPLIED SOFT COMPUTING LT P C 3 0 0 3

OBJECTIVES:
- To expose the students to the concepts of feed forward neural networks.
- To provide adequate knowledge about feedback neural networks
- To provide adequate knowledge about fuzzy and neuro-fuzzy systems
- To provide comprehensive knowledge of fuzzy logic control to real time systems.
- To provide adequate knowledge of genetic algorithms and its application to economic dispatch and unit commitment problems.

UNIT I ARCHITECTURES – ANN
UNIT II  NEURAL NETWORKS FOR CONTROL  9
Feedback networks – Discrete time Hopfield networks – Transient response of continuous time
system – Applications of artificial neural network - Process identification – Neuro controller for inverted
pendulum.

UNIT III  FUZZY SYSTEMS  9
Classical sets – Fuzzy sets – Fuzzy relations – Fuzzification – Defuzzification – Fuzzy rules -
Membership function – Knowledge base – Decision-making logic – Introduction to neuro fuzzy
system- Adaptive fuzzy system.

UNIT IV  APPLICATION OF FUZZY LOGIC SYSTEMS  9
Fuzzy logic control: Home heating system - liquid level control - aircraft landing- inverted pendulum –
fuzzy PID control, Fuzzy based motor control.

UNIT V  GENETIC ALGORITHMS  9
Basic concept of Genetic algorithm and detail algorithmic steps-adjustment of free Parameters-
Solution of typical control problems using genetic algorithm- Concept on some other search
techniques like tabu search and ant colony search techniques for solving optimization problems.

TOTAL: 45 PERIODS

OUTCOMES:
• Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory
  control theory and apply them to electrical engineering problems.
• To understand and apply computing platform and software for engineering problems.

TEXT BOOKS:

REFERENCES:
AIM:
To contribute to the knowledge of Fibre optics and Laser Instrumentation and its Industrial and Medical Application.

COURSE OBJECTIVES
- To expose the students to the basic concepts of optical fibres and their properties.
- To provide adequate knowledge about the Industrial applications of optical fibres.
- To expose the students to the Laser fundamentals.
- To provide adequate knowledge about Industrial application of lasers.
- To provide adequate knowledge about holography and Medical applications of Lasers.

UNIT I OPTICAL FIBRES AND THEIR PROPERTIES

UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBRES

UNIT III LASER FUNDAMENTALS

UNIT IV INDUSTRIAL APPLICATION OF LASERS

UNIT V HOLOGRAM AND MEDICAL APPLICATIONS
Holography: Basic Principle, Holography vs. photography, Principle Of Hologram Recording, Condition For Recording A Hologram, Reconstructing and viewing the holographic image– Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser-Tissue Interactions Photochemical reactions, Thermalisation, collisional relaxation, Types of

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs):
1. Understand the principle, transmission, dispersion and attenuation characteristics of optical fibers
2. Apply the gained knowledge on optical fibers for its use as communication medium and as sensor as well which have important applications in production, manufacturing industrial and biomedical applications.
4. Students will gain ability to apply laser theory for the selection of lasers for a specific Industrial and medical application.

TEXT BOOKS:

REFERENCES:
   http://nptel.ac.in/courses/117101002/

EE8391 ELECTROMAGNETIC THEORY L T P C
                          2  2  0  3

OBJECTIVES:
• To introduce the basic mathematical concepts related to electromagnetic vector fields
• To impart knowledge on the concepts of
  ✓ Electrostatic fields, electrical potential, energy density and their applications.
  ✓ Magneto static fields, magnetic flux density, vector potential and its applications.
  ✓ Different methods of emf generation and Maxwell’s equations
  ✓ Electromagnetic waves and characterizing parameters

UNIT I ELECTROSTATICS – I 6+6
Sources and effects of electromagnetic fields – Coordinate Systems – Vector fields –Gradient, Divergence, Curl – theorems and applications - Coulomb’s Law – Electric field intensity – Field due to discrete and continuous charges – Gauss’s law and applications.

UNIT II ELECTROSTATICS – II 6+6
Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectrics - Dielectric polarization – Dielectric strength - Electric field in multiple dielectrics – Boundary conditions, Poisson’s and
Laplace’s equations, Capacitance, Energy density, Applications.

UNIT III MAGNETOSTATICS 6+6
Lorentz force, magnetic field intensity (H) – Biot–Savart’s Law – Ampere’s Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization, Magnetic field in multiple media – Boundary conditions, scalar and vector potential, Poisson’s Equation, Magnetic force, Torque, Inductance, Energy density, Applications.

UNIT IV ELECTRODYNAMIC FIELDS 6+6

UNIT V ELECTROMAGNETIC WAVES 6+6
Electromagnetic wave generation and equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors- skin depth - Poynting vector – Plane wave reflection and refraction.

TOTAL : 60 PERIODS

OUTCOMES:
- Ability to understand the basic mathematical concepts related to electromagnetic vector fields.
- Ability to understand the basic concepts about electrostatic fields, electrical potential, energy density and their applications.
- Ability to acquire the knowledge in magneto static fields, magnetic flux density, vector potential and its applications.
- Ability to understand the different methods of emf generation and Maxwell’s equations
- Ability to understand the basic concepts electromagnetic waves and characterizing parameters
- Ability to understand and compute Electromagnetic fields and apply them for design and analysis of electrical equipment and systems

TEXT BOOKS:

REFERENCES
OBJECTIVES:
- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR).
- To enhance awareness of institutional processes in the country and
- 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
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)
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 stake-holders- 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
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
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
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

OUTCOMES:
The students will be able to
- Differentiate the types of disasters, causes and their impact on environment and society.
• Assess vulnerability and various methods of risk reduction measures as well as mitigation.
• Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXTBOOKS:

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

GE8074 HUMAN RIGHTS LT P C
3 0 0 3

OBJECTIVES :
• 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

OUTCOME :
• Engineering students will acquire the basic knowledge of human rights.
REFERENCES:

MG8491 OPERATIONS RESEARCH L T P C
3 0 0 3

OBJECTIVES:
• To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I LINEAR MODELS 15

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS 8

UNIT III INVENTORY MODELS 6
Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

UNIT IV QUEUEING MODELS 6
Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V DECISION MODELS 10

TOTAL: 45 PERIODS

OUTCOMES:
• Upon completion of this course, the students can able to use the optimization techniques for use engineering and Business problems

TEXT BOOK:
REFERENCES:

GE8072 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT

OBJECTIVES:
- To understand the global trends and development methodologies of various types of products and services
- 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
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- 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

UNIT III DESIGN AND TESTING
UNIT IV  SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT  

UNIT V  BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY  

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

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

REFERENCES:
COURSE OBJECTIVES

- To represent the linear time invariant System in discrete State Space form.
- To analyze the controllability, observability and stability of a Discrete time System.
- To estimate model parameters from input/output measurements
- To Design Digital Controllers
- To Design Multi-loop and Multivariable Controllers for multivariable system

UNIT I  DISCRETE STATE-VARIABLE TECHNIQUE
State equation of discrete data system with sample and hold – State transition equation – Methods of computing the state transition matrix – Decomposition of discrete data transfer functions – State diagrams of discrete data systems – System with zero-order hold – Controllability and observability of linear time invariant discrete data system–Stability tests of discrete-data system.

UNIT II  SYSTEM IDENTIFICATION

UNIT III  DIGITAL CONTROLLER DESIGN

UNIT IV  MULTI-LOOP REGULATORY CONTROL

UNIT V  MULTIVARIABLE REGULATORY CONTROL
Introduction to Multivariable control –Multivariable PID Controller – Multivariable Dynamic Matrix Controller – Fuzzy Logic Controller – Case Studies:- Distillation Column, CSTR and Four-tank system.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)
1. Ability to analyze the discrete time systems
2. Ability to build models from input-output data
3. Ability to design a digital controller
4. Ability to design multi-loop controller and multivariable controller for multi-variable systems.

TEXT BOOKS:
REFERENCES:

EI8692 ELECTRONIC INSTRUMENTATION LT P C
3 0 0 3

COURSE OBJECTIVES
- To introduce different types of electronic voltmeters and their applications.
- To provide knowledge on various types of cathode ray oscilloscopes, their applications and different types of signal analyzers.
- To introduce different types of waveform generators and analyzers and their applications.
- To educate on virtual instrumentation, its applications, programming and DAQ cards and modules.
- To give exposure to telemetry, modulation techniques and multiplexing.

UNIT I ELECTRONIC INSTRUMENTS 9

UNIT II CATHODE RAY OSCILLOSCOPE & SIGNAL ANALYZERS 9
General purpose cathode ray oscilloscope – Dual trace, dual beam and sampling oscilloscopes– Analog and digital storage oscilloscope - frequency selective and heterodyne wave analyzer – Harmonic distortion analyzer – Spectrum analyzer.

UNIT III WAVEFORM GENERATORS 9
Wien’s bridge and phase shift oscillators – Hartley and crystal oscillators – Square wave and pulse generators – Triangular wave-shape generator - Signal and function generators – Q meter – Electronic Counters.

UNIT IV VIRTUAL INSTRUMENTATION 9
Virtual instrumentation (VI) – Definition, flexibility – Block diagram and architecture of virtual instruments – Virtual instruments versus traditional instruments – Software in virtual instrumentation - VI programming techniques – DAQ cards for VI applications – DAQ modules with serial communication.
UNIT V  TELEMETRY

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)
• Ability to understand and analyze Instrumentation systems and their applications to various industries.

TEXT BOOKS:

REFERENCES:

EI8076  OPTIMAL CONTROL  L T P C  2 2 0 3

OBJECTIVES:
• To understand the optimal control concepts and its importance
• To study the important optimal control methods existing in the industries in order obtain the required level of control
• To introduce the concept of optimal control in various system
• To help the learners in the design and the implementation of the concept of optimal control
• To study, analyze and implement discrete-Time optimal control system

UNIT I  INTRODUCTION  6+6
Introduction to Optimal control – Comparison between the Conventional control and optimal control procedures - Statement of optimal control problem – Problem formulation and forms of optimal Control – Selection of performance measures. Necessary conditions for optimal control.

UNIT II  MATHEMATICAL EVALUATION  6+6
Introduction and Performance Index - Basic Concept of calculus of variation- The basic variational problem - Fixed end point problem - Free end point problem - Variational Approach to Optimal Control Systems.
UNIT III  CONTROL STRATEGY 6+6
Introduction - Time varying optimal control – LQR steady state optimal control – Frequency Domain Interpretation of LQR (LTI system) - Solution of Ricatti’s equation – Application examples.

UNIT IV  PROBLEM FORMATION 6+6

UNIT V  ADVANCED SYSTEMS 6+6

TOTAL : 60 PERIODS

OUTCOMES:
1. Problem formulation, forms of optimal control and its necessary conditions.
2. Solving the algebraic equations to design the controller and to study about various problems
3. Designing optimal controllers using a class of procedures
4. Predict the system dynamic behavior through solution of ODEs and formation of optimal control problem
5. Solve equations to design the controllers in discrete methods representing spatial and temporal variations in physical systems through numerical methods.
6. Implementing the Optimal control methodology for the benchmark /real time systems.

TEXT BOOKS:

REFERENCES:
3. M.Gopal,ModernControlSystemTheory,NewAgeInternational
5. http://nptel.ac.in/courses/108105019/

TL8071 RADAR AND NAVIGATIONAL AIDS L T P C
3 0 0 3

OBJECTIVES:
- To apply Doppler principle to radars and hence detect moving targets, cluster, also to understand tracking radars
- To refresh principles of antennas and propagation as related to radars, also study of transmitters and receivers.
- To understand principles of navigation, in addition to approach and landing aids as related to navigation

UNIT I  INTRODUCTION TO RADAR EQUATION 9
Introduction- Basic Radar –The simple form of the Radar Equation- Radar Block Diagram- Radar
### Frequencies
- Applications of Radar
- The Origins of Radar
- Detection of Signals in Noise
- Receiver Noise and the Signal-to-Noise Ratio
- Probability Density Functions
- Probabilities of Detection and False Alarm
- Integration of Radar Pulses
- Radar Cross Section of Targets
- Radar cross Section Fluctuations
- Transmitter Power
- Pulse Repetition Frequency
- Antenna Parameters
- System losses
- Other Radar Equation Considerations.

### UNIT II
#### MTI AND PULSE DOPPLER RADAR
9
- Introduction to Doppler and MTI Radar
- Delay –Line Cancellers
- Staggered Pulse Repetition Frequencies
- Doppler Filter Banks
- Digital MTI Processing
- Moving Target Detector
- Limitations to MTI Performance
- MTI from a Moving Platform (AMIT)
- Pulse Doppler Radar
- Other Doppler Radar Topics
- Tracking with Radar
- Monopulse Tracking
- Conical Scan and Sequential Lobing
- Limitations to Tracking Accuracy
- Low-Angle Tracking
- Tracking in Range
- Other Tracking Radar Topics
- Comparison of Trackers
- Automatic Tracking with Surveillance Radars (ADT).

### UNIT III
#### DETECTION OF SIGNALS IN NOISE
9
- Matched –Filter Receiver
- Detection Criteria
- Detectors
- Automatic Detector
- Integrators
- Constant-False-Alarm Rate Receivers
- The Radar operator
- Signal Management
- Propagation Radar Waves
- Atmospheric Refraction
- Standard propagation
- Nonstandard Propagation
- The Radar Antenna
- Reflector Antennas
- Electronically Steered Phased Array Antennas
- Phase Shifters
- Frequency-Scan Arrays
- Radar Transmitters and Receivers
- Introduction
- Linear Beam Power Tubes
- Solid State RF Power Sources
- Magnetron
- Crossed Field Amplifiers
- Other RF Power Sources
- Other aspects of Radar Transmitter.
- The Radar Receiver
- Receiver noise Figure
- Super heterodyne Receiver
- Duplexers and Receiver Protectors
- Radar Displays.

### UNIT IV
#### RADIO DIRECTION AND RANGES
9
- Introduction
- Four methods of Navigation
- The Loop Antenna
- Loop Input Circuits
- An Aural Null Direction Finder
- The Goniometer
- Errors in Direction Finding
- Adcock Direction Finders
- Direction Finding at Very High Frequencies
- Automatic Direction Finders
- The Commutated Aerial Direction Finder
- Range and Accuracy of Direction Finders
- The LF/MF Four course Radio Range
- VHF Omni Directional Range (VOR)
- VOR Receiving Equipment
- Range and Accuracy of VOR
- Recent Developments.
- Hyperbolic Systems of Navigation (Loran and Decca)
- Loran-A
- Loran-A Equipment
- Range and precision of Standard Loran
- Loran-C
- The Decca Navigation System
- Decca Receivers
- Range and Accuracy of Decca
- The Omega System.

### UNIT V
#### SATELLITE NAVIGATION SYSTEM
9
- Distance Measuring Equipment
- Operation of DME
- TACAN
- TACAN Equipment
- Instrument Landing System
- Ground Controlled Approach System
- Microwave Landing System (MLS)
- The Doppler Effect
- Beam Configurations
- Doppler Frequency Equations
- Track Stabilization
- Doppler Spectrum
- Components of the Doppler Navigation System
- Doppler range Equation
- Inertial Navigation
- Principles of Operation
- Navigation Over the Earth
- Components of an Inertial Navigation System
- Earth Coordinate Mechanization
- Strapped-Down Systems
- Accuracy of Inertial Navigation Systems
- The Transit System
- Navstar Global Positioning System (GPS).

### OUTCOMES:
After studying this course, Students will be able to
- Explain principles of navigation, in addition to approach and landing aids as related to navigation
- Derive and discuss the Range equation and the nature of detection.
- Describe about the navigation systems using the satellite.
TEXT BOOKS:
(For unit-1&2)
(For unit-3,4&5)

REFERENCES

GE8077 TOTAL QUALITY MANAGEMENT

OBJECTIVE:
- To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION

UNIT II TQM PRINCIPLES
Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I
The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II
Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY MANAGEMENT SYSTEM

OUTCOME:
- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.
TEXT BOOK:

REFERENCES:
4. ISO9001-2015 standards

EC8095 VLSI DESIGN

OBJECTIVES:
- Study the fundamentals of CMOS circuits and its characteristics.
- Learn the design and realization of combinational & sequential digital circuits.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed.
- Learn the different FPGA architectures and testability of VLSI circuits.

UNIT I INTRODUCTION TO MOS TRANSISTOR

UNIT II COMBINATIONAL MOS LOGIC CIRCUITS

UNIT III SEQUENTIAL CIRCUIT DESIGN
Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.

UNIT IV DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM
Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.
Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

UNIT V IMPLEMENTATION STRATEGIES AND TESTING

OUTCOMES:
UPON COMPLETION OF THE COURSE, STUDENTS SHOULD ABLE TO
- Realize the concepts of digital building blocks using MOS transistor.
- Design combinational MOS circuits and power strategies.
- Design and construct Sequential Circuits and Timing systems.
- Design arithmetic building blocks and memory subsystems.
- Apply and implement FPGA design flow and testing.

TEXT BOOKS:

REFERENCES

EE8691  EMBEDDED SYSTEMS

OBJECTIVES:
To impart knowledge on the following Topics
- Building Blocks of Embedded System
- Various Embedded Development Strategies
- Bus Communication in processors, Input/output interfacing.
- Various processor scheduling algorithms.
- Basics of Real time operating system and example tutorials to discuss on one real time operating system tool.

UNIT I  INTRODUCTION TO EMBEDDED SYSTEMS

UNIT II  EMBEDDED NETWORKING
Integrated Circuits (I²C) –need for device drivers.

UNIT III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT 9
Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN 9
Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance.

UNIT V EMBEDDED SYSTEM APPLICATION AND DEVELOPMENT 9

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze Embedded systems.
- Ability to suggest an embedded system for a given application.
- Ability to operate various Embedded Development Strategies
- Ability to study about the bus Communication in processors.
- Ability to acquire knowledge on various processor scheduling algorithms.
- Ability to understand basics of Real time operating system.

TEXT BOOKS:

REFERENCES
OBJECTIVES:

- To Introduce Fundamentals of Biomedical Engineering
- To study the communication mechanics in a biomedical system with few examples
- To study measurement of certain important electrical and non-electrical parameters
- To understand the basic principles in imaging techniques
- To have a basic knowledge in life assisting and therapeutic devices

UNIT I  FUNDAMENTALS OF BIOMEDICAL ENGINEERING  9

UNIT II  NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES  9

UNIT III  ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS  9

UNIT IV  IMAGING MODALITIES AND ANALYSIS  9

UNIT V  LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES  9

TOTAL : 45 PERIODS

OUTCOMES: At the end of the course students will have the

- Ability to understand the philosophy of the heart, lung, blood circulation and respiration system.
- Ability to provide latest ideas on devices of non-electrical devices.
- Ability to gain knowledge on various sensing and measurement devices of electrical origin.
- Ability to understand the analysis systems of various organ types.
OBJECTIVES: To impart knowledge about the following topics:

- Signals and systems & their mathematical representation.
- Discrete time systems.
- Transformation techniques & their computation.
- Filters and their design for digital implementation.
- Programmability digital signal processor & quantization effects.

TEXT BOOKS:

REFERENCES
UNIT IV  DESIGN OF DIGITAL FILTERS 6+6
FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. Analog filter design – Butterworth and Chebyshev approximations; IIR Filters, digital design using impulse invariant and bilinear transformation Warping, pre warping.

UNIT V  DIGITAL SIGNAL PROCESSORS 6+6

TOTAL : 60 PERIODS

OUTCOMES:
1. Ability to understand the importance of Fourier transform, digital filters and DS Processors.
2. Ability to acquire knowledge on Signals and systems & their mathematical representation.
3. Ability to understand and analyze the discrete time systems.
4. Ability to analyze the transformation techniques & their computation.
5. Ability to understand the types of filters and their design for digital implementation.
6. Ability to acquire knowledge on programmability digital signal processor & quantization effects.

TEXT BOOKS:

REFERENCES

GE8076  PROFESSIONAL ETHICS IN ENGINEERING  LT P C
3 0 0 3

OBJECTIVES:
- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I  HUMAN VALUES 10
Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for

UNIT II  ENGINEERING ETHICS
9

UNIT III  ENGINEERING AS SOCIAL EXPERIMENTATION
9
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV  SAFETY, RESPONSIBILITIES AND RIGHTS
9

UNIT V  GLOBAL ISSUES
8

TOTAL: 45 PERIODS

OUTCOMES:
- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

REFERENCES:

Web sources:
1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org
OBJECTIVES:
- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

UNIT II PLANNING

UNIT III ORGANISING

UNIT IV DIRECTING

UNIT V CONTROLLING
System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

TOTAL: 45 PERIODS

OUTCOMES:
- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXT BOOKS:
REFERENCES:


EI8078 PROJECT MANAGEMENT AND FINANCE LT P C
3 0 0 3

COURSE OBJECTIVES

- To understand what are the objectives of project management.
- To outline the principles followed in carrying out a project.
- To demonstrate knowledge and understanding of engineering and management principles.
- To function effectively as an individual, and as a member or leader in diverse teams.
- To understand the concepts of finance and accounts carried out in project management.

UNIT I PROJECT MANAGEMENT, PROJECT SELECTION AND PROJECT OBJECTIVES


UNIT II PROJECT IMPLEMENTATION, MONITORING AND CONTROL

Project representation: Role of project managers, relevance with objective of organization, preliminary manipulations, Basic Scheduling concepts: Resource levelling, Resource allocation, Setting a base line, Project management information system: Importance of contracts in projects: Team work in Project Management: Formation of Effective terms.

UNIT III PROJECT EVALUATION, AUDITING AND OTHER RELATED TOPICS IN PROJECT MANAGEMENT

Project Evaluation: Project auditing: Phase of project audit Project closure reports, computers, e-markets in Project Management:

UNIT IV WORKING CAPITAL MANAGEMENT AND CAPITAL BUDGETING


UNIT V FINANCE AND ACCOUNTING

Source of finance: Term Loans: Capital Structure: Financial Institution Accounting Principles:
Preparation and Interpretation of balance sheets, profit and loss statements, Fixed Assets, Current assets, Depreciation methods: Break even analysis:

TOTAL: 45 PERIODS

COURSE OUTCOMES

1. Ability to study the current market trends and choose projects.
2. Ability to prepare project feasibility reports.
3. Ability to implement the project effectively meeting government norms and conditions.
4. Ability to understand the role and responsibility of the Professional Engineer.
5. Be able to assess social, health, safety issues based on the reasoning received from the contextual knowledge.
6. Ability to choose projects which benefit the society and organization.

TEXT BOOKS:


REFERENCES:


IC8071 ADVANCED PROCESS CONTROL LT P C

2 2 0 3

COURSE OBJECTIVES

- To teach students to build and analyze models for time-varying systems and non-linear systems.
- To develop the skills needed to design adaptive controllers such as gain-scheduled adaptive controller, Model-reference adaptive controller and Self-tuning controller for various applications.
- To make the students learn to formulate optimal control schemes.
- 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.
- To introduce FDI Techniques, such as Principal component Analysis, state observer to detect and diagnose faults in sensors and actuators.
UNIT I CONTROL OF TIME-VARYING AND NONLINEAR SYSTEMS 6+6

UNIT II OPTIMAL CONTROL & FILTERING 6+6

UNIT III FRACTIONAL ORDER SYSTEM & CONTROLLER 6+6
Fractional-order Calculus and Its Computations – Frequency and Time Domain Analysis of Fractional-Order Linear Systems - Filter Approximations to Fractional-Order Differentiations – Model reduction Techniques for Fractional Order Systems – Controller Design Studies for Fractional Order.

UNIT IV H-INFINITY CONTROLLER 6+6

UNIT V FAULT DIAGNOSIS AND FAULT-TOLERANT CONTROL 6+6

TOTAL: 60 PERIODS

COURSE OUTCOMES
• Ability to Apply knowledge of mathematics, science, and engineering to build and analyze models for time-varying systems and non-linear systems.
• Ability to design and implement adaptive controllers such as gain-scheduled adaptive controller, Model-reference adaptive controller and Self-tuning controller
• Ability to Identify, formulate, and solve optimal controller
• Ability to Analyze Fractional-order systems, Fractional-order- controller and Design controller for fractional order systems
• Ability to design and implement H2 and H-infinity Controllers
• Ability to use the FDI Techniques, such as Principal component Analysis, state observer to detect and diagnose faults in sensors and actuators.

REFERENCE BOOKS
AIM

To provide comprehensive knowledge of robotics in the design, analysis and control point of view.

COURSE OBJECTIVES

- To study the various parts of robots and fields of robotics.
- To study the various kinematics and inverse kinematics of robots.
- To study the Euler, Lagrangian formulation of Robot dynamics.
- To study the trajectory planning for robot.
- To study the control of robots for some specific applications.
- To educate on various path planning techniques.
- To introduce the dynamics and control of manipulators.

UNIT I  BASIC CONCEPTS  9

Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Robot classifications and specifications- Asimov’s laws of robotics – dynamic stabilization of robots.

UNIT II  POWER SOURCES, SENSORS AND ACTUATORS  9


UNIT III MANIPULATORS AND GRIPPERS DIFFERENTIAL MOTION  9


UNIT IV  KINEMATICS AND PATH PLANNING  9

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment BalanceSolution kinematics problem – robot programming languages.

UNIT V  DYNAMICS AND CONTROL AND APPLICATIONS  9


TOTAL : 45 PERIODS

COURSE OUTCOMES

At the end of the course, the student should be able to:

- Understand the evolution of robot technology and mathematically represent different types of robot.
- Get exposed to the case studies and design of robot machine interface.
- Familiarize various control schemes of Robotics control.
TEXT BOOKS

2. Saeed B Niku, Introduction to Robotics, Analysis, Systems, Applications
   Prentice Hall, 3 edition 2104.

REFERENCES

   Prentice Hall of India, New Delhi, 1994.

GE8073 FUNDAMENTALS OF NANOSCIENCE

OBJECTIVES:
To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-
Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-
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 GENERAL METHODS OF PREPARATION
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling,
Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation,
Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS
Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon
Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth,
laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal
oxides-ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays-
functionalization and applications-Quantum wires, Quantum dots-preparation, properties and
applications.
UNIT IV CHARACTERIZATION TECHNIQUES

UNIT V APPLICATIONS

OUTCOMES:
- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS:

REFERENCES: