ANNA UNIVERSITY CHENNAI: CHENNAI – 600 025

B.E DEGREE PROGRAMME (3-8 SEMESTERS)

INSTRUMENTATION AND CONTROL ENGINEERING

(Offered in Colleges affiliated to Anna University)

CURRICULUM AND SYLLABUS – REGULATIONS – 2004

SEMESTER III

(Applicable to the students admitted from the Academic year 2006 – 2007 onwards)

			L	T	P	M
THEORY						
1.	MA 1201	Mathematics – III	3	1	0	100
2.	CY 1201	Environmental Science and Engineering	3	0	0	100
3.	EE 1211	Electrical Machines	3	0	0	100
4.	EC 1261	Electronic Circuits	3	0	0	100
5.	CS 1211	Data Structures and Algorithms	3	1	0	100
6.	EC 1211	Electronic Devices	4	0	0	100
PRACTICAL						
1.	EC 1262	Electronic Devices and Circuits Laboratory	0	0	3	100
2.	CS 1212	Data Structures and Algorithms Laboratory	0	0	3	100
3.	EE 1261	Electrical Machines Laboratory	0	0	3	100
4	EE 1152	Electric Circuits lab	3	1	0	100

SEMESTER IV

(Applicable to the students admitted from the Academic year 2006 – 2007 onwards)

			L	T	P	M
THEORY						
1.	IC 1251	Control Systems	3	1	0	100
2.	EI 1251	Electrical Measurements and Instruments	3	1	0	100
3.	EI 1252	Transducer Engineering	3	0	0	100
4.	EC 1312	Digital Logic Circuits	3	1	0	100
5.	EC 1313	Linear Integrated Circuits	3	0	0	100
6.	ME 1211	Applied Thermodynamics	3	1	0	100
PRACTICAL						
1.	EI 1261	Electrical Measurements and Instruments Laboratory	0	0	3	100
2.	CE 1261	Thermodynamics and Fluid Mechanics Laboratory	0	0	3	100

SEMESTER V

(Applicable to the students admitted from the Academic year 2006 – 2007 onwards)

THEORY			**L**	**T**	**P**	**M**
1.	IC 1301	Non-Linear Control System	3	1	0	100
2.	EE 1301	Power Electronics	3	0	0	100
3.	EI 1301	Industrial Instrumentation – I	3	0	0	100
4.	EC 1311	Communication Engineering	3	0	0	100
5.	EC 1362	Microprocessor and Microcontroller	3	1	0	100
6.	CS 1261	Object Oriented Programming	3	1	0	100
PRACTICAL						
1.	EI 1302	Transducer Laboratory	0	0	3	100
2.	EC 1314	Integrated Circuits Lab	0	0	3	100
3.	GE 1303	Communication Skills and Technical Seminar	0	0	2	**

SEMESTER VI

(Applicable to the students admitted from the Academic year 2006 – 2007 onwards)

THEORY			**L**	**T**	**P**	**M**
1.	IC 1351	Process Control	3	1	0	100
2.	EI 1351	Bio-medical Instrumentation	3	0	0	100
3.	EI 1352	Analytical Instruments	3	0	0	100
4.	EI 1353	Industrial Instrumentation – II	3	0	0	100
5.	EC 1361	Digital Signal Processing	3	1	0	100
6.	MG 1351	Principles of Management	3	0	0	100
PRACTICAL						
1.	IC 1352	Process Control Laboratory	0	0	3	100
2.	EI 1354	Industrial Instrumentation Laboratory	0	0	3	100
3.	EC 1363	Microprocessor and Microcontroller Laboratory	0	0	3	100
4.	GE 1351	Presentation Skills and Technical Seminar	0	0	2	**

SEMESTER VII

(Applicable to the students admitted from the Academic year 2006 – 2007 onwards)

THEORY			**L**	**T**	**P**	**M**
1.	IC 1401	Computer Control of Process	3	0	0	100
2.	IC 1402	Computer Networks & Distributed Control System	3	0	0	100
3.	IC 1403	Neural Network and Fuzzy Logic Control	3	0	0	100
4.	EI 1001	Fibre Optics and Laser Instruments	3	0	0	100

5.		Elective – I	3	0	0	100
6.		Elective – II	3	0	0	100
**** No Examination.**						
PRACTICAL						
1.	IC 1404	Computer Control of Process Laboratory	0	0	3	100
2.	EI 1401	Design Project Lab	0	0	3	100
3.	IC 1452	Comprehension	0	0	2	**

SEMESTER VIII

(Applicable to the students admitted from the Academic year 2006 – 2007 onwards)

THEORY			**L**	**T**	**P**	**M**
1.	EC 1461	VLSI Design	3	0	0	100
2.		Elective - III	3	0	0	100
3.		Elective - IV	3	0	0	100
PRACTICAL						
1.	IC 1451	Project Work	0	0	12	200

**** No Examination.**

B.E INSTRUMENTATION AND CONTROL ENGINEERING

LIST OF ELECTIVES

ELECTIVE I						
Sl.No	**Code No.**	**Course Title**	**L**	**T**	**P**	**M**
1.	CS 1032	Artificial Intelligence and Expert Systems	3	0	0	100
2.	IC 1001	Robust Control	3	0	0	100
3.	MH 1031	Mechatronics	3	0	0	100
4.	CS 1034	Computer Architecture	3	1	0	100
5.	GE 1301	Professional Ethics and Human Values	3	0	0	100
ELECTIVE II						
Sl.No	**Code No.**	**Course Title**	**L**	**T**	**P**	**M**
6.	EI 1002	Power Plant Instrumentation	3	0	0	100
7.	IC 1002	Adaptive Control	3	0	0	100
8.	EC 1031	Telecommunication and Switching Networks	3	0	0	100
9.	CS 1031	Visual Languages and Applications	3	1	0	100
10.	MG 1401	Total Quality Management	3	0	0	100
ELECTIVE III						
Sl.No	**Code No.**	**Course Title**	**L**	**T**	**P**	**M**
11.	EI 1003	Instrumentation in Petrochemical Industries	3	0	0	100
12.	IC 1003	Optimal Control	3	0	0	100
13.	IC 1004	Industrial Drives and Control	3	0	0	100
14.	CS 1035	Operating Systems	3	1	0	100
ELECTIVE IV						
Sl.No	**Code No.**	**Course Title**	**L**	**T**	**P**	**M**
16.	EI 1004	Virtual Instrumentation	3	0	0	100
17.	IC 1005	Robotics and Automation	3	0	0	100
18.	EC 1032	Embedded System Design	3	0	0	100
19.	CS 1033	Data Communication and Networks	3	0	0	100

SEMESTER III

MA 1201 MATHEMATICS III 3
1 0 100

AIM

The course aims to develop the skills of the students in the areas of boundary value problems and transform techniques. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

OBJECTIVES

At the end of the course the students would

i. Be capable of mathematically formulating certain practical problems in terms of partial differential equations, solve them and physically interpret the results.

ii. Have gained a well founded knowledge of Fourier series, their different possible forms and the frequently needed practical harmonic analysis that an engineer may have to make from discrete data.

iii. Have obtained capacity to formulate and identify certain boundary value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve them and interpret the results.

iv. Have grasped the concept of expression of a function, under certain conditions, as a double integral leading to identification of transform pair, and specialization to Fourier transform pair, their properties, and possible special cases with attention to their applications.

v. Have learnt the basics of Z – transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the Z – transform technique bringing out the elegance of the procedure involved.

1. PARTIAL DIFFERENTIAL EQUATIONS
9

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution 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.

2. FOURIER SERIES
9

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identify – Harmonic Analysis.

3. BOUNDARY VALUE PROBLEMS
9

Classification of second order quasi-linear partial differential equations – Solutions of one-dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

4. FOURIER TRANSFORM
9

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

5. Z -TRANSFORM AND DIFFERENCE EQUATIONS
9

Z-transform - Elementary properties – Inverse Z – transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z - transform.

L = 45 T = 15 Total = 60

TEXT BOOKS

1. B.S. Grewal, 'Higher Engineering Mathematics', Thirty Sixth Edition, Khanna Publishers, Delhi, 2001.

2. P. Kandasamy, K. Thilagavathy, and K. Gunavathy, 'Engineering Mathematics', Volume III, S. Chand & Company ltd., New Delhi, 1996.

2. Wylie C. Ray and C. Barrett Louis, 'Advanced Engineering Mathematics', Sixth Edition, McGraw Hill, Inc., New York, 1995.

REFERENCE BOOKS

1. L.A. Andrews and B.K. Shivamoggi, 'Integral Transforms for Engineers and Applied Mathematicians', Prentice Hall of India, 1988.

2. S. Narayanan, T.K. Manicavachagom Pillay and G. Ramaniah, 'Advanced Mathematics for Engineering Students', Volumes II and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, 2002.

3. R.V. Churchill and J.W. Brown, 'Fourier Series and Boundary Value Problems', Fourth Edition, McGraw Hill Book Co., Singapore, 1987.

CY 1201 ENVIRONMENTAL SCIENCE AND ENGINEERING 3 0 0 100

AIM

The aim of this course is to create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make him/her sensitive to the environment problems in every professional endeavour that he/she participates.

OBJECTIVE

At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity.

1. INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES

10

Definition, scope and importance – Need for public awareness – 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.

2. ECOSYSTEMS AND BIODIVERSITY

14

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.

3. ENVIRONMENTAL POLLUTION

8

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Soil waste management: Causes, effects and control measures of urban and industrial 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.

4. SOCIAL ISSUES AND THE ENVIRONMENT

7

From unsustainable to sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns, case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – Wasteland reclamation – Consumerism and waste products – Environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest

conservation act – Issues involved in enforcement of environmental legislation – Public awareness.

5. HUMAN POPULATION AND THE ENVIRONMENT

6

Population growth, variation among nations – Population explosion – Family welfare programme – Environment and human health – Human rights – Value education – HIV / AIDS – Women and child welfare – Role of information technology in environment and human health – Case studies.

L = 45 Total = 45

TEXT BOOKS

a. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2/ed, Pearson Education, 2004.

2. T.G. Miller Jr., 'Environmental Science', Wadsworth Publishing Co.

3. C. Townsend, J. Harper and Michael Begon, 'Essentials of Ecology', Blackwell Science.

4. R.K. Trivedi and P.K. Goel, 'Introduction to Air Pollution', Techno-Science Publications.

REFERENCE BOOKS

1. Bharucha Erach, 'The Biodiversity of India', Mapin Publishing Pvt. Ltd., Ahmedabad India, Email: mapin@icenet.net.

2. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.

3. Cunningham, W.P.Cooper, T.H.Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.

4. Wager, 'Environmental Management', W.B. Saunders Co., Philadelphia, USA, 1998.

EE 1211 ELECTRICAL MACHINES 3
0 0 100

AIM

To expose the students to the concepts of various types of electrical machines and transmission and distribution of electrical power .

OBJECTIVES

To impart knowledge on

i. Constructional details, principle of operation, performance, starters and testing of D.C. machines.

ii. Constructional details, principle of operation and performance of transformers.

iii. Constructional details, principle of operation and performance of induction motors.

iv. Constructional details and principle of operation of alternators and special machines.

v. Power System transmission and distribution.

1. D.C. MACHINES

9

Constructional details – emf equation – Methods of excitation – Self and separately excited generators – Characteristics of series, shunt and compound generators –Principle of operation of D.C. motor – Back emf and torque equation – Characteristics of series, shunt and compound motors - Starting of D.C. motors – Types of starters -Testing, brake test and Swinburne's test – Speed control of D.C. shunt motors.

2. TRANSFORMERS

9

Constructional details – Principle of operation – emf equation – Transformation ratio – Transformer on no load – Parameters referred to HV/LV windings – Equivalent circuit – Transformer on load – Regulation - Testing – Load test, open circuit and short circuit tests.

3. INDUCTION MOTORS

9

Construction – Types – Principle of operation of three phase induction motors – Equivalent circuit – Performance calculation – Starting and speed control –Single phase induction motors (only qualitative treatment).

4. SYNCHRONOUS AND SPECIAL MACHINES

9

Construction of synchronous machines - Types – Induced emf – Voltage regulation ; emf and mmf methods – Brushless alternators – Reluctance motor – Hysteresis motor – stepper motor.

5. TRANSMISSION AND DISTRIBUTION

9

Structure of electric power systems – Generation, transmission, sub- transmission and distribution systems - EHVAC and EHVDC transmission systems – Substation layout – Insulators – Cables.

L = 45 Total = 45

TEXT BOOKS

1. D.P.Kothari and I.J.Nagrath, 'Basic Electrical Engineering', Tata McGraw Hill publishing company ltd, second edition, 2002.

2. C.L. Wadhwa, 'Electrical Power Systems' Wiley eastern ltd India, 1985.

REFERENCE BOOKS

1. S.K.Bhattacharya, 'Electrical Machines', Tata McGraw Hill Publishing company ltd, second edition, 1998.

2. V.K.Mehta and Rohit Mehta, 'Principles of Power System', S.Chand and Company Ltd, third edition, 2003.

EC 1261 ELECTRONIC CIRCUITS 3
0 0 100

AIM

To introduce the concept of realising circuits using active and passive devices for signal generation and amplification.

OBJECTIVES

i. To expose the students to study the different biasing and configurations of the amplifier circuits.

ii. To study the characteristics of tuned amplifier.

iii. To expose the students to various amplifiers oscillator circuits with feedback concepts.

iv. To learn the wave shaping process and circuits.

v. To learn and analyse the process of AC to DC conversion.

1. SMALL-SIGNAL AND LARGE SIGNAL AMPLIFIERS

9

Fixed and self biasing of BJT & FET – Small signal analysis of CE, CC & Common source amplifiers – Cascade and Darlington connections, transformer coupled class A, B & AB amplifiers – Push-pull amplifiers.

2. DIFFERENTIAL AND TUNED AMPLIFIERS

9

Differential amplifiers – Common mode and differential mode analysis - DC and AC analysis - Characteristics of tuned amplifiers – Single & double tuned amplifier.

3. FEEDBACK AMPLIFIER AND OSCILLATORS

9

Characteristics of negative feedback amplifiers – Voltage / current, series/shunt feedback – Theory of sinusoidal oscillators – Phase shift and Wien bridge oscillators – Colpitts, Hartley and crystal oscillators.

4. PULSE CIRCUITS

9

RC wave shaping circuits – Diode clampers and clippers – Multivibrators – Schmitt triggers – UJT based saw tooth oscillators.

5. RECTIFIERS AND POWER SUPPLY CIRCUITS

9

Half wave & full wave rectifier analysis - Inductor filter – Capacitor filter - Series voltage regulator – Switched mode power supply.

L= 45 Total = 45

TEXT BOOKS

1. David A. Bell, 'Electronic Devices & Circuits', Prentice Hall of India/Pearson Education,
IV Edition, Eighth printing, 2003.

2. Jacob Millman & Christos.C.Halkias, 'Integrated Electronics: Analog and Digital Circuits and System', Tata McGraw Hill, 1991.

REFERENCE BOOKS

1. Robert. L. Boylestad & Lo Nashelsky, 'Electronic Devices & Circuit Theory', Eighth edition, Prentice Hall of India/Pearson Education, Third Indian Reprint, 2002 / PHI.

2. Jacob Millman & Herbert Taub, 'Pulse, Digital & Switching Waveforms', Tata McGraw Hill, Edition 2000, 24th reprint, 2003.

3. Donald L.Schilling and Charles Belove, 'Electronic Circuits', 3rd Edition, Tata McGraw Hill, 2003.

CS 1211 DATA STRUCTURES AND ALGORITHMS 3 1 0 100

AIM

To present the concept of arrays, recursion, stack, queue, linked list, trees and graph data structures.

OBJECTIVES

i. To introduce the concept of arrays, structures, pointers and recursion.

ii. To study stack, queue and linked list concepts.

iii. To study trees, representation of trees, tree traversal and basic operations on trees.

iv. To study some of the sorting and searching techniques.

v. To study the concept of graphs, traversal techniques and minimum spanning tree.

1. INTRODUCTION TO DATA STRUCTURES

9

Abstract data types - Sequences as value definitions - Data types in C - Pointers in C -Data structures and C - Arrays in C - Array as ADT - One dimensional array - Implementing one dimensional array - Array as parameters - Two dimensional array -Structures in C - Implementing structures - Unions in C - Implementation of unions -Structure parameters - Allocation of storage and scope of variables.

Recursive definition and processes: Factorial function - Fibonacci sequence - Recursion in C - Efficiency of recursion.

2. STACK, QUEUE AND LINKED LIST

9

Stack definition and examples – Primitive operations – Example - Representing stacks in C - Push and pop operation implementation.

Queue as ADT - C Implementation of queues - Insert operation - Priority queue - Array implementation of priority queue.

Inserting and removing nodes from a list-linked implementation of stack, queue and priority queue - Other list structures - Circular lists: Stack and queue as circular list -Primitive operations on circular lists. Header nodes - Doubly linked lists - Addition of long positive integers on circular and doubly linked list.

3. TREES

9

Binary trees: Operations on binary trees - Applications of binary trees - Binary tree representation - Node representation of binary trees - Implicit array representation of binary tree – Binary tree traversal in C - Threaded binary tree - Representing list as binary tree - Finding the K^{th} element - Deleting an element.

Trees and their applications: C representation of trees - Tree traversals - Evaluating an expression tree - Constructing a tree.

4. SORTING AND SEARCHING

9

General background of sorting: Efficiency considerations, Notations, Efficiency of sorting. Exchange sorts; Bubble sort; Quick sort; Selection sort; Binary tree sort; Heap sort. Heap as a priority queue - Sorting using a heap-heap sort procedure - Insertion sorts: Simple insertion - Shell sort - Address calculation sort - Merge sort -Radix sort.

Sequential search: Indexed sequential search - Binary search - Interpolation search.

5. GRAPHS

9

Application of graph - C representation of graphs - Transitive closure - Warshall’s algorithm – Shortest path algorithm - Linked representation of graphs - Dijkstra’s algorithm - Graph traversal - Traversal methods for graphs - Spanning forests - Undirected graph and their traversals - Depth first traversal - Application of depth

first traversal - Efficiency of depth first traversal - Breadth first traversal - Minimum spanning tree - Kruskal's algorithm - Round robin algorithm.

L=45 T=15 Total = 60

TEXT BOOK

1. Aaron M. Tenenbaum, Yeedidyah Langsam, Moshe J. Augenstein, 'Data Structures Using C', Pearson Education, 2004 / PHI.

REFERENCE BOOKS

1. E.Balagurusamy, 'Programming in Ansi C', Second Edition, Tata McGraw Hill Publication, 2003.

2. Robert L. Kruse, Bruce P. Leung Clovis L.Tondo, 'Data Structures and Program Design in C', Pearson Education, 2000 / PHI.

EC 1211 ELECTRONIC DEVICES 3 0 0 100

AIM

To study the characteristics and applications of electronic devices.

OBJECTIVES

To acquaint the students with construction, theory and characteristics of the following electronic devices:

i) p-n junction diode
ii) Bipolar transistor
iii) Field Effect transistor
iv) LED, LCD and other photo electronic devices.
v) Power control/regulator devices.

1. SEMICONDUCTOR DIODE 9

Theory of p-n junction – p-n junction as diode – p-n diode currents – Volt-amp characteristics – Diode resistance – Temperature effect of p-n junction – Transition and diffusion capacitance of p-n diode – Diode switching times.

2. BI-POLAR TRANSISTOR 9

Junction transistor – Transistor construction – Detailed study of currents in transistor – Input and output characteristics of CE, CB and CC configurations – Transistor hybrid model for CE configuration – Analytical expressions for transistor characteristics – Transistor switching times – Voltage rating – Power transistors.

3. FIELD EFFECT TRANSITORS 9

Junction field effect transistor – Pinch off voltage – JFET volt-ampere characteristics – JFET small signal model – MOSFETS and their characteristics – FET as a variable resistor – Unijunction transistor.

4. OPTO ELECTRONIC DEVICES 9

Photo emissivity and photo electric theory – Theory, construction and characteristics: light emitting diodes, liquid crystal cell, seven segment display, photo conductive cell, photodiode, solar cell, photo transistor, opto couplers and laser diode.

5. MISCELLANEOUS DEVICES 9

Theory, characteristics and application: SCR, TRIAC, PUT, tunnel diode, thermistors, piezo electric devices, zener diode, charge coupled devices, varactor diode and LDR.

L = 45 Total = 45

TEXT BOOKS

1. Jacob. Millman, Christos C.Halkias, 'Electronic Devices and Circuits', Tata McGraw Hill Publishing Limited, New Delhi, 2003.
2. David A.Bell, 'Electronic Devices and Circuits', Prentice Hall of India Private Limited, New Delhi, 2003.

REFERENCE BOOKS

1. Theodre. F. Boghert, 'Electronic Devices & Circuits', Pearson Education, VI Edition, 2003.

2. Ben G. Streetman and Sanjay Banerjee, 'Solid State Electronic Devices', Pearson Education, 2002 / PHI

3. Allen Mottershead, 'Electronic Devices and Circuits – An Introduction', Prentice Hall of India Private Limited, New Delhi, 2003.

CE 1161 FLUID AND SOLID MECHANICS 4 0 0 100

AIM

The aim of this course is to make the electrical and electronics engineering student to appreciate the principles of mechanics underlying the design of transmission line towers and the hydraulic power generation and utilisation.

OBJECTIVE

At the end of this course the student is expected to have a knowledge of the concepts of Forces, Equilibrium, Stress, Strain, Shear force, Bending movement & Strain energy and should be able to apply this concepts to simple problems in beams and trusses. Further, he is also expected to gain knowledge regarding the fundamentals of fluid flow and their applications to flow through pipes and hydraulic machines. He should be able to solve application problems in these areas.

MECHANICS OF SOLIDS

1. DEFORMATION OF SOLIDS

6

Concept of stress and strain – Normal and shear stresses – Simple and compound Stresses - Explanation of principal stresses and principal planes – Normal, shear and volumetric strains – Constitutive relationship between stress and strain – Elasticity and elastic moduli – Poisson's ratio – Concept of free body – External and internal equilibrium – Concepts of strength, stability and stiffness.

2. BENDING OF BEAMS

6

Concept of shear force and bending moment – Beams and support forces – Relationship between bending moment and shear force – Bending moment and shear force diagrams for simply supported, cantilever and overhanging beams.

3. STRENGTH OF BEAMS AND COLUMNS

6

Theory of simple bending – Stress and strain variation along the depth of beams – Struts and columns - Concept of strain energy– Stability and buckling – Euler buckling load for columns.

4. SHAFTS AND SPRINGS

6

Torsion – Shear stresses in circular solid and hollow shafts - Torque and power – Helical and leaf springs – Load, deflection, stress and stiffness relationships – Design of buffer springs.

5. PLANE TRUSSES

6

Plane trusses and frames – Types of trusses – Analysis of forces in truss members – Method of joints – Method of tension co-efficient.

MECHANICS OF FLUIDS

6. FLUID PROPERTIES AND FLOW CHARACTERISTICS

6

Surface tension – Capillarity – Viscosity – Newton's law – Fluid pressure and pressure head - Fluid velocity and acceleration – Uniform and steady flow – Stream lines and path lines – Reynold's number – Classification as laminar and turbulent flow – Continuity equation – Potential and stream functions.

7. FLOW DYNAMICS

6

Euler's and Bernoulli's equations – Pressure losses along the flow – Categorisation into major and minor losses - Flow through circular pipes – Poisseule's equation – Statement of Darcy – Weisbach equation – Friction factor – Hydraulic grade line.

8. FLOW MEASUREMENT AND PIPE NETWORKS

6

Manometer - Venturi and orifice meters – Flow through weirs - Principles of open channel flow – Pipes in series and parallel – Kirchoff's Laws.

9. TURBINES

6

Introduction to and classification of turbines – Rotor blade profiles and their importance with respect to hydraulic efficiency – Specific speed – Turbine characteristics – Speed governance.

10. PUMPS

6

Classification – Principles of positive displacement pumps – Slip – Centrifugal pumps – Impeller blade profiles – Pump characteristics – Efficiency.

L = 60 Total = 60

TEXT BOOKS

b. R. K. Rajput, 'Strength of Materials (Mechanics of Solids)', S. Chand & Company Ltd., 2003.

c. K. L. Kumar, 'Engineering Fluid Mechanics', S. Chand & Company Ltd., 2002.

EXAMINATION PATTERN

In Part A, there shall be 5 questions from Mechanics of Solids and 5 questions from Mechanics of Fluids (one from each section). In Part B, the compulsory question shall have one part from Mechanics of Solids and another from Mechanics of Fluids. Each of the either or form questions shall have a Mechanics of Solids part as well as a Mechanics of Fluids part. For example, Q12.a. i. Mechanics of Solids, ii. Mechanics of Fluids OR Q12.b. i. Mechanics of Solids, ii. Mechanics of Fluids. The other questions shall be set similarly.

ME 1211 APPLIED THERMODYNAMICS 3 1 0 100

OBJECTIVES

i. To expose the fundamentals of thermodynamics and to be able to use it in accounting for the bulk behaviour of the sample physical systems.

ii. To integrate the basic concepts into various thermal applications like IC engines, gas turbines, steam boiler, steam turbine, compressors, refrigeration and air conditioning.

iii. To enlighten the various modes of heat transfer and their engineering applications.

Use of standard steam tables, refrigeration tables and heat transfer data book are permitted)

1. BASIC CONCEPTS AND LAWS OF THERMODYNAMICS

12

Classical approach: Thermodynamic systems – Boundary - Control volume - System and surroundings – Universe – Properties - State-process – Cycle – Equilibrium - Work and heat transfer – Point and path functions - First law of thermodynamics for open and closed systems - First law applied to a control volume - SFEE equations [steady flow energy equation] - Second law of thermodynamics - Heat engines - Refrigerators and heat pumps - Carnot cycle -

Carnot theorem - Clausius inequality - Concept of entropy - Principle of increase of entropy - Basic thermodynamic relations.

2. IC ENGINES AND GAS TURBINES

8

Air standard cycles: Otto, diesel and dual cycles and comparison of efficiency - Working Principle of four stroke and two stroke engines - Working principle of spark ignition and compression ignition engines - Applications of IC engines - Normal and abnormal combustion - Working principle of four stroke and two stroke engines - Working principle of spark ignition and compression ignition engines - Applications of IC engines.

Open and closed cycle gas turbines – Ideal and actual cycles - Brayton cycle - Cycle with reheat, intercooling and regeneration – Applications of gas turbines for aviation and power generation.

3. STEAM BOILERS AND TURBINES

8

Formation of steam - Properties of steam – Use of steam tables and charts – Steam power cycle (Rankine) - Modern features of high-pressure boilers – Mountings and accessories – Testing of boilers.

Steam turbines: Impulse and reaction principle – Velocity diagrams – Compounding and governing methods of steam turbines (qualitative treatment only) - Layout diagram and working principle of a steam power plant.

4. COMPRESSORS, REFRIGERATION AND AIR CONDITIONING

8

Positive displacement compressors – Reciprocating compressors – Indicated power – Clearance volume – Various efficiencies – Clearance ratio - Volume rate - Conditions for perfect and imperfect intercooling - Multi stage with intercooling – Rotary positive displacement compressors – Construction and working principle of centrifugal and axial flow compressors.

Unit of refrigeration - Basic functional difference between refrigeration and air conditioning – Various methods of producing refrigerating effects (RE) – Vapour compression cycle: P-H and T-S diagram - Saturation cycles - Effect of subcooling and super heating - (qualitative treatment only) - Airconditioning systems – Basic psychrometry - Simple psychrometric processes - Types of airconditioning systems -Selection criteria for a particular application (qualitative treatment only).

5. HEAT TRANSFER

9

One-dimensional Heat Conduction: Plane wall – Cylinder – Sphere - Composite walls – Critical thickness of insulation –Heat transfer through extended surfaces (simple fins).

Convection: Free convection and forced convection - Internal and external flow - Empirical relations - Determination of convection heat transfer co-efficient by using Dittus–Baetter equation.

Radiation: Black–Gray bodies - Radiation Shape Factor (RSF) - Cooling of electronic components: Thermoelectric cooling – Chip cooling.

L = 45 T = 15 Total = 60

TEXT BOOKS

1. P.K. Nag, 'Basic and Applied Engineering Thermodynamics', Tata McGraw Hill, New Delhi, 2002.

2. B.K. Sachdeva, 'Fundamentals of Engineering Heat and Mass Transfer (SI Units)', New Age International (P) Limited, Chennai, 2003.

REFERENCE BOOKS

1. Rogers and Mayhew, 'Engineering Thermodynamics – Work and Heat Transfer', Addision Wesley, New Delhi, 1999.

2. Eastop and McConkey, 'Applied Thermodynamics', Addison Wesley, New Delhi. 1999.

3. M.L. Mathur and F.S. Metha, 'Thermal Engineering', Jain Brothers, New Delhi, 1997.

4 B.K. Sankaar, 'Thermal Engineering', Tata McGraw Hill, New Delhi, 1998.

EC 1262 ELECTRONIC DEVICES AND CIRCUITS LABORATORY 0 0 3 100

AIM

To study the characteristics and to determine the device parameters of various solid-state devices.

1. Static Characteristics of transistor under CE, CB, CC and determination of hybrid parameters.

2. Static characteristics and parameter determination of JFET.

3. Static characteristics of semiconductor diode, zener diode and study of simple voltage regulator circuits.

4. Static characteristics of UJT and its application as a relaxation oscillator.

5. Photodiode, Phototransistor characteristics and study of light activated relay circuit.

6. Static characteristics of Thermistors.

7. Single phase half wave and full wave rectifiers with inductive and capacitive filters.

8. Phase shift oscillators and Wien bridge oscillators.

9. Frequency response of common emitter amplifiers.

10. Differential amplifiers using FET.

P = 45 Total = 45

Detailed Syllabus

1. Static Characteristics of transistor under CE, CB, CC and determination of hybrid parameters

Aim

To determine the static characteristics of transistor under CE, CB, CC mode.

Exercise

a. Plot the BJT CE, CB and CC input and output characteristics.

b. Determine the h-parameters hi, ho, hr and hf for CE, CB and CC characteristics from I/P and O/P characteristics.

2. Static characteristics and parameter determination of JFET

Aim

To determine the static characteristics of JFET

Exercise

1. Plot the JFET drain characteristics from the results obtained

2. Plot the JFET transfer characteristics from the results obtained.

3. From the drain characteristics for $V_{GS} = 0$ determine the value of the r_D and Y_{OS} parameters.

4. From the transfer characteristic, determine the values of the Y_{fs} parameters at V_{GS} =-1 V and V_{GS} = - 4V.

5. Draw horizontal and vertical scales on the drain characteristics plotted by the XY recorder. Identify each characteristic according to the V_{GS} level. Also, print the JFET type number on the characteristics.

3. Static characteristics of semiconductor diode, zener diode and study of simple voltage regulator circuits

Aim

1. To determine the static characteristics of semiconductor diode and zener diode

2. To study the simple voltage regulator circuits as Op-amp voltage regulator, source effect and load effect measurement, use of current limiter.

Exercise

Semiconductor diode

1. Plot the forward characteristic of the low – current diode and rectifier diode from the results obtained.

2. From the forward characteristics, determine the approximate forward voltage drop and dc forward resistance for D_2 and for D_2. Also estimate the ac resistance for each diode.

3. Comment on the results of reverse biased diode current measurements.

Zener diode

1. Plot a graph showing the Zener diode reverse characteristics.

2. From the Zener diode reverse characteristics determine the reverse voltage at I_Z = 20 mA. Also determine the dynamic impedance for the device.

3. Calculate the line regulation, load regulation and ripple reduction factor produced by the Zener diode regulator.

Voltage regulator

1. Analyze the voltage regulator circuit for ripple reduction, source effect and load effect. Compare the calculated and measured circuit performance.

2. Plot the regulator current limiting characteristics. Analyze the two current limiter circuits and compare the calculated and measured circuit performances.

4. Static characteristics of UJT and its application as a relaxation oscillator

Aim

To determine the static characteristics of UJT.

Exercise

1. Plot the UJT characteristics from the results obtained.

2. Calculate the intrinsic stand – off ratio from the results obtained.

3. Compare the calculated value with the specified value for the UJT.

4. Discuss the waveforms obtained for the UJT relaxation oscillator investigated. Compare the operating frequency with that calculated frequency.

5. Photodiode, Phototransistor characteristics and study of light activated relay circuit

Aim

1. To draw the characteristics of photodiode, phototransistor.

2. To study the light activated relay circuit.

Exercise

Photodiode

1. Plot the photodiode reverse current upon different level of illumination.

2. Draw the dc load line for the circuit and determine the diode currents and voltages at different level of illumination.

Phototransistor

1. Draw the output characteristics I_C / V_{CE} of a phototransistor and determine the output voltage at different illumination levels.

2. Bias Phototransistor as a switch. Illuminate the phototransistor to activate a relay.

6. Static characteristics of Thermistors

Aim

To determine the static characteristics of thermistors.

Exercise

1. Draw the resistance / temperature characteristic of a thermistor and determine the resistance value for variations in temperature.

2. Draw the static voltage / current characteristics of a thermistor and determine whether device resistance remains constant until power dissipation is large enough to produce self-heating.

3. Use the thermistor as a temperature-compensating device by increasing the resistance with increasing temperature.

7. Single phase half wave and full wave rectifiers with inductive and capacitive filters

Aim

To construct half wave and full wave rectifiers and to draw their input and output waveforms.

Exercise

1. Plot the input and output waveforms and explain the difference between the two.

2. Explain the effect of open – circuiting of any one diode.

2. Measure the PIV of two-diode full wave rectifier to the bridge rectifier.

3. Calculate the ripple factor of output waveform of inductive and capacitive filter and compare it with measured practical values.

8. Phase shift oscillators and Wien bridge oscillators

Aim

To construct the phase shift oscillator and Wien bridge oscillators and to draw its

output waveforms.

Exercise

1. Discuss the phase shift oscillator and Wien bridge oscillator output waveforms obtained from the experiment. Analyze the circuits and compare the calculated and measured frequencies.

2. Change the capacitor values and discuss the results.

3. Analyze the diode amplitude stabilization circuit for the Wien bridge oscillator and compare the calculated output amplitude to that of the measured values.

9. Frequency response of common emitter amplifiers

Aim

To determine the frequency response of common emitter amplifiers.

Exercise

1. For different values of cut – off frequencies determine suitable values of resistors and capacitors for common emitter amplifiers.

2. Plot the frequency response and determine 3dB bandwidth.

10. Differential amplifiers using FET

Aim

To analyse the characteristics of differential amplifier circuit using FET

Exercise

1. Construct the circuit and

   a. Determine differential gain A_d

   b. Determine common mode gain A_c

   c. Determine the CMRR = A_d / A_c

2. Construct the circuit using common source configuration. Measure i/p – o/p impedance of the circuit.

3. Try the same as common drain circuit (source follower) and check for V_{DD} = 25 V

CS 1212 DATA STRUCTURES AND ALGORITHMS LAB 0 0 3 100

AIM

To implement Quene, stack, linked lists and to implement search, sort and traversal technique.

1. Queue implementation using arrays.

2. Stack implementation-using arrays.

3. Singly, doubly and circular liked list implementation and all possible operations on lists.

4. Queue and Stack implementation using linked list

5. Binary search tree implementation using linked list and possible operations on binary search trees.

6. In-order, preorder and post order traversals.

7. Quick sort implementation and its efficiency calculation.

8. Binary Search implementation.

9. Graph implementation using arrays and list structure.

10. Depth first and Breadth first traversal in graphs.

P = 45 Total = 45

Detailed Syllabus

1. Queue implementation using arrays

Aim

To implement queue using arrays

Objective

To represent queue using an array and to perform insert and delete operations in the queue.

Exercises

1. Declare an array Q of size N.
2. Assign F and R to be the front and rear pointers of the queue and assign 0 to F and R.
3. Get the new element Y to be inserted in to the queue
4. If R is less than N, insert Y at the end, by incrementing R by 1. Otherwise display queue is full.
5. If F is zero then assign F to be 1.
6. To delete an element check whether F is greater than zero, then delete an element pointed by F, otherwise display queue is empty.
7. If F and R are equal the set F = R=0;otherwise F=F+1;
8. Display the queue Q from F to R.

Software Requirements

Turbo C - 30 nodes

Hardware Requirements

PC (preferably P-IV) - 30 nos.

2. Stack implementation-using arrays.

Aim

To implement stack using arrays

Objective

To represent stack using an array and to perform push and pop operations in the stack.

Exercises

1. Declare an array S of size N.
2. Assign TOP as a pointer to denote the top element in the stack
3. Get the new element Y to be added in to the stack.
4. If TOP is greater than or equal to N then display stack over flow;

otherwise set

TOP=TOP+1.

5. Set S[TOP] = Y.
6. To delete top element from the stack check if TOP =0,the display stack underflow, otherwise decrement TOP by one, and display S [TOP+1].
7. Display the stack S from 1 to TOP.

Software Requirements

Turbo C - 30 nodes

Hardware Requirements

PC - 30 nos.

3. Singly, Doubly and Circular linked list implementation and all possible operations on lists

Aim

To implement singly, doubly and circular linked list and performing insert, delete and search operations.

Objective

To represent singly, doubly and circular linked list and to perform operations like insertion, deletion and search.

Exercises

SINGLY LINKED LIST:

1. Set a node to contain INFO and LINK fields.
2. Allot memory dynamically for a node and declare it as a header H.

3. To create a singly linked lists get the element N and allot memory for a node S1.
4. Set S1->INFO=N; and S1->LINK=NULL.
5. Repeat the above two steps for all the elements.
6. A node can be inserted at the front, in the middle or at the end of the list.
7. To insert a node X at the front check whether the list is empty, if not set X->LINK=H->LINK and H->LINK=X.
8. To insert a node X at the end travel till the end of the list and assign the last node's LINK value to X.
9. To insert a node X after the specified node Y, travel the list till the node Y is reached. Set X->LINK=Y->LINK and Y->LINK=X
10. A node can be deleted at the front, in the middle or at the end of the list.
11. To delete a node X at the front set H->LINK=H->LINK->LINK.
12. To delete a node X at the end travel the list till the end and assign the previous to last node's LINK value to be NULL.
13. To delete a node X after the specified node Y, travel the list till the node Y is reached Set Y->LINK= Y->LINK->LINK.
14. To search an element E traverse the list until E is found.

DOUBLY LINKED LIST

1. Set a node to contain INFO and RLINK and LLINK fields.
2. Allot memory dynamically for a node and declare it as a header H.
3. To create a doubly linked list get the element N and allot memory for a node S1.
4. Set S1->INFO=N; and S1->RLINK=NULL, S1->LLINK=H.
5. Repeat the above two steps for all the elements.
6. A node can be inserted at the front, in the middle or at the end of the list.
7. To insert a node X at the front check whether the list is empty, if not set X->RLINK=H->RLINK and H->RLINK=X.
8. To insert a node X at the end travel till the end of the list and assign the last node's RLINK value to X and set X->LLINK=last node's RLINK.

9. To insert a node X after the specified node Y, travel the list till the node Y is reached. Set X->RLINK=Y->RLINK , Y->RLINK=X,X->LLINK=Y and X->RLINK->LLINK=X
10. A node can be deleted at the front, in the middle or at the end of the list.
11. To delete a node X at the front set X->RLINK->LLINK=H,H->RLINK->RLINK= X.
12. To delete a node X at the end travel the list till the end and assign the previous to last node's RLINK value to be NULL.
13. To delete a node X after the specified node Y, travel the list till the node Y is reached Set X->RLINK->LLINK=Y, Y->RLINK= X->RLINK.
14. To search an element E traverse the list until E is found.

CIRCULAR LINKED LIST

1. Set a node to contain INFO and LINK fields.
2. Allot memory dynamically for a node and declare it as a header H.
3. To create a singly linked lists get the element N and allot memory for a node S1.
4. Set S1->INFO=N; and S1->LINK=H.
5. Repeat the above two steps for all the elements.
6. A node can be inserted at the front, in the middle or at the end of the list.
7. To insert a node X at the front check whether the list is empty, if not set X->LINK=H->LINK and H->LINK=X.
8. To insert a node X at the end travel till the end of the list and assign the last node's LINK value to X and X->LINK=H.
9. To insert a node X after the specified node Y, travel the list till the node Y is reached. Set X->LINK=Y->LINK and Y->LINK=X
10. A node can be deleted at the front, in the middle or at the end of the list.
11. To delete a node X at the front set H->LINK=H->LINK->LINK.
12. To delete a node X at the end travel the list till the end and assign the previous to last node's LINK value to be H.
13. To delete a node X after the specified node Y, travel the list till the node Y is reached Set Y->LINK= Y->LINK->LINK.

14. To search an element E traverse the list until E is found.

Software Requirements

Turbo C - 30 nodes.

Hardware Requirements

PC - 30 nos.

4. Queue and Stack implementation using linked list

Aim

To implement queue and stack using linked list.

Objective

To represent queue and stack operations using linear linked list.

Exercises

STACK

1. Create a singly linked list.
2. To PUSH a node X travel the list until the end is reached. Assign last node's LINK to X.
3. To POP a node X delete the last node and set the previous to last node's LINK to NULL.
4. To display the stack contents traverse the list from the header till the last node.

QUEUE

1. Create a singly linked list.
2. Set first node as F and last node as R.
3. To insert a node X set R->LINK=X;
4. To delete a node X check whether the list is empty, if not set F=F->LINK;
5. To display the queue contents traverse the list from F to R.

Software Requirements

Turbo C - 30 nodes.

Hardware Requirements

PC - 30 nos.

5. In-order, Pre-order and Post-order Traversals

Aim

To perform In-order, Preorder and Post order traversals in Binary Search Tree

Objective

To perform traversals in binary search tree using In-order, Preorder and Post-order techniques.

Exercises

1. Create the binary search tree
2. To perform in-order traversals
   a. process the left sub tree
   b. process the root
   c. process the right sub-tree
3. To perform preorder traversal
   a. process the root node
   b. process the left
   c. process the right
4. To perform post-order traversal
   a. process the left node
   b. process the right node.
   c. process the root node.

Software Requirements

Turbo C - 30 nodes.

Hardware Requirements

PC - 30 nos.

6. Binary search tree implementation using linked list and possible operations on binary search trees

Aim

To implement binary search tree using linked list and possible operations on binary search trees.

Objective

To represent binary search tree using linked list and to implement operations like insertion, deletion and search operations

Exercises

1. Create the memory space for the root node and initialize the value to zero.
2. Read the value.
3. If the value is less than the root value ,it is assigned as the left child of the root.

   Else if new value is greater than the root value, it is assigned as the right child

   of the root. Else if there is no value in the root, the new value is assigned as the

   root.

4. The step (2) and (3) is repeated to insert the 'n' number of values.

Search operation

1. Read the value to be searched.
2. Check whether the root is not null.
3. If the value to be searched is less than the root, consider the left sub-tree for searching the particular element else if the value is greater than the root consider the right sub - tree to search the particular element else if the value is equal then return the value that is the value which was searched.

Insertion

1. Read the value to be inserted
2. First perform the search operation to check whether the key values is different from those existing element
3. If the search is unsuccessful, then the key is inserted at the point the search is

   terminated.

Deletion

1. Read the key value to be deleted
2. First perform search operation to get that particular key element
3. If it is, check whether

   (a) it is leaf node,

   (b) or it has only one sub-tree

   (c) or it has exactly 2 sub-trees
4. If the key value is the leaf-node, assign null value to that node ,else if the key contains only one sub-tree either left (or)right sub-tree, if the key is root, it is discarded and the root its single sub-tree becomes the new search tree root. Else if the key is the child node , then we change the pointer from the root of key to the child of the key.
5. If the key contain both left and right sub-tree replace the key with either largest

   element is the left sub-tree or smallest element is the right sub-tree.

Software Requirements

Turbo C - 30 nodes.

Hardware Requirements

PC - 30 nos.

7. Quick sort implementation and it's efficiency calculation

Aim

To implement quick sort and calculate it's efficiency

Objective

To arrange the elements using fastest sorting technique quick sort and the time taken to sort the elements.

Exercises

1. Get N elements which are to be sorted, and store it in the array A.
2. Select the element from A[0] to A[N-1] for middle. This element is the pivot.
3. Partition the remaining elements into the segments left and right so that no elements in left has a key larger than that of the pivot and no elements in right has a key smaller than that of the pivot.

4. Sort left using quick sort recursively.
5. Sort right using quick sort recursively.
6. Display the sorted array A.

Software Requirements

Turbo C - 30 nodes.

Hardware Requirements

PC - 30 nos.

8. Binary Search implementation

Aim

To implement binary search technique.

Objective

To perform sorting using binary search technique.

Exercises

1. Get N elements and store the elements in the array K in ascending order.
2. Get the element to be searched X.
3. Initialize LOW=1,HIGH=N;
4. Until LOW<= HIGH check whether X <K[MIDDLE], if so
5. HIGH=MIDDLE-1,otherwise check whether X > K[MIDDLE] ,if so LOW=MIDDLE+1,otherwise Display UNSUCCESSFUL SEARCH

Software Requirements

Turbo C - 30 nodes.

Hardware Requirements

PC - 30 nos.

9. Graph implementation using arrays and list structure

Aim

Graph implementation using arrays and linear linked list.

Objective

To represent Graph using arrays and linked list

Exercises

1. Construct adjacency matrix, such that it has value one if there exists direct path between two vertices and otherwise zero.
2. For linked representation of graph an array H of head nodes each contains one pointer field INFO.

3. If there exists a direct path between i^{th} head node H[I] and the node X , then
   H[I]->INFO=X.

Software Requirements

Turbo C - 30 nodes.

Hardware Requirements

PC - 30 nos.

10. Depth first and Depth first traversal in Graph

Aim

To implement depth first and Breadth first traversal in graphs.

Objective

Depth first and Breadth first traversal implementation in graphs .

Exercises

1. Construct a graph.
2. To traverse a graph in breadth first technique, label vertex v as reached.
3. Initialize Q to be a queue with only v in it.
4. While Q is not empty, do the following steps
5. Delete a vertex W from the queue
6. Let u be a vertex adjacent from w.
7. While u, if u has not been labeled then add u to the queue label u as reached.
8. Set u = next vertex, that is adjacent from w
9. To traverse a graph in DFS label vertex v as reached.

10. While u is adjacent to v, if u is not reached call DFS recursively
11. Set u as next adjacent vertex of v. Repeat from step 9 till all the nodes are visited.

Software Requirements

Turbo C - 30 nodes.

Hardware Requirements

PC - 30 nos.

IC 1251 CONTROL SYSTEMS **3**
1 0 100

AIM

To provide sound knowledge in the basic concepts of linear control theory and design of control system.

OBJECTIVES

i. To understand the methods of representation of systems and getting their transfer function models.

ii. To provide adequate knowledge in the time response of systems and steady state error analysis.

iii. To give basic knowledge is obtaining the open loop and closed–loop frequency responses of systems.

iv. To understand the concept of stability of control system and methods of stability analysis.

v. To study the three ways of designing compensation for a control system.

1. SYSTEMS AND THEIR REPRESENTATION

9

Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

2. 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 – P, PI, PID modes of feed back control.

3. FREQUENCY RESPONSE

9

Frequency response – Bode plot – Polar plot – Constant M and N circles – Nichols chart – Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications.

4. STABILITY OF CONTROL SYSTEM

9

Characteristics equation – Location of roots in S plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterion.

5. COMPENSATOR DESIGN

9

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots.

L = 45 T = 15 Total = 60

TEXT BOOKS

1. K. Ogata, 'Modern Control Engineering', 4th edition, Pearson Education, New Delhi, 2003 / PHI.
2. I.J. Nagrath & M. Gopal, 'Control Systems Engineering', New Age International Publishers, 2003.

REFERENCE BOOKS

1. B.C. Kuo, 'Automatic Control Systems', Prentice Hall of India Ltd., New Delhi, 1995.

2. M. Gopal, 'Control Systems, Principles & Design', Tata McGraw Hill, New Delhi, 2002.

3. M.N. Bandyopadhyay, 'Control Engineering Theory and Practice', Prentice Hall of India, 2003.

EI 1251 ELECTRICAL MEASUREMENTS AND INSTRUMENTS 3
1 0 100

AIM

To provide adequate knowledge in electrical measurements and instrumentation.

OBJECTIVES

To make the students to gain a clear knowledge of the basic laws governing the operation of electrical instruments and the measurement techniques.

i. Emphasis is laid on the meters used to measure current & voltage.

ii. To have an adequate knowledge in the measurement techniques for power and energy, power and energy meters are included.

iii. Elaborate discussion about potentiometer & instrument transformers.

iv. Detailed study of resistance measuring methods.

v. Detailed study of inductance and capacitance measurement.

1. MEASUREMENT OF VOLTAGE AND CURRENT

9

Galvanometers – Ballistic, D'Arsonval galvanometer – Theory, calibration, application – Principle, construction, operation and comparison of moving coil, moving iron meters, dynamometer, induction type & thermal type meter, rectifier type – Extension of range and calibration of voltmeter and ammeter – Errors and compensation.

2. MEASUREMENT OF POWER AND ENERGY

9

Electrodynamometer type wattmeter – Theory & its errors – Methods of correction – LPF wattmeter – Phantom loading – Induction type KWH meter – Calibration of wattmeter, energy meter.

3. POTENTIOMETERS & INSTRUMENT TRANSFORMERS

9

DC potentiometer – Basic circuit, standardization – Laboratory type (Crompton's) – AC potentiometer – Drysdale (polar type) type – Gall-Tinsley (coordinate) type – Limitations & applications – C.T and V.T construction, theory, operation, phasor diagram, characteristics, testing, error elimination – Applications.

4. RESISTANCE MEASUREMENT

9

Measurement of low, medium & high resistance – Ammeter, voltmeter method – Wheatstone bridge – Kelvin double bridge – Ductor ohmmeter – Series and shunt type ohmmeter – High resistance measurement – Megger – Direct deflection methods – Price's guard-wire method – Loss of charge method – Earth resistance measurement.

5. IMPEDANCE MEASUREMENT

9

A.C bridges – Measurement of inductance, capacitance – Q of coil – Maxwell Bridge – Wein's bridge – Hey's bridge – Schering bridge – Anderson bridge – Campbell bridge to measure mutual inductance – Errors in A.C. bridge methods and their compensation – Detectors – Excited field – A.C. galvanometer – Vibration galvanometer – Introduction to cable fault and eddy current measurement.

L = 45 T = 15 Total = 60

TEXT BOOKS

1. E.W.Golding & F.C.Widdis, 'Electrical Measurements & Measuring Instruments', A.H.Wheeler & Co, 1994.

2. A.K. Sawhney, 'Electrical & Electronic Measurements and Instrumentation', Dhanpath Rai & Co (P) Ltd, 2004.

REFERENCE BOOKS

1. J.B.Gupta, 'A Course in Electronic and Electrical Measurements and Instrumentation', S.K. Kataria & Sons, Delhi, 2003.

2. S.K.Singh, 'Industrial Instrumentation and control', Tata McGraw Hill, 2003.

3. H.S.Kalsi, 'Electronic Instrumentation', Tata McGraw Hill, 1995.

4. Martia U. Reissland, 'Electrical Measurement', New Age International (P) Ltd., 2001.

EI 1252 TRANSDUCER ENGINEERING 3 0 0 100

AIM

To provide adequate knowledge in sensors and transducers.

OBJECTIVES

i. To impart knowledge about the principles and analysis of sensors.

ii. Discussion of errors and error analysis.

iii. Emphasis on characteristics and response of transducers.

iv. To have an adequate knowledge in resistance transducers.

v. Basic knowledge in inductance and capacitance transducers and exposure to other transducers.

1. SCIENCE OF MEASUREMENTS AND INSTRUMENTATION OF TRANSDUCERS

9

Units and standards – Calibration methods – Static calibration – Classification of errors – error analysis – statistical methods – Odds and uncertainty – Classification of transducers – Selection of transducers.

2. CHARACTERISTICS OF TRANSDUCERS

9

Static characteristics – Accuracy, Precision, Resolution, Sensitivity, Linearity etc. Dynamic characteristics – Mathematical model of transducer – Zero, I and II order transducers. Response to impulse, step, ramp and sinusoidal inputs.

3. VARIABLE RESISTANCE TRANSDUCERS

9

Principle of operation, construction details, characteristics and application of resistance potentiometer, strain gauge, resistance thermometer, thermistor, hot-wire anemometer, Piezoresistive sensor and humidity sensor.

4. VARIABLE INDUCTANCE AND VARIABLE CAPACITANCE TRANSDUCERS 9

Induction potentiometer – Variable reluctance transducers – EI pick up – LVDT – capacitive transducer and types – Capacitor microphone – Frequency response.

5. OTHER TRANSDUCERS

9

Piezoelectric transducer, Magnetostrictive – IC sensor – Digital transducers – Smart

sensor – Fibre optic transducer.

L = 45 Total = 45

TEXT BOOKS

1. E.A. Doebelin, 'Measurement Systems – Applications and Design', Tata McGraw Hill, New York, 1990.

2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurement and Instrumentation', Dhanpat Rai and Co (P) Ltd., 2004.

REFERENCE BOOKS

1. D. Patranabis, 'Sensors and Transducers', Prentice Hall of India, 1999.

2. John P. Bentley, 'Principles of Measurement Systems', III Edition, Pearson Education, 2000.

3. Hermann K.P. Neubert, 'Instrument Transducers', Oxford University Press, 2000.

4. D.V.S Murthy, 'Transducers and Instrumentation', Prentice Hall of India, 2001.

5. S. Ranganathan, 'Transducer Engineering', Allied Publishers Pvt. Ltd., 2003.

6. Al Sutko and J.D. Faulk, 'Industrial Instrumentation', Vikas Publications, Delhi, 1996.

EC 1312 DIGITAL LOGIC CIRCUITS 3

1 0 100

AIM

To introduce the fundamentals of Digital Circuits, combinational and sequential circuit.

OBJECTIVES

i. To study various number systems and to simplify the mathematical expressions using Boolean functions – simple problems.

ii. To study implementation of combinational circuits

iii. To study the design of various synchronous and asynchronous circuits.

iv. To expose the students to various memory devices.

1. NUMBER SYSTEM & BOOLEAN ALGEBRA

11

Review of number system; types and conversion, codes. Boolean algebra: De-Morgan's theorem, switching functions and simplification using K-maps & Quine McCluskey method.

2. COMBINATIONAL CIRCUITS

11

Design of Logic gates. Design of adder, subtractor, comparators, code converters, encoders, decoders, multiplexers and demultiplexers. Function realization using gates & multiplexers.

3. SYNCHRONOUS SEQUENTIAL CIRCUITS

11

Flip flops - SR, D, JK and T. Analysis of synchronous sequential circuits; design of synchronous sequential circuits – Counters, state diagram; state reduction; state assignment.

4. ASYNCHRONOUS SEQUENCTIAL CIRCUIT

5

Analysis of asynchronous sequential machines, state assignment, asynchronous design
problem.

5. PROGRAMMABLE LOGIC DEVICES, MEMORY AND LOGIC FAMILIES 7

Memories: ROM, PROM, EPROM, PLA, PLD, FPGA, digital logic families: TTL, ECL, CMOS.

L = 45 T = 15 Total = 60

TEXT BOOKS

1. M. Morris Mano, 'Digital Logic and Computer Design', Prentice Hall of India, 2002.

2. John M.Yarbrough, 'Digital Logic, Application & Design', Thomson, 2002.

REFERENCE BOOKS

1. Charles H.Roth, 'Fundamentals Logic Design', Jaico Publishing, IV edition, 2002.

2. Floyd, 'Digital Fundamentals', 8th edition, Pearson Education, 2003.

3. John F.Wakerly, 'Digital Design Principles and Practice', 3rd edition, Pearson Education, 2002.

EC 1313 LINEAR INTEGRATED CIRCUITS 3 0 0 100

AIM

To introduce the concepts for realising functional building blocks in ICs, fabrications & application of ICs.

OBJECTIVES

i. To study the IC fabrication procedure.

ii. To study characteristics; realise circuits; design for signal analysis using Op-amp ICs.

iii. To study the applications of Op-amp.

iv. To study internal functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits, ADCs.

1. IC FABRICATION

9

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging.

2. CHARACTERISTICS OF OPAMP

9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, offset voltage and current: voltage series feedback and shunt feedback amplifiers, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – summer, differentiator and integrator.

3. APPLICATIONS OF OPAMP

9

Instrumentation amplifier, first and second order active filters, V/I & I/V converters, comparators, multivibrators, waveform generators, clippers, clampers,

peak detector, S/H circuit, D/A converter (R-2R ladder and weighted resistor types), A/D converter - Dual slope, successive approximation and flash types.

4. SPECIAL ICs

9

555 Timer circuit – Functional block, characteristics & applications; 566-voltage controlled oscillator circuit; 565-phase lock loop circuit functioning and applications, Analog multiplier ICs.

5. APPLICATION ICs

9

IC voltage regulators - LM317, 723 regulators, switching regulator, MA 7840, LM 380 power amplifier, ICL 8038 function generator IC, isolation amplifiers, opto coupler, opto electronic ICs.

L = 45 Total = 45

TEXT BOOKS

1. Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI.

2. D.Roy Choudhary, Sheil B.Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.

REFERENCE BOOKS

1. Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system', Tata McGraw Hill, 2003.

2. Robert F.Coughlin, Fredrick F.Driscoll, 'Op-amp and Linear ICs', Pearson Education, 4th edition, 2002 / PHI.

3. David A.Bell, 'Op-amp & Linear ICs', Prentice Hall of India, 2nd edition, 1997.

CS 1261 OBJECT ORIENTED PROGRAMMING 3
1 0 100

AIM

To present the concept of object oriented programming and discuss briefly the important elements of object oriented analysis and design of systems.

OBJECTIVES

i. To study the object oriented programming principles, tokens, expressions, control

structures and functions.

ii. To introduce the classes, objects, constructors and destructors.

iii. To introduce the operator overloading, inheritance and polymorphism concepts in C++.

iv. To introduce constants, variables, data types, operators, classes, objects, methods, arrays and strings in Java.

v. To introduce the programming approach in Java, interfaces and packages, multithreading, managing errors and exceptions and Applet programming.

1. OBJECT ORIENTED PROGRAMMING AND BASICS OF C++

9

Software crisis – Software evolution – A look at procedure oriented programming – Object oriented programming paradigm – Basic concepts of object oriented programming – Benefits of OOP – Object oriented languages – Applications of OOP - What is C++? – A simple C++ program – More C++ statements – Structure of C++ Program.

Tokens – Keywords – Identifiers and constants – Basic data types – User defined data types – Derived data types – Symbolic constants – Declaration of variables – Dynamic initialization of variables – Reference variables – Operators in C++ – Scope resolution operator – Manipulators – Type cast operator – Expressions and their types – Special assignment expressions – Control structures - The main function – Function prototyping – Call by reference – Return by reference – Inline functions – Default arguments – Function overloading.

2. CLASSES AND OBJECTS

9

Specifying a class – Defining member functions – Private member functions – Arrays within a class – Memory allocation for objects – Static data members – Static member functions – Arrays of objects – Objects as function arguments – Friendly functions – Returning objects.

Constructors: Parameterized constructors – Multiple constructors in a class – Constructors with default arguments – Dynamic initialization of objects – Copy constructor – Dynamic constructors – Destructors.

3. OPERATOR OVERLOADING, INHERITANCE AND POLYMORPHISM

9

Defining operator overloading: Overloading unary, binary operators. Manipulation of strings using operators – Rules for overloading operators – Type Conversions - Defining derived classes – Single inheritance – Multilevel inheritance – Multiple inheritance – Hierarchical inheritance – Hybrid inheritance – Virtual base classes – Abstract classes - Introduction to pointers to objects: This pointer – Pointers to derived classes – Virtual functions – Pure virtual functions.

4. JAVA EVOLUTION, CONSTANTS, VARIABLES, DATA TYPES, OPERATORS, CLASSES, OBJECTS, METHODS, ARRAYS AND STRINGS 9

Java features: How Java differs from C and C++ - Simple Java program – Java program structures – Java tokens – Java statements – Implementing a Java program – Java virtual machine – Command line arguments - Constants – Variables – Data types – Scope of variables – Operators in Java.

Defining a class – Adding variables and methods – Creating objects – Accessing class members – Constructors – Method overloading – Static members – Inheritance: Extending a class – Overriding methods – Final variables and methods – Final classes – Abstract methods and classes – Visibility control - Arrays – One dimensional array – Creating an array – Two-dimensional arrays – Strings – Vectors.

5. PROGRAMMING USING INTERFACES, PACKAGES, MULTITHREADING, MANAGING ERRORS AND EXCEPTIONS AND APPLETS 9

Defining interfaces – Extending interfaces – Implementing interfaces – Accessing interface variables – Java API packages – Using system packages – Creating, accessing and using a package – Adding a class to a package - Creating threads – Extending the thread class – Stopping and blocking a thread – Thread exceptions – Thread priority – Synchronization – Life cycle of a thread – Using thread methods.

Types of errors: Exceptions – Syntax of exception handling code – Multiple catch statements – Using finally statements – Throwing our own exceptions – Using exceptions for debugging. Preparing to write applets – Applet lifecycle – Creating an executable applet – Designing a web page – Applet tag – Adding applet to HTML file – Running the Applet.

L = 45 T = 15 Total = 60

TEXT BOOKS

1. E.Balagurusamy, ‘Object Oriented Programming with C++’, Second edition, Tata McGraw Hill, 2003.

2. E.Balagurusamy, 'Programming with JAVA – A Primer', Second edition, Tata McGraw Hill, 2003.

REFERENCE BOOKS

1. Herbert Schildt, 'C++ - The Complete Reference', Tata McGraw Hill, 1997.
2. Bjarne Stroustrup, 'The C++ Programming Language', Addison Wesley, 2000.
3. John .R .Hubbard, 'Schaums Outline Programming with C++', Tata McGraw Hill, 2003.
4. Kris Jasma, 'Java Programming–A Complete Reference', Galgotia publication, 1994.

EI 1261 ELECTRICAL MEASUREMENTS & INSTRUMENTS LABORATORY

0 0 3 100

AIM

The main aim of this lab is to train the students in the area of different electrical equipment and measuring devices.

OBJECTIVE

The students acquire an adequate knowledge and expertise in handling electrical measuring instruments and feel comfortable with this equipment.

1. Measurements of medium resistance using Wheatstone's bridge.
2. Kelvin Double Bridge.
3. Calibration of single-phase energy meter.
4. Calibration of wattmeter.
5. Schering and Anderson Bridges.
6. Statistical analysis of random errors.
7. Study of transients.
8. Calibration of current transformer.
9. Voltage to current, current to voltage converters.
10. D.C. Potentiometer.

P = 45 Total = 45

Detailed Syllabus

1. Measurement of Medium Resistance Using Wheatstone's Bridge

Aim

To measure the value of unknown resistance using Wheatstone's Bridge.

Exercise

Find the value of unknown resistance.

Procedure

1. Connections are given as per the circuit diagram.
2. Supply is switched on.
3. When the unknown resistance s connected, the bridge becomes unbalanced.
4. The bridge is balanced by varying standard resistance.
5. The value of unknown resistance is calculated by the given formula.
6. The above steps are repeated for different value of unknown resistances.

Equipment

1. Resistors – 1 No
2. Galvanometer – 1 No
3. Regulated Power supply – 1 No
4. Bread board – 1 No
5. Decade resistance box – 1 No
6. Multimeter – 1 No

2. Kelvin's Double Bridge

Aim

To find the unknown value of low resistance using Kelvin's Double Bridge.

Exercise

Find the unknown value of low resistance.

Procedure

1. Connections are given as per the circuit diagram.
2. Supply is switched on.

3. The bridge becomes unbalanced when unknown resistance R is connected.
4. The bridge is balanced by varying standard resistance.
5. Unknown resistance is calculated using balance equation.
6. The above steps are repeated for various values of unknown resistance.

Equipment

1. Power supply – 1 No
2. Fixed resistance – 1 No
3. Unknown resistors – 1 No
4. Decade resistance box – 1 No
5. Multimeter – 1 No
6. Galvanometer – 1 No
7. Bred board - 1 No

3. Calibration Of Single Phase Energy Meter

Aim

To calibrate the given energy meter using two substandard wattmeters and to obtain percentage error.

Exercise

Calibrate the given energy meter and draw % error Vs load graph.

Procedure

1. Connections are given as per the circuit diagram.
2. The value of load current is adjusted to desire value.
3. When the red mark on the disk of the energy meter passes the observation point, the stopwatch is started and the number of revolution made by the disc is noted.
4. The load current is maintained by adjusting the load.
5. When the disc of the energy meter completes desired number of revolutions the stopwatch is stopped and the time taken is noted.

6. The procedure is repeated for different values of wattmeter reading and time taken, number of revolutions of the disc is noted down.

7. The graph is plotted between percentage error and load.

Equipment

1. Wattmeter – 2 No
2. Voltmeter – 1 No
3. Ammeter – 1 No
4. Resistive load – 1 No

4. Calibration Of Wattmeter

Aim

To calibrate the given wattmeter using direct loading.

Exercise

Calibrate the given wattmeter and draw the graph between % error and load current.

Procedure

1. Connections are given as per the circuit diagram.
2. Supply is given at no load condition.
3. Resistive load is applied in steps and the readings are tabulated.
4. Graph is drawn between % error and load current.

Equipment

1. Ammeter – 1 No
2. Voltmeter – 1 No
3. Wattmeter – 1 No
4. Load – 1 No

5(a) Schering's Bridge

Aim

To measure the unknown value of capacitance using Schering's bridge

Exercise

Measure the unknown value of capacitance.

Procedure

1. Connections are given as per the circuit.
2. Supply is witched on.
3. When unknown value of capacitance is connected, bridge becomes unbalanced.
4. The bridge is balanced by varying the standard.
5. The unknown value of capacitance is calculated using the balance equation.
6. The above steps are repeated for different values of unknown capacitances.

Equipment

1.	Resistors	- Some set.
2.	Capacitors	– Some set.
3.	Decade Resistance box	– 1 No.
4.	Decade Capacitance box	– 1 No.
4.	CRO	– 1 No.
6.	Function Generator	– 1 No.

5(b) Anderson's Bridge

Aim

To measure the unknown value of inductance using Anderson's Bridge

Exercise

Measure the unknown value of inductance.

Procedure

1. Connections are given as per the circuit diagram.
2. Supply is switched on.

3. When unknown value of inductance is connected the bridge becomes unbalanced.
4. The unknown value of inductance is calculated by using the balance equation.
5. The above step are repeated for different values of unknown inductance.

Equipment

1. Resistors – Some set
2. Decade Inductance box – 1 No.
3. Decade Condenser box – 1 No.
4. Regulated power supply – 1 No.
5. CRO – 1 No.
6. Bread board - 1 No.

6. Statistical Analysis Of Random Errors

Aim

To analyze the measured data statistically.

Exericse

Take a set of data and calculate the arithmetic mean, deviation from the mean, average deviation, standard deviation and variance.

Procedure

1. Connect the voltage source to the load.
2. Measure the load current or load voltage using the digital meter.
3. After taking the reading switch off the supply.
4. Switch on the supply and repeat the experiment.
5. Take 4 readings for same supply voltage or same load current.
6. Using the data calculate the Arithmetic mean, Deviation from the mean, Average deviation, Standard deviation, Variance.

Equipment

1. Digital voltmeter or ammeter of suitable range – 1 No
2. Resistor to act as load – 1 No

3. Voltage source – 1 No

7. Study of Transients

Aim

Trace the transient waveform and peek time, settling time.

Exercise

Wire up a RLC circuit and obtain its waveform on CRO. Find out peak time,
settling time etc., form the waveform.

Procedure

1. Wire ups as PLC circuit.
2. Give a suitable (Sine wave input).
3. Observe the output waveform storage oscilloscope.
4. Find out peak line setting time etc, from the waveform.

Equipment

1. Breadboard – 1 No.
2. Storage C.R.O. – 1 No.
3. Resisters – A set.
4. Capacitors – A set.
5. Inductors – A set.

8. Calibration Of Current Transformer

Aim

To study the working of current transformer

Exercise

1. Draw the curve primary current Vs secondary current
2. Observe the o/p for lamp load
3. Calculate the efficiency

Equipment

1. Current Transformer – 1 No
2. Lamp Load – 1 No

3. Voltmeter – 1 No

4. Ammeter – 1 No

9. Voltage To Current, Current To Voltage Converter

Aim

To construct a current to voltage & Voltage to current converter circuit.

Exercise

Voltage To Current Converter

Observe the changes in o/p current for changes in i/p voltage.

1. Connect the circuit
2. Vary the R.P.S
3. Observe the O/P current

Current To Voltage Converter

Observe the changes in o/p voltage for changes in i/p current.

1. Connect the circuit
2. Vary the i/p current by varying the R.P.S
3. Tabulate the changes in o/p voltage

Equipment

1. IC 741 Trainer kit – 1 No
2. Resistors – A set
3. RPS – 1 No
4. Multimeter – 1 No
5. Ammeter – 1 No
6. Voltmeter – 1 No

10. DC Potentiometer

Aim

To conduct a suitable experiment to measure an unknown voltage by comparing it with a known voltage.

Exercise

1. Determine the current by measuring the voltage drop across the standard resistor
2. Calculate theoretical voltage
3. Calculate the practical voltage
4. Fluid Percentage Error

Equipment

1.	DC Potentiometer	– 1 No
2.	Voltmeter	– 1 No
3.	Resistor	– 1 No
4.	RPS	– 1 No

EE 1261 ELECTRICAL MACHINES LABORATORY 0 0 3 100

AIM

To expose the students to the basic operation of electrical machines and help them to develop experimental skills.

1. Open circuit and load characteristics of separately excited and self excited D.C. generator.
2. Load test on D.C. shunt motor.
3. Load test on D.C. series motor.
4. Swinburne's test and speed control of D.C. shunt motor.
5. Load test on single phase transformer and open circuit and short circuit test on single phase transformer
6. Regulation of three-phase alternator by EMF and MMF methods.
7. Load test on three-phase induction motor.
8. No load and blocked rotor tests on three phase induction motor (Determination of equivalent circuit parameters)
9. Load test on single-phase induction motor.
10. Study of D.C. motor and induction motor starters.

P = 45 Total = 45

Detailed Syllabus

1. Open circuit and load characteristics of separately excited and self excited DC

Generator

Aim

To conduct no load and load test on self and separately excited generators and obtain the characteristics.

Exercise

1. Obtain the open circuit characteristics of a separately and self excited D.C generator and determine critical resistance.

2. Draw the external and internal characteristics of a separately and self excited D.C generator and compute full load regulation.

2. Load Test on DC Shunt motor

Aim

To conduct load test on DC shunt motor and draw the characteristic curves.

Exercise

1. Draw the following characteristic curves for DC shunt motor

   i. Output Vs η%
   ii. Output Vs T
   iii. Output Vs N
   iv. Output Vs I_L
   v. Torque Vs N

3. Load Test on DC series motor

Aim

To conduct load test on DC series motor and draw the characteristics curves

Exercise

1. Draw the following characteristics curve for DC series motor

    a. Output Vs η%
    b. Output Vs T
    c. Output Vs N
    d. Output Vs I
    e. Torque Vs N

4. Swinburne's Test and speed control of DC shunt motor

Aim

To conduct Swinburne's test and predetermine the performance characteristics of DC machine and speed control of DC motor.

Exercise

1. Predetermine efficiency at various load current while operating as a motor and generator and plot a graph output Vs η%

2. Draw the following curves for

    a. I_f Vs N at $V_a = 0.8\ V_a$ and V_a

    b. V_a Vs N at $0.8\ I_f$ and I_f

5. Load Test On Single-Phase Transformer and Open Circuit And Short Circuit Tests On Single Phase Transformer

Aim

1. To conduct load test on the given single phase transformer and determine its performance

2. To conduct O.C and S.C test on a single phase transformer and calculate the performances

Exercise

1. Draw the following graph for single phase transformer

    a. Output Vs η%

2. Determine the equivalent circuit of the transformer.

3. Predetermine the efficiency at different load at UPF and 0.8 Power factor lagging.

4. Predetermine the full load regulation at different power factor.
5. Draw the following curves
   a. Output Vs η%
   b. Power factor Vs %Regulation

6. Regulation of three phase alternator by EMF and MMF methods

Aim

To predetermine the voltage regulation of given three phase alternator by emf and mmf methods.

Exercise

1. Obtain the open circuit and short circuit characteristics of a three phase alternator.
2. Calculate synchronous impedance from the open circuit characteristics and short circuit characteristics
3. Predetermine the full load regulation at different power factor by EMF and MMF methods and draw the graph between regulation Vs Power factor.
4. Draw the phasor diagram for EMF and MMF method.

7. Load Test On Three Phase Induction Motor

Aim

To obtain the load characteristics of three phase induction motor.

Exercise

1. Conduct the load test on a given three phase induction motor and draw the following curves.
   1. Output Vs % η
   2. Output Vs Speed
2. Output Vs Line current
3. Output Vs Slip
4. Output Vs Power factor
5. T Vs N (on separate graph sheet)

8. No load and blocked rotor test on three-phase induction motor

Aim

To conduct no load and blocked rotor test and to draw the equivalent circuit and predetermine the performance.

Exercise

1. Determine the equivalent circuit parameters.

2. Draw the circle diagram and predetermine the efficiency, torque, power factor, slip and line current for three load condition.

3. Predetermine the performance characteristics using the equivalent circuit for three load condition.

9. Load test on single phase induction motor

Aim

To obtain the load characteristics of single phase motor by load test.

Exercise

1. Conduct the load test on given single-phase induction motor and draw the following curves.

1. Output Vs % η
2. Output Vs Speed
3. Output Vs Line current I_B
4. Output Vs Slip
5. Output Vs Power factor

10. Study of DC motors and induction motor starters

Aim

1. To study the circuitry of three point and four point starters.

2. To study the difference and advantage of four-point starter over three point starter.

3. To study the DOL, autotransformer and star/delta starter for starting squirrel cage induction motor.

4. To study the rotor resistance starter for starting the slip ring induction motor.

Exercise

1. Connect the starters in the motor circuit and study its operation.

2. Study the difference between star/delta and autotransformer starters.

CE 1261 THERMODYNAMICS AND FLUID MECHANICS LABORATORY 0 0 3 100

THERMODYNAMICS LAB

1. Valve timing and port timing diagrams for IC Engines.

2. Performance test on a Petrol Engine.

3. Performance test on a Diesel Engine.

4. Heat Balance test on an IC Engine.

5. Boiler – performance and Heat Balance Test.

6. Performance test on a Refrigerator (Determination of COP)

7. Determination of heat transfer Coefficient (Free and forced convection)

List of Equipments

1. Engine – cut section models.
2. Single cylinder petrol engine with Mechanical dynamometer.
3. Multi cylinder petrol engine with hydraulic dynamometer.
4. Multi cylinder diesel engine with Electrical dynamometer.
5. Steam boilers with suitable mountings and accessories.
6. Refrigeration Test Rig.
7. Forced convection Heat transfer Test set up.
8. Free convection Heat transfer test set up.

FLUID MECHANICS LABORATORY

OBJECTIVES

At the end of this course the student shall be able to do hydraulic tests on pumps and turbines and should have developed the knowledge about the characteristics of hydraulic machines and their importance.

1. Flow measurements using venturi meter.

2. Test to estimate frictional losses in pipe flow.

3. Test on positive displacement pump for obtaining its characteristics curves and design flow parameters.

4. Test on centrifugal pump for obtaining its characteristics curves and design flow parameters.

5. Test on jet pump for obtaining its characteristics curves and design flow parameters.

6. Test on reaction turbine for obtaining the characteristics curves and to design values of specific speed, discharge, output and efficiency.

7. Test on impulse turbine to obtain its characteristics curves and hydraulic design values.

Equipment List

S.No	Apparatus	Quantity
1	Apparatus for measuring pipe friction	1 No
2	Francis turbine	1 No
3	Pelton wheel	1 No
4	Turgo impulse wheel	1 No
5	Positive displacement and accessories for conducting the test	1 No
6	Centrifugal pump and accessories for conducting the test	1 No
7	Venturi meter with connecting pipes for flow measurement	1 No
8	Jet pump	1 No
9	Stop watches	6 Nos

IC 1301 NON-LINEAR CONTROL SYSTEM 3
1 0 100

AIM

To obtain comprehensive knowledge in nonlinear control theory and design of controllers for nonlinear systems.

OBJECTIVES

i. To study the features of linear and non-linear systems and expose the students to the physical non-linearities.

ii. To provide adequate knowledge in the phase plane analysis.

iii. To give a basic knowledge in describing function analysis.

iv. To analyze the stability of the systems using different techniques.

v. To design a controller for a non-linear system.

1. INTRODUCTION

9

Features of linear and non-linear systems –State variable representation – Solution of state equations – Conversion of state variable models to transfer functions – Eigen values – Eigen vectors – Concepts of controllability and observability - Common physical non-linearities – Methods of linearising nonlinear systems.

2. PHASE PLANE ANALYSIS

9

Concept of phase portraits – Singular points – Limit cycles – Construction of phase portraits – Phase plane analysis of linear and non-linear systems – Isocline method.

3. DESCRIBING FUNCTION ANALYSIS

9

Basic concepts, derivation of describing functions for common non-linearities – Describing function analysis of non-linear systems – Conditions for stability – Stability of oscillations.

4. STABILITY ANALYSIS

9

Introduction – Liapunov's stability concept – Liapunov's direct method – Lure's transformation – Aizerman's and Kalman's conjecture – Popov's criterion – Circle criterion.

5. CONTROLLER SYNTHESIS FOR NON-LINEAR SYSTEMS

9

Linear design and non-linear verification – Non-linear internal model control – Parameter optimization – Model predictive controller – Optimal controller – State feedback and observer.

L = 45 T = 15 Total = 60

TEXT BOOKS

1. E. Jean-Jacques, 'Slot line, Applied Non-linear Control', Pearson Education.

2. Torkel Glad & Lennart Ljung, 'Control Theory – Multi Variable and Non-linear Methods', Taylor's & Francis Group, 2002.

REFERENCE BOOKS

a. Peter A. Cook, 'Non-linear Dynamical Systems', Pearson Education.

2. I.J. Nagrath & M. Gopal, 'Control System Engineering', New Age International Publishers, 2003.

3. S. Hasan Saeed, 'Automatic Control Systems', S.K. Kataria & Sons, 2002.

4. George J. Thaler, 'Automatic Control Systems', Jaico Publishing house, 1993.

5. Ronald R. Mohler, 'Non-linear Systems, Vol. – I, Dynamics & Control', Pearson Education, 1998.

6. Hassan K. Kahalil, 'Non-linear Systems', Pearson Education, 2002.

EE 1301 POWER ELECTRONICS 3
0 0 100

AIM

To introduce the application of electronic devices for conversion, control and conditioning of electric power.

OBJECTIVES

i. To get an overview of different types of power semi-conductor devices and their switching characteristics.

ii. To understand the operation, characteristics and performance parameters of controlled rectifiers.

iii. To study the operation, switching techniques and basic topologics of DC-DC switching regulators.

iv. To learn the different modulation techniques of pulse width modulated inverters and to understand the harmonic reduction methods.

v. To know the practical application for power electronics converters in conditioning the power supply.

1. POWER SEMI-CONDUCTOR DEVICES

9

Structure, operation and characteristics of SCR, TRIAC, power transistor, MOSFET and IGBT. Driver and snubber circuits for MOSFET - Turn-on and turn-off characteristics and switching losses.

2. PHASE-CONTROLLED CONVERTERS

9

2-pulse, 3-pulse and 6-pulse converters – Inverter operation of fully controlled converter - Effect of source inductance - Distortion and displacement factor – Ripple factor - Single phase AC voltage controllers.

3. DC TO DC CONVERTERS

9

Step-down and step-up choppers - Time ratio control and current limit control - Switching mode regulators: Buck, boost, buck-boost and cuk converter - Resonant switching based SMPS.

4. INVERTERS

9

Single phase and three phase (both 120^0 mode and 180^0 mode) inverters - PWM techniques: Sinusoidal PWM, modified sinusoidal PWM and multiple PWM - Voltage and harmonic control - Series resonant inverter - Current source inverters.

5. APPLICATIONS

9

Uninterrupted power supply topologies - Flexible AC transmission systems - Shunt and series static VAR compensator - Unified power flow controller- HVDC Transmission.

L = 45 Total = 45

TEXT BOOKS

1. Muhammad H. Rashid, 'Power Electronics: Circuits, Devices and Applications', Prentice Hall of India/Pearson Education, Third edition, 2004.

2. Ned Mohan, Tore.M.Undeland, William.P.Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2003.

REFERENCE BOOKS

1. Cyril.W.Lander, 'Power Electronics', McGraw Hill International, Third edition, 1993.

2. Bimal K. Bose, 'Modern Power Electronics and AC Drives', Pearson Education, 2003.

3. Mr. Jaganathan, 'Introduction to Power Electronics', Prentice Hall of India, 2004.

EI 1301 INDUSTRIAL INSTRUMENTATION – I 3 0

0 100

AIM

To equip the students with relevant knowledge to suit the industrial requirements.

OBJECTIVES

To provide sound knowledge about various techniques used for the measurement of industrial parameters.

i. Discussion of load cells, torque meter and various velocity pick-ups.

ii. Exposure to various accelerometer pick-ups, vibrometers, density and viscosity pick-ups.

iii. To have an adequate knowledge about pressure transducers.

iv. To have an idea about the temperature standards, calibration and signal conditioning used in RTD's.

v. To have a sound knowledge about thermocouples and pyrometry techniques.

1. MEASUREMENT OF FORCE, TORQUE AND VELOCITY

7

Electric balance – Different types of load cells – Magnets – Elastic load cells - Strain gauge load cell – Different methods of torque measurement – Strain gauge, relative regular twist – Speed measurement – Revolution counter – Capacitive tacho-drag cup type tacho – D.C and A.C tacho generators – Stroboscope.

2. MEASUREMENT OF ACCELERATION, VIBRATION, DENSITY AND VISCOSITY

8

Accelerometers – LVDT, piezoelectric, strain gauge and variable reluctance type accelerometers – Mechanical type vibration instruments – Seismic instrument as an accelerometer and vibrometer – Calibration of vibration pick-ups – Units of density, specific gravity and viscosity used in industries – Baume scale, API scale – Pressure head type densitometer – Float type densitometer – Ultrasonic densitometer – Bridge type gas densitometer – Viscosity terms – Saybolt viscometer – Rotameter type.

3. PRESSURE MEASUREMENT

12

Units of pressure - Manometers – Different types – Elastic type pressure gauges – Bourdon type bellows – Diaphragms – Electrical methods – Elastic elements with LVDT and strain gauges – Capacitive type pressure gauge – Piezoresistive pressure sensor – resonator pressure sensor – Measurement of vacuum – McLeod gauge – Thermal conductivity gauges – Ionization gauge, cold cathode and hot cathode types – Testing and calibration of pressure gauges – Dead weight tester.

4. TEMPERATURE MEASUREMENT

9

Definitions and standards – Primary and Secondary fixed points – Calibration of thermometer, different types of filled in system thermometer – Sources of errors in filled in systems and their compensation – Bimetallic thermometers – Electrical methods of temperature measurement – Signal conditioning of industrial RTDs and their characteristics – three lead and four lead RTDs.

5. THERMOCOUPLES AND PYROMETERS

9

Thermocouples – Laws of thermocouple – Fabrication of industrial thermocouples – Signal conditioning of thermocouples output – Thermal block reference functions – Commercial circuits for cold junction compensation – Response of thermocouple – special techniques for measuring high temperature using thermocouples – Radiation methods of temperature measurement – Radiation fundamentals – Total radiation & selective radiation pyrometers – Optical pyrometer – Two colour radiation pyrometers.

L = 45 Total = 45

TEXT BOOKS

1. E.O. Doebelin, 'Measurement Systems – Application and Design', Tata McGraw Hill publishing company, 2003.

2. R.K. Jain, 'Mechanical and Industrial Measurements', Khanna Publishers, New Delhi,1999.

REFERENCE BOOKS

1. D. Patranabis, 'Principles of Industrial Instrumentation', Tata McGraw Hill Publishing Company Ltd, 1996.

2. A.K. Sawhney and P. Sawhney, 'A Course on Mechanical Measurements, Instrumentation and Control', Dhanpath Rai and Co, 2004.

3. B.C. Nakra & K.K.Chaudary, 'Instrumentation Measurement & Analysis', Tata McGraw Hill Publishing Ltd, 2004.

4. S.K. Singh, 'Industrial Instrumentation and Control', Tata McGraw Hill, 2003.

5. D.P. Eckman', Industrial Instrumentation', Wiley Eastern Ltd.,

EC 1311 COMMUNICATION ENGINEERING 3
0 0 100

AIM

1. To introduce the fundamental techniques of analog, digital and data communication.

2. To explain satellite and fibre optic communication and Networking systems.

OBJECTIVES

i. To understand basic signals, analog modulation, demodulation and radio receivers.

ii. To explain the characteristics and model of transmission medium.

iii. To understand source digitization, digital multiplexing and modulation.

iv. To understand data communication system and techniques.

v. To learn the basics of satellite and optical fibre communication systems.

1. MODULATION SYSTEMS

9

Time and frequency domain representation of signals, amplitude modulation and demodulation, frequency modulation and demodulation, super heterodyne radio receiver. Frequency division multiplexing. Pulse width modulation.

2. TRANSMISSION MEDIUM

9

Transmission lines – Types, equivalent circuit, losses, standing waves, impedance matching, bandwidth; radio propagation – Ground wave and space wave propagation, critical frequency, maximum usable frequency, path loss, white Gaussian noise.

3. DIGITAL COMMUNICATION

9

Pulse code modulation, time division multiplexing, digital T-carrier system. Digital radio system. Digital modulation: Frequency and phase shift keying – Modulator and demodulator, bit error rate calculation.

4. DATA COMMUNICATION AND NETWORK PROTOCOL

9

Data Communication codes, error control. Serial and parallel interface, telephone network, data modem, ISDN, LAN, ISO-OSI seven layer architecture for WAN.

5. SATELLITE AND OPTICAL FIBRE COMMUNICATIONS

9

Orbital satellites, geostationary satellites, look angles, satellite system link models, satellite system link equations; advantages of optical fibre communication - Light propagation through fibre, fibre loss, light sources and detectors.

L= 45 Total = 45

TEXT BOOKS

1. Wayne Tomasi, 'Electronic Communication Systems', Pearson Education, Third Edition, 2001.

2. Roy Blake, 'Electronic Communication Systems', Thomson Delmar, 2nd Edition, 2002.

REFERENCE BOOKS

1. William Schweber, 'Electronic Communication Systems', Prentice Hall of India, 2002.

2. G. Kennedy, 'Electronic Communication Systems', McGraw Hill, 4th edition, 2002.

3. Miller, 'Modern Electronic Communication', Prentice Hall of India, 2003.

EC 1362 MICROPROCESSOR AND MICRO CONTROLLER 3 1 0 100

AIM

To introduce Microprocessor Intel 8085 and the Micro Controller 8051

OBJECTIVES

i. To study the Architecture of 8085 & 8051.

ii. To study the addressing modes & instruction set of 8085 & 8051.

iii. To introduce the need & use of Interrupt structure.

iv. To develop skill in simple program writing.

v. To introduce commonly used peripheral / interfacing ICs – To study simple applications.

1. 8085 PROCESSOR 9

Functional block diagram - Signals – Memory interfacing – I/O ports and data transfer concepts – Timing Diagram – Interrupt structure.

2. 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 table - Subroutine instructions stack.

3. PERIPHERAL INTERFACING **9**

Study of Architecture and programming of ICs: 8255 PPI, 8259 PIC, 8251 USART, 8279 Key board display controller and 8253 Timer/ Counter – Interfacing with 8085 - A/D and D/A converter interfacing.

4. MICRO CONTROLLER 8051 **9**

Functional block diagram - Instruction format and addressing modes – Interrupt structure – Timer –I/O ports – Serial communication.

5. MICRO CONTROLLER PROGRAMMING & APPLICATIONS **9**

Data Transfer, Manipulation, Control & I/O instructions – Simple programming exercises key board and display interface – Closed loop control of servo motor-stepper motor control.

L = 45 T = 15 Total = 60

TEXT BOOKS

1. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', Wiley Eastern Ltd., New Delhi, 1995.

2. Muhammad Ali Mazidi & Janice Gilli Mazidi, 'The 8051 Micro Controller and Embedded Systems', Pearson Education, 5th Indian reprint, 2003.

REFERENCE BOOKS

1. William Kleitz, 'Microprocessor and Micro Controller Fundamental of 8085 and 8051 Hardware and Software', Pearson Education, 1998.

GE 1301 PROFESSIONAL ETHICS AND HUMAN VALUES 3 0 0 100

OBJECTIVE

(i) To create an awareness on Engineering Ethics and Human Values.

(ii) To instill Moral and Social Values and Loyalty

(iii) To appreciate the rights of Others

1. HUMAN VALUES 10

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality

2. ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

3 ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study

4 SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and chernobyl case studies.
Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

5 GLOBAL ISSUES 8

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics (Specific to a particular Engineering Discipline).

L = 45 Total =45

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in engineering", McGraw Hill, New York 1996.

2. Govindarajan M, Natarajan S, Senthil Kumar V. S, " Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCE BOOKS

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education/ Prentice Hall, New Jersey, 2004 (Indian Reprint now available)

2. Charles E Harris, Michael S. Protchard and Michael J Rabins, " Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available)

3. John R Boatright, " Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.

4. Edmund G Seebauer and Robert L Barry, " Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001 .

EI 1302 TRANSDUCER LABORATORY 0

0 3 100

AIM

The aim of this lab is to train the students in handling the different kinds of transducers like LVDT, Hall effect, Thermocouple etc., which he often meets in his study.

OBJECTIVE

By training the students in the different aspects of transducers, which are magnetic, electrical, mechanical and optical in nature, he becomes a capable and efficient technician.

1. Loading effect of potentiometer.
2. Strain gauge & load cell characteristics.

3. Capacitive transducers.
4. Photoelectric tachometer & Piezoelectric transducers.
5. Hall effect transducers.
6. Characteristics of LVDT.
7. Characteristics of thermocouple, Thermistor and LDR.
8. Step response characteristics of RTD and thermocouple.
9. P/I and I/P converters.
10. Digital transducer – shaft angle encoder.

P = 45 Total = 45

Detailed Syllabus

1. Loading effect on potentiometer

Aim

To study the loading effect on potentiometer circuit.

Objectives

i. To observe the output, input calibration curve using FET voltmeter has the output device.

ii. To observe the output, input characteristic with an voltmeter whose input impedance is finite.

iii. To observe the linearity which decreases with a decrease in the input impedance of the output meter.

Exercise

1. In the potentiometer circuit, displacement is given to the wiper arm and the corresponding output is observed with 2 meters (one is a FET voltmeter and the other is meter with a finite input impedance)

2. For various input displacements, output voltage from the two different meters are recorded and tabulated.

3. Plot the graph output Vs input displacement for both cases.

Equipment

1. Potentiometer – Linear displacement transducer kit – 1 No
2. Regulated power supply – 1 No

3. FET voltmeter, ordinary voltmeter – 1 No

2. Strain guage and load cell characteristics

Aim

To study the characteristics of strain guage and load cell.

Objectives

1. To identify and study the characteristics of strain guage and load cell.
2. To determine the sensitivity of strain guage and load cell.
3. To determine the Young's modulus and hence the guage factor of the given strain guage.

Exercise

1. Load and Unload the load cell and strain guage.
2. Measure the corresponding voltages during both loading and unloading and plot the calibration curve.
3. Find the Young's Modulus and gauge factor from the graph.

Equipment

1. Strain guage and Load cell kit. – 1 No
2. Variable power supply – 1 No
3. Loads for measurement - A set

3. Capacitive Transducers

Aim

To study the operation of capacitive transducers and use it for measurement of displacement, pressure etc.

Objectives

1. To identify and study the characteristics of capacitive transducer.
2. To operate the capacitive transducer and accurately measure the displacement in of voltage.
3. To determine the sensitivity of capacitive transducer.

Exercise

1. Change in capacitive is observed in terms of output voltage for the given input displacement.
2. Measure the output voltage for various input displacements.
3. Plot output voltage versus input displacement and determine the sensitivity of the capacitive transducer.

Equipment

1. Capacitive transducer – 1 No
2. Regulated power supply – 1 No

4(a) Characteristics of Photoelectric tachometer

Aim

To study the characteristics of photoelectric tachometer using the servo motor speed control trainer kit.

Objective

1. To calculate the number of pulses generated in the photoelectric pick up.
2. To study the variation of speed with the variation of the input voltage.

Exercise

1. Connect the circuit as per instructions given in the manual.
2. Adjust the power supply.
3. Vary the speed of the motor by using rotary potentiometer and note down the readings.
4. Calculate number of pulses generated in the photoelectric pick up.
5. Draw the graph between voltage and speed.

Equipments

1. Speed control trainer kit – 1 No
2. Power supply – 1 No
3. Wires - Some

4. Multimeter – 1 No

4(b) Piezoelectric transducer

Aim

To study the characteristics of piezoelectric transducer.

Objective

1. To measure acceleration in both the directions using piezoelectric transducer.
2. To find the voltage sensitivity of the piezoelectric transducer.
3. To find the response of the piezoelectric transducer.

Exercise

1. Generate the vibrations from vibration excitor.
2. Note down the output voltage from the piezoelectric transducer.
3. Tabulate the readings for various frequencies.
4. Plot the response.

Equipment

1. Piezoelectric transducer – 1 No
2. Vibration excitor – 1 No
3. Voltmeter – 1 No
4. Power supply – 1 No

5. Hall effect Transducer

Aim

To study the characteristics of Hall effect transducer.

Objective

1. To determine the positive hall voltage at the bottom of the transducer.
2. To determine the negative hall voltage.
3. To identify and study the characteristics of Hall effect transducer.
4. To measure the displacement of a structural element .

Exercise

1. Study the internal configuration of Hall effect IC.
2. Patch the circuit diagram as per patching diagram.

3. Place the north pole of the magnet above the scale and take the reading air gap between hall IC and magnet to output voltage.
4. Place the south pole of the magnet above the scale and take the reading for different distances and plot the graph between air gap voltmeter readings.

Equipments

1. Hall effect characteristics trainer – 1 No
2. Power supply – 1 No
3. Voltmeter – 1 No

6. Characteristics of LVDT

Aim

To study the operation and characteristics of LVDT

Objective

1. To study the displacement of the core from its null position.
2. To study the variation of output voltage with change in displacement.

Exercise

1. Adjust the potentiometer knob present in the LVDT kit to bring the core to Null position (set the output voltage to be '0' volts)
2. Rotate the knob in the positive direction such that the LVDT scale moves in steps of 1cm and measure the corresponding output voltage.
3. Tabulate the readings.
4. Repeat the above procedure for negative displacement.
5. Plot the characteristic curve between displacement and output voltage.

Equipments

1. LVDT trainer kit – 1 No
2. Power supply – 1 No

7(a) Characteristics of Thermocouple

Aim

To determine the characteristics of thermocouple.

Objectives

To determine the voltage for corresponding change in temperature.

Exercise

1. Measure the initial temperature and temperature of boiling water (100^0C)
2. Calibrate the thermocouple in the hot water and measure the 5^0C temperature fall in thermocouple.
3. The output voltage is noted for corresponding fall in temperature.

Equipment

1. Thermocouple trainer kit – 1 No
2. Thermocouple – 1 No
3. Voltmeter – 1 No
4. Heater – 1 No

7(b) Characteristics of thermistor

Aim

To determine the characteristics of thermistor

Objectives

To measure the resistance value for the corresponding changes in temperature.

Exercise

1. Measure the initial temperature of water.
2. Take another vessel full of water and boil it to100^0C.
3. Note down the readings for every 5^0C fall of temperature in thermistor, thermometer and output voltage readings.
4. Plot the Thermistor characteristics.

Equipments

1. Thermistor Trainer kit – 1 No
2. Heater – 1 No
3. Thermistor – 1 No
4. Thermometer – 1 No
5. Voltmeter – 1 No

7(c) Characteristics of LDR

Aim

To determine the characteristics of LDR

Objectives

1. To determine the change in resistance for corresponding change in light intensity.
2. To determine the output voltage for corresponding change in voltage.

Exercise

1. The lamp for LDR is selected by using a select switch.
2. Initially the lamp is kept away from LDR.
3. Now the distance is decreased gradually and the corresponding values of voltages and resistances are taken.
4. Repeat the above steps for various positions of lamp.

Equipments

1. Photo conductive trainer kit – 1 No
2. Multimeter – 1 No
3. Connecting wires – 1 No

8. Step response characteristics of RTD and Thermocouple

Aim

To study the step response characteristic of RTD and thermocouple.

Objective

a. To analyse the change in temperature due to change in emf in case of thermocouple.

b. To analyse the change in temperature due to change in resistance in case of RTD.

c. To observe the transients when step input [i.e sudden change in the input] is given.

Exercise

1. Calibrate the RTD and thermocouple at room temperature and 100^0C alternatively.

2. Bring down the sensor to room temperature and provide a sudden change of input temperature to boiling point (i.e) 100^0C.
3. Start the stop clock and tabulate the time taken for every 5^0C rise of temperature.
4. Plot the step response for both the sensors.

Equipment

1. Thermocouple and RTD trainer kit – 1 No
2. Thermometer – 1 No
3. Heater – 1 No
4. Thermocouple and RTD sensors – 1 No
5. Voltmeters – 1 No

9. P/I and I/P Converters

Aim

To study the characteristics of P/I and I/P converters.

Objective

1. To convert the given input pressure to corresponding current output using a P/I converter.
2. To convert the given input current to corresponding pressure output using a I/P converter.

Exercise

P/I converter

1. Connect the P/I converter to the pressure source.
2. Set the pressure range to 3-15 psi using the regulator unit.
3. By varying the pressure range note down the values of the current meter.
4. Plot the graph by taking pressure in x-axis and current in y-axis.

I/P converter

1. Connect the I/P converter to pressure source.
2. Set the pressure range to 20psi using the regulator unit.
3. Vary the input current (4-20) mA using potentiometer and note down the reading using ammeter.

4. Note down the value opening (stem position) in % or in mm.
5. Calculate the output pressure using the valve opening.
6. By repeating above steps, tabulate the readings.
7. Plot the graph by taking current in x-axis and pressure in y-axis.

Equipment

1. P/I trainer kit – 1 No
2. I/P trainer kit – 1 No
3. Pressure source – 1 No
4. Control valve etc – 1 No

10. Digital transducer – shaft angle encoder

Aim

To study the operation of shaft angle encoder and use it for measurement of angular position.

Objectives

1. Linear of angular displacements can be converted into digital signal by having digital encoders.

2. Shaft angle encoders can be used for a total angular displacement of 360^0.

Exercise

1. The length of the scale of a translational encoder becomes the circumference of circle on a flat disc of a shaft encoder.

2. The scale is scanned radially and a binary 0 or 1 is obtained from each track depending upon angular position of disc.

3. The accuracy depends upon the number of brakes and if there are n tracks the accuracy obtained is $360^0 / 2^n$

Equipments

1. Digital shaft angle encoder – 1 No
2. Regulated power supply – 1 No

EC 1314 INTEGRATED CIRCUITS LABORATORY 0

0 3 100

AIM

To study various digital & linear integrated circuits used in simple system configuration.

1. Study of Basic Digital IC's.
(Verification of truth table for AND, OR, EXOR, NOT, NOR, NAND, JK FF, RS FF,
D FF)

2. Implementation of Boolean Functions, Adder/ Subtractor circuits.

3a) Code converters, Parity generator and parity checking, Excess 3, 2s Complement, Binary
to grey code using suitable IC's .

3(b) Encoders and Decoders: Decimal and Implementation of 4-bit shift registers in SISO,SIPO,PISO,PIPO modes using suitable IC's.

4. Counters: Design and implementation of 4-bit modulo counters as synchronous and
asynchronous types using FF IC's and specific counter IC.

5 Shift Registers:
Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.

6 Multiplex/ De-multiplex
Study of 4:1; 8:1 multiplexer and Study of 1:4; 1:8 demultiplexer

7 Timer IC application.
Study of NE/SE 555 timer in Astable, Monostable operation.

8. Application of Op-Amp-I
Slew rate verifications, inverting and non-inverting amplifier,
Adder, comparator, Integrater and Differentiator.

9 Study of Analog to Digital Converter and Digital to Analog Converter: Verification of
A/D conversion using dedicated IC's.

10 Study of VCO and PLL ICs
i. Voltage to frequency characteristics of NE/ SE 566 IC.
ii. Frequency multiplication using NE/SE 565 PLL IC.

P = 45 Total = 45

Detailed Syllabus

1. Study of Basic Digital IC's.
(Verification of truth table for AND, OR, EXOR, NOT, NOR, NAND, JK FF, RS FF,
D FF)

Aim

To test of ICs by using verification of truth table of basic ICs.

Exercise

1. Breadboard connection of ICs with truth table verification using LED's.

2. Implementation of Boolean Functions, Adder/ Subtractor circuits. [Minimisation using K-map and implementing the same in POS, SOP from using basic gates]

Aim

Minimization of functions using K-map implementation and combination Circuit.

Exercise

1. Realization of functions using SOP, POS, form.

2. Addition, Subtraction of atleast 3 bit binary number using basic gate IC' s.

3a) Code converters, Parity generator and parity checking, Excess 3, 2s Complement, Binary to grey code using suitable IC's .

Aim

Realizing code conversion of numbers of different bar.

Exercise

1 Conversion Binary to Grey, Grey to Binary;
1's. 2's complement of numbers addition, subtraction,

2. Parity checking of numbers using Gates and with dedicated IC's

3b) Encoders and Decoders: Decimal and Implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.

Exercise

1. Decimal to binary Conversion using dedicated IC's.

2. BCD – 7 Segment display decoder using dedicated decoder IC& display.

4. Counters: Design and implementation of 4-bit modulo counters as synchronous and asynchronous types using FF IC's and specific counter IC.

Aim

Design and implementation of 4 bit modulo counters.

Exercise

1. Using flipflop for up-down count synchronous count.
2. Realization of counter function using dedicated ICs.

5. Shift Registers

Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.

Aim

Design and implementation of shift register.

Exercise

1. Shift Register function realization of the above using dedicated IC's For SISO, SIPO, PISO, PIPO, modes of atleast 3 bit binary word.

2. Realization of the above using dedicated IC's.

6. Multiplex/ De-multiplex.
Study of 4:1; 8:1 multiplexer and Study of 1:4; 1:8 demultiplexer

Aim

To demonstrate the addressing way of data channel selection for multiplex De-multiplex operation.

Exercise

1. Realization of mux-demux functions using direct IC's.
2. Realization of mux-demux using dedicated IC's for 4:1, 8:1, and vice versa.

7. Timer IC application. Study of NE/SE 555 timer in Astable, Monostable operation.

Aim

To design a multi vibrater circuit for square wave and pulse generation.

Exercise

1. Realization of Astable multivibrater & monostable multivibrater circuit using Timer IC.
2. Variation of R, C, to vary the frequency, duty cycle for signal generator.

8. Application of Op-Amp-I
Slew rate verifications, inverting and non-inverting amplifier,
Adder, comparator, Integrater and Differentiator.

Aim

Design and Realization of Op-Amp application.

Exercise

1. Verification of Op-Amp IC characteristics.
2. Op-Amp IC application for simple arithmetic circuit.
3. Op-Amp IC application for voltage comparator wave generator and wave shifting circuits.

9. Study of Analog to Digital Converter and Digital to Analog Converter: Verification of
A/D conversion using dedicated IC's.

Aim

Realization of circuit for digital conversions.

Exercise

1. Design of circuit for analog to digital signal conversion using dedicated IC's.
2. Realization of circuit using dedicated IC for digital analog conversion.

10. Study of VCO and PLL ICs
i). Voltage to frequency characteristics of NE/ SE 566 IC.
ii). Frequency multiplication using NE/SE 565 PLL IC.

Aim

Demonstration of circuit for communication application

Exercise

1. To realize V/F conversion using dedicated IC's vary the frequency of the generated signal.

2. To realize PLL IC based circuit for frequency multiplier, divider.

GE 1303 COMMUNICATION SKILLS AND TECHNICAL SEMINAR

OBJECTIVE

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for a duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews.

IC 1351 PROCESS CONTROL 3
1 0 100

AIM

To provide basic knowledge of controllers, find control elements and the processes.

OBJECTIVES

i. To study the basic characteristics of first order and higher order processes.

ii. To get adequate knowledge about the characteristics of various controller modes and methods of tuning of controller.

iii. To study about various complex control schemes.

iv. To study about the construction, characteristics and application of control valves.

v. To study the five selected unit operations and a case study of distillation column control.

1. MATHEMATICAL MODELLING OF PROCESSES

9

Need for process control – Mathematical model of first order liquid level and thermal processes – Higher order process – Process with dead time, process with inverse response – Interacting and non-interacting systems – Continuous and batch process – Servo and regulator operation.

2. CONTROLLER CHARACTERISTICS & TUNING

9

Basic control action – Characteristics of ON-OFF, proportional, integral and derivative control modes – Composite control modes – P+I, P+D and P+I+D control modes – Electronic controllers to realize various control actions – Evaluation criteria – IAE, ISE, ITAE and ¼ decay ratio – Tuning of controllers – Ziegler-Nichol's method and cohencoon method – Damped oscillation method.

3. CONTROL SYSTEMS WITH MULTIPLE LOOPS

9

Cascade control – Feed forward control – Ratio control – Selective control systems – Split range control – Adaptive and inferential control.

4. FINAL CONTROL ELEMENT

9

I/P converter – Pneumatic and electric actuators – Valve positioner – Control valves characteristics – Classification of control valves – Control valve sizing – Cavitation and flashing – Selection of control valves.

5. SELECTED UNIT OPERATIONS

9

Mixing – Evaporation – Drying – Heat exchanger – Distillation process – Case study of control schemes of binary distillation column.

L = 45 T = 15 Total = 60

TEXT BOOKS

1. Donald P. Eckman, 'Automatic Process Control', Wiley Eastern Ltd., New Delhi, 1993.

2. G. Stephanopoulis, 'Chemical Process Control', Prentice Hall of India, New Delhi, 1990.

REFERENCE BOOKS

1. B.G. Liptak, 'Process Control', Chilton Book Company, 1994.

2. Curtis D. Johnson, 'Process Control Instrumentation Technology', 7th Edition, Pearson Education, New Delhi, 2002 / PHI.

3. J.G. Balchen and K.J. Mumme, 'Process Control Structures and Application', Van nostrand Reinhold Co., New York, 1988.

EI 1351 BIO–MEDICAL INSTRUMENTATION 3 0 0 100

AIM

The course is designed to make the student acquire an adequate knowledge of the physiological systems of the human body and relate them to the parameters that have clinical importance. The fundamental principles of equipment that are actually in use at the present day are introduced.

OBJECTIVES

i. To provide an acquaintance of the physiology of the heart, lung, blood circulation and circulation respiration. Methods of different transducers used.

ii. To introduce the student to the various sensing and measurement devices of electrical origin.

iii. To provide the latest ideas on devices of non-electrical devices.

iv. To bring out the important and modern methods of imaging techniques.

v. To provide latest knowledge of medical assistance / techniques and therapeutic equipments.

1. PHYSIOLOGY AND TRANSDUCERS

9

Cell and its structure – Action and resting – Potential propagation of action potential – Sodium pump – Nervous system – CNS – PNS – Nerve cell – Synapse – Cardio pulmonary system – Physiology of heart and lungs – Circulation and respiration – Transducers – Different types – Piezo–electric, ultrasonic, resistive, capacitive, inductive transducers – selection criteria.

2. ELECTRO – PHYSIOLOGICAL MEASUREMENTS

9

Basic components of a biomedical system – Electrodes – Micro, needle and surface electrodes – Amplifiers – Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier.

ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms.

3. NON-ELECTRICAL PARAMETER MEASUREMENTS

9

Measurement of blood pressure – Cardiac output – Cardiac rate – Heart sound – Respiratory rate – Gas volume – Flow rate of Co_2, O_2 in exhaust air - pH of blood, ESR, GSR measurements – Plethysmography.

4. MEDICAL IMAGING AND PMS

9

X-ray machine - Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography – Different types of biotelemetry systems and patient monitoring – Electrical safety**.**

5. ASSISTING AND THERAPEUTIC EQUIPMENTS

9

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dializers.

L = 45 Total = 45

TEXT BOOKS

1. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II edition, Pearson Education, 2002 / PHI.

2. R.S.Khandpur, 'Hand Book of Bio-Medical instrumentation', Tata McGraw Hill Publishing Co Ltd., 2003.

REFERENCE BOOKS

1. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.

2. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley & Sons, 1975.

3. J.Webster, 'Medical Instrumentation', John Wiley & Sons, 1995.

4. C.Rajarao and S.K. Guha, 'Principles of Medical Electronics and Bio-medical Instrumentation', Universities press (India) Ltd, Orient Longman ltd, 2000.

5. S.K. Gupta, 'Introduction to Medical Electronics', Bharathi Bhavan, Patna, 1969.

EI 1352 ANALYTICAL INSTRUMENTS 3
0 0 100

AIM

The course is designed to equip the students with an adequate knowledge of a number of analytical tools which are useful for clinical analysis in hospitals, drugs and pharmaceutical laboratories and above all for environmental Pollution Monitoring and Control.

OBJECTIVES

i. To provide various techniques and methods of analysis which occur in the various regions of the spectrum. These are the powerful tools used in Clinical and Research laboratories.

ii. To give unique methods of separation of closely similar materials, the most powerful being gas chromatography.

iii. To study important methods of analysis of industrial gases. Awareness and control of pollution in the environment is of vital importance.

iv. To bring out the latest ideas on ion-selective electrodes as well as biosensors which have potential applications in medical field, food and beverage industries.

v. To provide the important radio chemical methods of analysis. Further they are both sensitive and specific and often are characterized by good accuracy. NMR & ESR techniques are useful in structure determination.

1. COLORIMETRY AND SPECTROPHOTOMETRY

10

Special methods of analysis – Beer-Lambert law – Colorimeters – UV-Vis spectrophotometers – Single and double beam instruments – Sources and detectors – IR Spectrophotometers – Types – Attenuated total reflectance flame photometers – Atomic absorption spectrophotometers – Sources and detectors – FTIR spectrophotometers – Flame emission photometers.

2. CHROMATOGRAPHY

8

Different techniques – Gas chromatography – Detectors – Liquid chromatographs – Applications – High-pressure liquid chromatographs – Applications.

3. INDUSTRIAL GAS ANALYZERS AND POLLUTION MONITORING INSTRUMENTS

9

Types of gas analyzers – Oxygen, NO_2 and H_2S types, IR analyzers, thermal conductivity analyzers, analysis based on ionization of gases. Air pollution due to carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation - Dust and smoke measurements.

4. pH METERS AND DISSOLVED COMPONENT ANALYZERS

8

Principle of pH measurement, glass electrodes, hydrogen electrodes, reference electrodes, selective ion electrodes, ammonia electrodes, biosensors, dissolved oxygen analyzer – Sodium analyzer – Silicon analyzer.

5. RADIO CHEMICAL AND MAGNETIC RESONANCE TECHNIQUES

10

Nuclear radiations – Detectors – GM counter – Proportional counter – Solid state detectors – Gamma cameras – X-ray spectroscopy – Detectors – Diffractometers – Absorption meters – Detectors. NMR – Basic principles – NMR spectrometer - Applications. Mass spectrometers – Different types – Applications.

L = 45 Total = 45

TEXT BOOKS

1. R.S. Khandpur, 'Handbook of Analytical Instruments', Tata McGraw Hill publishing Co. Ltd., 2003.

2. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, 'Instrumental Methods of Analysis', CBS publishing & distribution, 1995.

REFERENCE BOOKS

1. Robert D. Braun, 'Introduction to Instrumental Analysis', McGraw Hill, Singapore, 1987.

2. G.W. Ewing, 'Instrumental Methods of Analysis', McGraw Hill, 1992.

3. D.A. Skoog and D.M. West, 'Principles of Instrumental Analysis', Holt, Saunders Publishing, 1985.

4. C.K. Mann, T.J. Vickers & W.H. Gullick, 'Instrumental Analysis', Harper and Row publishers, 1974.

EI 1353 INDUSTRIAL INSTRUMENTATION – II 3 0 0 100

AIM

To equip the students with relevant knowledge to suit the industrial requirement.

OBJECTIVES

i. To study about humidity and moisture measurements.

ii. To study about mechanical flow meters and their installation.

iii. To study about area flow meters, mass flow meters and calibration.

iv. To know elaborately about non-content type flow meters.

v. To know about various types of level measurements adopted in industry environment.

1. MEASUREMENT OF HUMIDITY & MOISTURE

8

Humidity terms – Dry and wet bulb psychrometers – Hot wire electrode type hygrometer – Dew cell – Electrolysis type hygrometer – Commercial type dew point meter – moisture terms – Different methods of moisture measurement – Moisture measurement in granular materials, solid penetrable materials like wood, web type material.

2. MECHANICAL TYPE FLOW METERS

8

Theory of fixed restriction valuable head type flow meters –Orifice plate – Venturi tube – Flow nozzle – Dall tube – Installation of head flow meters – Piping arrangement for different fluids – Pitot tube.

3. QUANTITY METERS, AREA FLOW METERS AND MASS FLOW METERS

10

Positive displacement flow meters – Constructional details and theory of operation of mutating disc, reciprocation piston, oval gears and helix type flow meters – Inferential meter – Turbine flow meter – Rotameter – Theory and installation – Angular momentum mass flow meter – Coriolis mass flow meters – Thermal mass flow meters – Volume flow meter plus density measurement – Calibration of flow meters – Dynamic weighing method.

4. ELECTRICAL TYPE FLOW METER

10

Principle and constructional details of electromagnetic flow meter – Different types of excitation schemes used – Different types of ultrasonic flow meters – Laser Doppler anemometer systems – Vortex shedding flow meter – Target flow meter – Solid flow rate measurement – Guidelines for selection of flow meter.

5. LEVEL MEASUREMENT

9

Gauge glass techniques coupled with photoelectric readout system – Float type level indication – Different schemes – Level switches, level measurement using displacer and torque tube – Bubble system. Boiler drum level measurement – Differential pressure method – Hydra step systems – Electrical types of level gauges using resistance, capacitance, nuclear radiation and ultrasonic sensors.

L = 45 Total = 45

TEXT BOOKS

1. D. Patranabis, 'Principles of Industrial Instrumentation', Tata McGraw Hill, New Delhi, 1999.

2. R.K. Jain, 'Mechanical & Industrial Measurements', Khanna publishers, New Delhi, 1999.

REFERENCE BOOKS

1. A.K. Sawhney and P. Sawhney, 'A Course on Mechanical Measurement, Instrumentation and Control', Dhanpat Rai and Co, 2004.

2. D.P. Eckman, 'Industrial Instrumentation', Wiley Eastern Limited, 1975.

3. Alan S. Morris, 'Principles of Measurement and Instrumentation', Prentice Hall of India,2003.

4. B.C. Nakra and K.K. Chaudry, 'Instrumentation, Measurement and Analysis', Tata McGraw Hill, 2004.

5. B.G.Liptak, 'Instrument Engineers Hand Book (Measurement)', Chilton Book Co., 1994.

EC 1361 DIGITAL SIGNAL PROCESSING 3
1 0 100

AIM

To introduce the concept of analyzing discrete time signals & systems in the time and frequency domain.

OBJECTIVES

i. To classify signals and systems & their mathematical representation.

ii. To analyse the discrete time systems.

iii. To study various transformation techniques & their computation.

iv. To study about filters and their design for digital implementation.

v. To study about a programmable digital signal processor & quantization effects.

1. INTRODUCTION

9

Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect. Digital signal representation, analog to digital conversion.

2. DISCRETE TIME SYSTEM ANALYSIS

9

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, frequency response – Convolution – Fourier transform of discrete sequence – Discrete Fourier series.

3. DISCRETE FOURIER TRANSFORM & COMPUTATION

9

DFT properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT & DIF - FFT using radix 2 – Butterfly structure.

4. DESIGN OF DIGITAL FILTERS

9

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics.

IIR design: Analog filter design - Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation - Warping, prewarping - Frequency transformation.

5. PROGRAMMABLE DSP CHIPS

9

Architecture and features of TMS 320C54 signal processing chip – Quantisation effects in designing digital filters.

L = 45 T = 15 Total = 60

TEXT BOOKS

1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, 2003 / PHI.

2. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', Tata McGraw Hill, New Delhi, 2001.

REFERENCE BOOKS

1. Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, 'Discrete – Time Signal Processing', Pearson Education, New Delhi, 2003.

2. B. Venkataramani, M. Bhaskar, 'Digital Signal Processors, Architecture, Programming and Applications', Tata McGraw Hill, New Delhi, 2003.

3. S. Salivahanan, A. Vallavaraj, C. Gnanapriya, 'Digital Signal Processing', Tata McGraw Hill, New Delhi, 2003.

4. Texas TMS 320C54X user manual (website).

MG 1351 PRINCIPLES OF MANAGEMENT 3 0

0 100

OBJECTIVE

Knowledge on the principles of management is essential for all kinds of people in all kinds of organizations. After studying this course, students will be able to have a clear understanding of the managerial functions like planning, organizing, staffing, leading and controlling. Students will also gain some basic knowledge on international aspect of management.

1 HISTORICAL DEVELOPMENT

9

Definition of Management – Science or Art – Management and Administration – Development of Management Thought – Contribution of Taylor and Fayol – Functions of Management – Types of Business Organisation.

2 PLANNING

9

Nature & Purpose – Steps involved in Planning – Objectives – Setting Objectives – Process of Managing by Objectives – Strategies, Policies & Planning Premises- Forecasting – Decision-making.

3 ORGANISING

9

Nature and Purpose – Formal and informal organization – Organization Chart – Structure and Process – Departmentation by difference strategies – Line and Staff authority – Benefits and Limitations – De-Centralization and Delegation of Authority – Staffing – Selection Process - Techniques – HRD – Managerial Effectiveness.

4 DIRECTING

9

Scope – Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques – Job Enrichment – Communication – Process of Communication – Barriers and Breakdown – Effective Communication – Electronic media in Communication.

5 CONTROLLING

9

System and process of Controlling – Requirements for effective control – The Budget as Control Technique – Information Technology in Controlling – Use of computers in handling the information – Productivity – Problems and Management – Control of Overall Performance – Direct and Preventive Control – Reporting – The Global Environment – Globalization and Liberalization – International Management and Global theory of Management.

L = 45 Total = 45

TEXT BOOKS

1. Harold Kooritz & Heinz Weihrich “Essentials of Management”, Tata Mcgraw Hill,1998.

2. Joseph L Massie “Essentials of Management”, Prentice Hall of India, (Pearson) Fourth Edition, 2003.

REFERENCE BOOKS

1 Tripathy PC And Reddy PN, " Principles of Management", Tata Mcgraw Hill,1999.

2. Decenzo David, Robbin Stephen A, "Personnel and Human Reasons Management",
Prentice Hall of India, 1996.

3. JAF Stomer, Freeman R. E and Daniel R Gilbert Management, Pearson Education,
Sixth Edition, 2004.

4. Fraidoon Mazda, " Engineering Management",Addison Wesley,-2000.

IC 1352 PROCESS CONTROL LABORATORY 0 0 3 100

AIM

To experimentally verify the process control concepts on the selected process control loops.

1. Study of interacting and non-interacting systems.
2. Response of different order processes with and without transportation lag.
3. Response of P+I+D controller.
4. Characteristics of control valve with and without positioner.
5. Closed loop response of flow control loop.
6. Closed loop response of level control loop.
7. Closed loop response of temperature control loop.
8. Closed loop response of pressure control loop.
9. Tuning of PID controller.
10. Response of cascade control system.

P = 45 Total = 45

Detailed Syllabus

1. Study of interacting and non- interacting systems

Aim

To study the operation of interacting and non- interacting systems

Exercise

1. Connect the two tank system (Level process) in series (as non- interacting system)

2. Check whether level in tank is affected due to changes made in the second tank.

3. Connect the two tank system in series (as interfacing as system).

4. Check whether level in tank 1 is affected due to changes made in the second tank.

5. Determine the transfer function of individual and overall system.

Equipment

1. Two tank system with provision for making them as interfacing and non-interfacing. – 1 No

2. Level transmitters – 1 No

3. Recorder – 1 No

2. Response of different order processes with and without transportation delay

Aim

To determine the transient response of a first order process with and without transportation delay and second order process with and without transportation delay to step change in input.

Exercise

1. Record the transient response to a step change of first order process and second order process (Level or thermal (or) any process) with and without transportation lag.

2. Calculate the process gain, time constant and dead time of the process from the step response.

Equipment

1. Two tank system with provision for transportation delay (Non – interacting process)

2. Level transmitter – 1 No

3. Recorder – 1 No

3. Response of P+I+D controller

Aim

To investigate the operation of an electronic controllers with P, P+I and P+I+D action.

Exercise

1. Plot the response of P, P+I, P+D and P+I+D controllers to step and ramp inputs.
2. Determine the calibration of the proportional, Integral and derivative adjustments.

Equipment

1. Electronic PID controller – 1 No
2. Source for generating step and ramp inputs – 1 No
3. Recorder – 1 No
4. Digital Multimeter – 1 No

4. Characteristics of control valve with and without valve positioner

Aim

To determine the flow – lift characteristics (Internet / Installed) of a control valve equipped with and without valve positioner.

Exercise

1. Plot the flow – lift characteristics of the given valve without positioner keeping
   (i) Constant ΔP
   (ii) Variable ΔP
2. Compute the valve gain at different operating points.
3. Plot the flow – lift characteristics of the given with positioner keeping.
   i. Constant ΔP
   ii. Variable ΔP
4. Compute the valve gain at different operating points.

Equipment

1. Control valve trainer (with position for varying ΔP across the valve) - 1 No
2. Flowmeter - 1 No

5. Closed loop response of flow control loop

Aim

To obtain the closed loop response of flow control loop for servo and regulator operation.

Exercise

1. Closed – loop connection is made in the flow process station.
2. The flow controller (P+I) is tuned using any one of the tuning techniques.
3. The response of the control loop is obtained for changes in the set point.
4. The response of the control loop is obtained for changes in the load variable.
5. The step 3 and 4 are repeated for different controller modes and settings.

Equipment

1. Flow process station with all accessories - 1 No
2. Analog / Digital PID controller - 1 No
3. Recorder - 1 No

6. Closed loop response of level control loop

Aim

To obtain the closed loop response of level control loop for servo and regulator operation.

Exercise

1. Closed loop connection is made in the level process station.
2. The level controller (P+I) is tuned using any one of the tuning techniques.

3. The response of the control loop is obtained for changes in the set point.

4. The response of the control loop is obtained for changes in the load variable.

5. The step 3 and step 4 are repeated for different controller modes and settings.

Equipment

1. Level process station with all accessories - 1 No
2. Analog / Digital PID controller - 1 No
3. Recorder - 1 No

7. Closed loop response of temperature control loop

Aim

To obtain the closed loop response of temperature control loop for servo and regulator operation.

Exercise

1. Closed-loop connection is made in the temperature process station.

2. The temperature controller (P+I+D) is tuned using any one of the tuning techniques.

3. The response of the control loop is obtained for changes in the set point.

4. The response of the control loop is obtained for changes in the load variable.

5. The step 3 and 4 are repeated for different controller modes and settings.

Equipment

1. Temperature process station with all accessories - 1 No
2. Analog / Digital PID controller - 1 No
3. Recorder - 1 No

8. Closed loop response of pressure control loop

Aim

To obtain the closed loop response of pressure control loop for servo and regulator operation.

Exercise

1. Closed – loop connection is made in the pressure process station.

2. The pressure controller (P+I) is tuned using any one of the tuning techniques.
3. The response of the control loop is obtained for changes in the set point.

4. The response of the control loop is obtained for changes in the load variable.

5. The step 3 and 4 are repeated for different controller modes and settings.

Equipment

1. Pressure process station with all accessories - 1 No

2. Analog / Digital PID controller - 1 No

3. Recorder - 1 No

9. Tuning of PID controller

Aim

To determine the controller settings of a given process using two popular tuning
techniques.

Exercise

1. Plot the process reaction curve for the given process (higher order process)

2. From the reaction curve, calculate the process gain, time constant and dead time using the above process parameters calculate the K_c, Ti, T_d valves using the appropriate thumb rules.

3. Conduct the closed loop test as per Z-N method [continuous cycling method] and determine the ultimate gain (K_u) and ultimate period (P_u), calculate the controller parameters (K_c, T_i, T_d) using Ziegler Nichol's closed loop tuning approach.

Equipment

1. Process control trainer / real time process (level / thermal process) - 1 No

2. Recorder - 1 No

3. PID controller - 1 No

10. Response of cascade control system

Aim

To determine the closed loop performance of a cascade control system and compare it with that of conventional control system.

Exercise

1. The secondary and primary controllers are tuned using any one of the tuning techniques.

2. Obtain the closed loop response of cascade control system with the load variable entering the inner loop.

3. Obtain the closed loop regulating response with conventional control system.

4. Compare the performance of conventional control system and cascade control system internal of peak overshoot, setting time, I&E etc

Equipment

1. Cascade control system with flow as inner variable and liquid level as outer variable with following accessories.

2. Level transmitter - 1 No

3. Flow transmitter - 1 No

4. Control valve - 1 No

5. Analog / Digital PID controller - 1 No

6. Recorder - 1 No

EI 1354 INDUSTRIAL INSTRUMENTATION LABORATORY 0 0 3 100

AIM

This purpose of training in this lab is to impart an adequate knowledge and expertise to handle equipment generally available in an industry.

OBJECTIVE

The training gained by the student in this area will be of immerse help and ease for him in any industrial establishment.

1. Measurement of flow using Venturi meter and orifice meter.
2. Calibration of Pressure gauge.
3. Calibration of Temperature sensor.
4. Torque measurement.
5. Viscosity measurement.
6. Level measurement using d/p transmitter.
7. UV – visible spectrophotometer.
8. pH meter standardization and measurement of pH values of solutions.
9. ECG analyzer.
10. Measurement of pulse rate/respiration rate.

P = 45 Total = 45

Detailed Syllabus

1. Measurement of Flow Using Venturimeter And Orifice Meter

Aim

To measure the flowrate using venturimeter and orifice meter.

Exercise

Find the discharge co-efficient C_d.

Procedure

1. Open the outlet value completely and switch on the motor.
2. Now open the inlet value.
3. With a particular operating a the inlet value note the reading on two time of manometer and computer the value of x.
4. Compute the actual discharge using the collecting task and stop watch and the theoretical discharge.
5. Now change the opening of the inlet values and note the reading of monometer and compare and discharge.
6. Calculate the value of C_d.

Equipment

1. Venturimeter – 1 No
2. Orifice meter – 1 No
3. Stopwatch – 1 No

2. Calibration Of Pressure Gauge

Aim

To calibrate the given pressure gauge using dead weight tester.

Exercise

Calibrate the pressure gauge and discuss the graphs (i) Actual pressure Vs true pressure (ii) Actual pressure Vs Error

Procedure

1. A standard weight of 0.5 Kg/cm^2 is kept on the piston plate form.
2. Pressure is applied to the chamber containing oil by rotating the hand operated wheel in the anti clock wise direction.
3. This is continued until piston carrying weight shows a list.
4. In the movement the pressure acts equally on the piston as well as on the gauge.
5. The reading shown by the gauge is taken as actual reading.
6. The same procedure is repeated for increasing weights on the platform in steps of 0.5 Kg/cm^2 and actual reading shown by the gauge is noted down.
7. Graphs are drawn between
   i. Actual pressure Vs true pressure.
   ii. Actual pressure Vs Error.

Equipment

1. Dead weight tester - 1 No
2. Pressure gauge and standard weight - 1 No

3. Calibration Of Temperature Sensor

Aim

To calibrate the given theromocouple using a standard thermocouple.

Exercise

Calibrate the given thermocouple and draw the graph between the response of standard thermocouple and calibrated thermocouple.

Procedure

1. Water bath is filled cooling water.
2. Both the std thermocouple and thermocouple and thermocouple to be calibrate are placed in separate holes drilled in a water location inside the given water bath.
3. At room temperature note the standard thermocouple and the readings of the thermocouple to be calibrated.
4. Switch the thermocouple 'on' and to every 5^0C rise in temperature note the thermocouple readings.
5. The above readings are tabulated and % error is determined.
6. The graph is drawn between the response of standard thermocouple and calibrated thermocouple.

Equipment

1. Water bath – 1 No
2. Thermocouple – 1 No
3. Heater – 1 No
4. Stirrer – 1 No
5. Measuring meter – 1 No

4. Torque Measurement

Aim

To determine the due to dead weights using strain torsion meter and to determine the unknown weight.

Exercise

Find the % error of the torque measurement.

Procedure

1. Connect the strain gauge torsion meter to the power supply.

2. Now change or hanger is fixed to the shift, the torque is to subject.
3. Now keep the dead weights in the hanger gently.
4. Note the indicated torque value from the strain gauge torsion indicator.
5. Repeat the same for different weights (say 1Kg, 2Kg,) and tabulate the readings.
6. Now repeat the same procedure for the given unknown weight.
7. The unknown weight is interpreted from graph.

Equipment

1. Strain gauge torsion meter – 1 No
2. Dead weight – 1 No

5. Measurement Of Viscosity Using Saybolt Viscometer

Aim

To measure the viscosity using saybolt viscometer.

Exercise

Measure the viscosity using saybolt viscometer and draw the graph between voltage on x-axis and dynamo viscosity on y-axis.

Procedure

1. Viscosity determination shall be done in room free from dust rapid changes in temperature.
2. The oil in the cup and allow it to drain.
3. Pour oil in the cup and allow it to drain.
4. The cark stopper should be installed at the lower and of the tube.
5. The cark should be tight enough to prevent escape of oil.
6. Since the oil should be stirred well until a constant temperature is maintained both in the water and the oil.
7. After thermal equilibrium has been obtained.
8. Remove the thermometer from the oil bath.
9. 60ml of flask should be kept in position to collect oil from the tube.
10. Open the cork and start the stopwatch.

11. Record the time for the fall of 60mm of oil.
12. Vary the temperature of oil using temperature controller record the actual temperature.
13. Draw the graph between voltage on x-axis and dynamo viscosity on y-axis.

Equipment

1. Thermometer – 1 No
2. Stop watch – 1 No
3. 60ml flask – 1 No
4. Water – 1 No

6. Level Measurement Using DPT

Aim

To measure the level of liquid in the tank with the differential pressure transmitter and to calibrate the zero and span of the level interns of 4-20 mA.

Exercise

Measure the liquid level and calibrate it interms of 4-20 mA.

Procedure

a) Weight the empty container and calibrate the daters level to 4mA.
b) Fill the container with the water and calibrate the full level to 20mA.
c) Now perform the experiment in the ascending order in steps of 5cms.
d) Repeat the same procedure for the descending order.
e) Tabulate the readings.
f) Draw the hastenis

Equipment

1. DPT - 1 No
2. Container - 1 No

7. UV-Spectrophoto – Meter

Aim

To find out the absorbance, % of transmittance and concentration for a given test solution, using UV spectrophotometer.

Exercise

Find out the absorbance, % of transmittance and concentration of the given test solutions.

Procedure

1. Switch on the UV-spectrophotometer.
2. Switch on the lamp by electing the names of rating disc.
3. Place the reference solution in the first column of rotating disc.
4. Use any other column to place the test solution.
5. Select the operating mode. There are 4 types of operating modes:
   i. Single wavelength
   ii. Multiple wavelength
   iii. Scanning mode
   iv. Time scan mode
6. Select the mode. The 3 parameters to be measures are absorbance, % of transmittance and concentration for a given test solution.

   Note down the result from the 1^{st} parameter.

Equipment

1. UV spectrophotometer – 1 No.
2. Curettes

8. pH – METER MEASUREMENT OF pH-VALUE OF TEST SOLUTIONS1

Aim

To measure the P_H values of the test solutions using pH-meter.

Exercise

Find the pH values of the test solutions.

Procedure

1. Switch on the P_H meter
2. Connect the glass electrode to the P_H-meter
3. Take distilled water in a beaker and insert electrode in the beaker
4. The P_H meter should show approximately test solutions. If Acidic than the P_H is < 7 and if alkaline than the P_H >7

Equipment

1. pH meter – 1 No.
2. Test solutions – few types
3. Beaker – 2 Nos.
4. Stand – 1 No.

9. ECG Analyser

Aim

To trace the ECG waveform and measure the various time interval and amplitude of ECG, waveform to make a diagnosis

Exercise

Take ECG waveforms and analyse for normality, first-degree AV block, bundle block, myo cardial infraction, coronary insufficiency and ventricular Fibrillation.

Procedure

1. Connect the leads appropriately.
2. Trace the waveform.
3. Find the time interval of PQ, QRS complex, ST interval, T-U interval.
4. Measure the amplitude of P wave, T wave, ST interval & U wave.

Name of the Wave	Amplitude mv	Duration Sec
P-wave	0-25	0.12 to 0.22 (P-R interval)
R-wave	1.6	0.07 to 0.1
T wave	0.1 to 0.5	0.05 to 0.15 (S-T interval)

S-T wave		
U-wave	<0.1	0.2 (T-U interval)

Diagnosis

1. Normal ECG.
2. First degree AV block. If PQ segment is greater than 0.22 sec.
3. If QRS complex is greater than 0.1 c. Bundle block is present.
4. If ST segment is elevated then myo cardial fraction is found.
5. The patient suffers from coronary insufficiency, if ST segment is depressed.
6. The patient might be suffering from ventricular fibrillation if PQRST wave form is absent and only a train of pulses is present.

10. Measurement Of Pulse Rate / Respiratory Rate

Aim

To measure the pulse rate / respiratory rate.

Exercise

Measure the pulse rate / respiratory rate.1

Procedure

1. Use piezoelectric pulse sensor.
2. Absence the pressure pulse wave former ECG recorder.
3. Find out the pulse rate from it.

Equipment

1. Pulse / respiratory kit - 1 No

EC 1363 MICROPROCESSOR AND MICRO CONTROLLER LABORATORY 0 0 3100

AIM

To understand programming using instruction sets of processors.

List of experiments with objective and exercise

8-bit Microprocessor

1. Simple arithmetic operations:
   - Multi precision addition / subtraction / multiplication / division.

2. Programming with control instructions:
   - Increment / Decrement.
   - Ascending / Descending order.
   - Maximum / Minimum of numbers.
   - Rotate instructions.
   - Hex / ASCII / BCD code conversions.

3. Interface Experiments:
   - A/D Interfacing.
   - D/A Interfacing.
   - Traffic light controller.

4. Interface Experiments:
   - Simple experiments using 8251, 8279, 8254.

5. Programming practice on assembler and simulator tools.

8-bit Micro controller

6. Demonstration of basic instructions with 8051 Micro controller execution, including:
   - Conditional jumps, looping
   - Calling subroutines.
   - Stack parameter testing

7. Parallel port programming with 8051 using port 1 facility:
   - Stepper motor and D / A converter.

8. Programming Exercise on
   - RAM direct addressing
   - Bit addressing

9. Programming practice using simulation tools and C - compiler
   - Initialize timer
   - Enable interrupts.

10. Study of micro controllers with flash memory.

P = 45 Total = 45

REFERENCE BOOKS

1. R.S. Gaonkar., 'Microprocessor Architecture Programming and Applications', Wiley Eastern Ltd., New Delhi., 1995.

2. Myke Predko., 'Programming and Customizing the 8051 Microcontroller', Tata McGraw Hill, 1999.

Detailed Syllabus

8-bit Microprocessor

1. Simple arithmetic operations:
   a. Multi precision addition / subtraction / multiplication / division.

Aim

To perform simple arithmetic operations using assembly language program.

Exercise

1. Write an assembly language program using 8085 instructions set to perform the following arithmetic operations

    1. Addition of two 8 bit numbers
    2. Subtraction of two 8 bit numbers
    3. Multiplication of two 8 bit numbers
    4. Division of two 8 bit numbers

2. Programming with control instructions:

    a. Increment / Decrement.
    b. Ascending / Descending order.
    c. Maximum / Minimum of numbers.
    d. Rotate instructions.
    e. Hex / ASCII / BCD code conversions.

Aim

To write an assembly language program using the control instructions

Exercise

1. Using the control instructions of 8085 microprocessor write assembly language programs to perform the following

1. Arrange the given array of data in ascending and descending order

2. Find the maximum and minimum number in a group of data given.

3. Conversion of the following

    1. ASCII to HEX code
    2. Conversion of HEX to ASCII code
    3. Conversion of BCD to HEX
    4. Conversion of HEX to BCD

3. Interface Experiments:
    a. A/D Interfacing.
    b. D/A Interfacing.
    c. Traffic light controller.

Aim

To write an assembly language program to convert Analog input to Digital output and Digital input to Analog output.

Exercise

1. Write an assembly language program (using 8085) to convert Analog input to Digital output

2. Write an assembly language programs to convert digital input into analog signal of following type.

    1. Square wave
    2. Triangular wave
    3. Sawtooth wave

3. Interface Experiments:

    Simple experiments using 8251, 8279, 8254.

4. Programming practice on assembler and simulator tools.

8-bit Micro controller

5. Demonstration of basic instructions with 8051 Micro controller execution, including:
    a. Conditional jumps, looping
    b. Calling subroutines.
    c. Stack parameter testing

Aim

To demonstrate use of control logic instructors.

Exercise

1. To write programs which can include instruction sets for jump, loop, cell, return, stack.

2. To observe the change in status registers and various relevant registers.

6. Parallel port programming with 8051 using port 1 facility:
   a. Stepper motor and D / A converter.

Aim

To demonstrate the access of parallel port.

Exercise

1. To develop command words on choice of port, addressing of port pins.

2. To vary timing cycle of speed of motor, direction of motor.

3. To demonstrate generation of sine wave saw tooth, triangular wave of various frequency, amplitude.

7. Programming Exercise on

   - RAM direct addressing
   - Bit addressing

Aim

To write the program to check the content of memory locations using READ / WRITE instructions using different addressing modes.

Exercise

To READ / WRITE the content of RAM registers, bits and the RAM from location 1 to N and check the display with say LEDs.

8. Programming practice using simulation tools and C – compiler

   a. Initialize timer
   b. Enable interrupts.

Aim

To use the facility of popular Micro controller programming tools like KEIL or

RIDE software.

Exercise

1. To study the initializing of timer interrupt with context saving like increasing or decreasing the counter count.

2. To demonstrate use of instruction like cjne, djnz, jb etc.

9. Study of micro controllers with flash memory.

Aim

To familiarize of loading and executing on flash memory

Exercise

1. To write the program to generate sine wave, square wave etc.
2. To vary the frequency, amplitude of the signal.

GE 1351 PRESENTATION SKILLS AND TECHNICAL SEMINAR

OBJECTIVE

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for a duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews.

SEMESTER VII

IC 1401 COMPUTER CONTROL OF PROCESS 3 0 0 100

AIM

To provide sound knowledge on the principle of discrete data control system and PLC.

OBJECTIVES

i. To study the importance of state-space representation and stability analysis of discrete data system.

ii. To develop different types of algorithm for digital controllers.

iii. To provide adequate knowledge about the various ways of using computers for control.

iv. To give an introductory knowledge about PLC and the programming languages.

v. To give adequate knowledge about of application of PLC.

1. ANALYSIS OF DISCRETE DATA SYSTEM

9

State-space representation of discrete data systems – Selection of sampling process – Selection of sampling period – Review of z-transform – Pulse transfer function – Modified z-transform - Stability of discrete data system – Jury's stability test.

2. DESIGN OF DIGITAL CONTROLLER

9

Digital PID – Position and velocity form – Deadbeat's algorithm – Dahlin's algorithm – Kalman's algorithm - Pole placement controller – Predictive controller.

3. COMPUTER AS A CONTROLLER

9

Basic building blocks of computer control system – Data acquisition systems – SCADA – Direct digital control – Introduction to AI and expert control system – Case study - Design of computerized multi loop controller.

4. PROGRAMMABLE LOGIC CONTROLLER

9

Evolution of PLC's – Components of PLC – Advantages over relay logic - PLC programming languages – Ladder diagram – Programming timers and counters – Design of PLC.

5. APPLICATIONS OF PLC

9

Instructions in PLC – Program control instructions, math instructions, sequencer instructions – Use of PC as PLC – Application of PLC – Case study of bottle filling system.

L = 45 Total = 45

TEXT BOOKS

1. P.B. Deshpande and R.H. Ash, 'Computer Process Control', ISA Publication, USA, 1995.

2. Petruzella, 'Programmable Controllers', McGraw Hill, 1989.

REFERENCE BOOKS

1. C.M. Houpis, G.B. Lamount, 'Digital Control Systems Theory, Hardware and Software', International Student Edition, McGraw Hill Book Co., 1985.

2. G. Stephanoupoulis, 'Chemical Process Control', Prentice Hall of India, New Delhi, 1990.

3. T. Hughes, 'Programmable Logic Controllers', ISA press.

4. Singh, 'Computer Aided Process Control', Prentice Hall of India, 2004.

IC 1402 COMPUTER NETWORKS AND DISTRIBUTED CONTROL SYSTEM

3

0 0 100

AIM

To illustrate the concept of networking of computers and distributed control system.

OBJECTIVES

i. To provide fundamental knowledge about computer networks.

ii. To provide comprehensive knowledge about the methods of internetworking.

iii. To give basic knowledge in the architecture and local control unit of distributed control system.

iv. To give adequate information in the interfaces used in DCS.

v. To give basic knowledge about HART (Highway Addressable Remote Transducer) and field bus technology.

1. DATA NETWORK FUNDAMENTALS

9

Network hierarchy and switching – Open system interconnection model of ISO – Data link control protocol – BISYNC – SLDC – HLDC – Media access protocol – Command – Token passing – CSMA/CD, TCP/IP.

2. INTERNET WORKING

8

Bridges –Routers – Gateways – Open system with bridge configuration – Open system with gateway configuration – Standard ETHERNET and ARCNET configuration – Special requirement for networks used for control.

3. DISTRIBUTED CONTROL SYSTEM

9 Evolution – Architectures – Comparison – Local control unit – Process interfacing issues – Communication facilities.

4. INTERFACES IN DCS

9

Operator interfaces - Low level and high level operator interfaces – Operator displays - Engineering interfaces – Low level and high level engineering interfaces – General purpose computers in DCS.

5. HART AND FIELD BUS

10

Evolution of signal standards – HART communication protocol – Communication modes – HART networks – Control system interface – HART and OSI model – Filed bus introduction – General field bus architecture – Basic requirements of field bus standard – Field bus topology – Inter operability.

L = 45 Total = 45

TEXT BOOKS

1. A.S. Tanenbaum, 'Computer Networks', 3rd Edition, Pearson Education, 1996 / PHI.

2. Michael P. Lukas, 'Distributed Control System', Van Nostrand Reinhold Co., Canada, 1986.

REFERENCE BOOKS

1. G. K. McMillan, 'Process/Industrial Instruments Hand book', Tata McGraw Hill, New York, 1999.

2. Romily Bowden, 'HART Application Guide and OSI communication Foundation', 1999.

3. W. Buchanan, 'Computer Buses', Arnold Publishers, London, 2000.

IC 1403 NEURAL NETWORK AND FUZZY LOGIC CONTROL 3 0 0 100

AIM

To cater the knowledge of Neural Networks and Fuzzy Logic Control and use these for controlling real time systems.

OBJECTIVES

i. To expose the students to the concepts of feed forward neural networks.

ii. To provide adequate knowledge about feed back neural networks.

iii. To teach about the concept of fuzziness involved in various systems. To provide adequate knowledge about fuzzy set theory.

iv. To provide comprehensive knowledge of fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.

v. To provide adequate knowledge of application of fuzzy logic control to real time systems.

1. ARCHITECTURES

9

Introduction – Biological neuron – Artificial neuron – Neuron modeling – Learning rules – Single layer – Multi layer feed forward network – Back propagation – Learning factors.

2. NEURAL NETWORKS FOR CONTROL

9

Feed back networks – Discrete time hop field networks – Transient response of continuous time networks – Applications of artificial neural network - Process identification – Neuro controller for inverted pendulum.

3. FUZZY SYSTEMS

9

Classical sets – Fuzzy sets – Fuzzy relations – Fuzzification – Defuzzification – Fuzzy rules.

4. FUZZY LOGIC CONTROL

9

Membership function – Knowledge base – Decision-making logic – Optimisation of membership function using neural networks – Adaptive fuzzy system – Introduction to genetic algorithm.

5. APPLICATION OF FLC

9

Fuzzy logic control – Inverted pendulum – Image processing – Home heating system – Blood pressure during anesthesia – Introduction to neuro fuzzy controller.

L = 45 Total = 45

TEXT BOOKS

1. Jacek M. Zurada, 'Introduction to Artificial Neural Systems', Jaico Publishing home, 2002.

2. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', Tata McGraw Hill, 1997.

REFERENCE BOOKS

1. Laurance Fausett, N.J. Englewood Cliffs, 'Fundamentals of Neural Networks', Pearson Education.

2. H.J. Zimmermann, 'Fuzzy Set Theory & Its Applications', Allied Publication Ltd., 1996.

3. Simon Haykin, 'Neural Networks', Pearson Education, 2003.

4. John Yen & Reza Langari, 'Fuzzy Logic – Intelligence Control & Information', Pearson Education, New Delhi, 2003.

MG 1401 TOTAL QUALITY MANAGEMENT 3 0 0 100

OBJECTIVE

i. To understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management.

ii. To understand the statistical approach for quality control.

iii. To create an awareness about the ISO and QS certification process and its need for the industries.

1. INTRODUCTION
9

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

2. TQM PRINCIPLES

9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

3. STATISTICAL PROCESS CONTROL (SPC)

9

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

4. TQM TOOLS

9

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

5. QUALITY SYSTEMS

9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits.

L = 45 Total = 45

TEXT BOOK

1. Dale H.Besterfiled, et al., Total Quality Management, Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.

REFERENCE BOOKS

1. James R.Evans & William M.Lidsay, The Management and Control of Quality, (5^{th} Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).

2. Feigenbaum.A.V. "Total Quality Management, McGraw Hill, 1991.

3. Oakland.J.S. "Total Quality Management Butterworth – Hcinemann Ltd., Oxford. 1989.

4. Narayana V. and Sreenivasan, N.S. Quality Management – Concepts and Tasks, New Age International 1996.

5. Zeiri. "Total Quality Management for Engineers Wood Head Publishers, 1991.

EI 1401 DESIGN PROJECT LABORATORY 0 0 3 100

1. Design and implementation of instrumentation amplifier.
2. Design and implementation of active filter.
3. Design and implementation of V/I and I/V converters.
4. Design and implementation of cold – junction compensation circuit for thermocouple.
5. Design and implementation of signal conditioning circuit for RTD.

6. Design of orifice plate and rotameter.
7. Design of control valve (sizing and flow – lift characteristic)
8. Design of PID controller (using operational amplifier and microprocessor)
9. Piping and Instrumentation Diagram – case study.
10. Preparation of documentation of instrumentation project (process flow sheet, instrument index sheet and instrument specifications sheet).

P = 45 Total = 45

Detailed Syllabus

1. Design and implementation of instrumentation amplifiers

Aim

To design an instrumentation amplifier based on the three operational amplifier configuration with a differential gain of 100.

Exercise

1. Develop the instrumentation amplifier with differential gain of 100 and draw the input Vs output characteristics of the three operational amplifier based instrumentation amplifier and make a comment on the response.

2. Compare the performance characteristics of Instrumentation amplifiers with commercial Monolithic Instrumentation amplifier.

Equipment

1. Dual power supply – 1 No
2. Digital Multimeters – 1 No
3. Resistors – 10 No
4. Operational Amplifiers – 4 No
5. Any commercial Monolithic Instrumentation amplifier - 2 No

2. Design and Implementation of Active filters

Aim

To design an active first order / second order Butterworth type Low – Pass / High Pass / Band-pass filter with the following specifications.

Low pass filter : Cut – off frequency : 1 KHz

High pass filter : Cut – off frequency : 1 KHz

Band pass filter : Cut off frequency : 1 KHz < f_c < 5 KHz

Exercise

1. Develop an active Butterworth first order (or) second order low pass and / or high – pass, band pass filter and determine experimentally the frequency response.

Equipment

1. Dual power supply - 1 No
2. Operational amplifiers - 2 Nos
3. Resistors - 10 Nos
4. Capacitors - 10 Nos
5. Signal generator - 1 No
6. C.R.O - 1 No

3. Design and Implementation of V/I and I/V converters

Aim

To design a voltage to current converter and a current to voltage converter and

verify the characteristics experimentally.

Objectives

1. To design a voltage to current converter (grounded load) with the following specification
   Input voltage range : (0 – 5) V
   Output current range : (4-20) mA (should be independent of load)

2. To design a current to voltage converter with the following specification
   Input current range : (4-20) mA
   Output voltage range : (0-5) V

Exercise

1. Determine experimentally the characteristics of voltage and current converter an plot output current versus input voltage and comment on the response.

2. Determine experimentally the characteristics of current to voltage converter and plot output voltageVs input current and comment on the response.

Equipment

1. Resistors - 10 No
2. Operational amplifiers - 5 No
3. Transistor (NPN / PNP) - 2 No
4. Dual power supply - 1 No
5. Digital Multimeters - 2 No
6. Loop analyzer - 1 No

4. Design and Implementation of cold function compensation circuit for thermocouple

Aim

To design a cold – junction compensation circuit for thermocouple.

Objectives

To design a automatic reference correction circuit for thermocouple.(A solid –

state temperature sensor or RTD can be used for the cold function measurement)

Exercise

1. Develop the circuit for reference junction compensation.
2. Keep the hot junction temperature at say 400^0C.
3. Vary the cold – junction temperature from 30 – 90^0C and observe the output voltage for with and without cold-junction compensation.
4. Plot the output voltage versus cold-junction temperature and comment on the response.

Equipment

1. Thermocouple - 1 Nos

2. Operational amplifier - 3 Nos
3. AD – 590 or RTD - 1 Nos
4. Resistors - 10 Nos
5. Dual power supply - 1 No
6. Multimeters - 1 No

5. Design and implementation of signal conditioning circuit for RTD

Aim

To design a signal conditioning circuit to RTD. The specification are as follows

Temperature Range : 30^0 C – 100^0C (Approximately)

Output voltage : 0 – 5 V DC

Sensor : RTD (Pt 100)

Current through RTD : Not to exceed 10mA

Equipment

1. RTD (Pt 100) - 1 No
2. Resistors - ?
3. Operational amplifiers - 4 Nos
4. Dual power supply - 1 No
5. Temperature bath - 1 No
6. Multimeter - 1 No
7. Trim Pot - 3 Nos

Exercise

1. Develop the signal conditioning circuit and plot the output voltage versus temperature and comment on the linearity.

IC 1404 COMPUTER CONTROL OF PROCESS LABORATORY 0 0 3 100

AIM

To study the concept of controlling the different continuous / discrete process using computers, DCS / PLC.

1. Simulation of first order system and second order with and without dead time using discretization method and Runge – Kutta method

2. Design of Discrete P+I+D controller for a first order system

3. Study of Programmable logic controller.

4. Control of Bottle filling system using PLC.

5. PC based Data Acquisition.

6. Simulation of complex control systems using matlab package.

7. Operation of computer controlled liquid level system.
8. Operation of computer controlled thermal system.

9. Study of distributed control system.

10. Design of dead beat / Dahlin algorithms.

P = 45 Total = 45

Detailed Syllabus

1. Simulation of first order system and second order system with and without dead time using discretization method and Runge – Kutta method

Aim

To simulate a first order system and second order system with and without dead time using discretization method and Runge-Kutta method.

Exercises

1. Write a program in C language for a first order system and second order system with and without dead time using discretization method.
2. Write a program in C language for a first order system and second order system with and without dead time using Runge – Kutta method.
3. To analyse the responses for various standard forcing functions.

Equipment

1. Computer Pentium (3 or 4) - 1 No

2. Design of Discrete P+I+D controller for a first order system

Aim

To design a discrete P+I+D controller for a first order system

Exercise

1. Write a program in C for position form of control algorithm.
2. Write a program in C for velocity form of control algorithm.
3. Analysis of the responses by implementing the position and velocity form of control algorithms for the first order system.
4. How to select the sampling rate in a digital control loop.

Equipment

1. Pentium Computer (3 or 4) - 1 No

3. Study of Programmable logic controller

Aim

To study the operation of Programmable logic controller.

Exercise

1. Implementation of the AND / OR gate using PLC.
2. Implementation of proportional (P) control system.
3. A program which sounds an alarm when a preset count value is reached.
4. A program sounds an alarm after a time delay.
5. A program which illustrates the use of flags and the flag instructions.

Equipment

1. PLC Unit - 1 No
2. Computer Pentium (3 or 4) - 1 No

4. Control of Bottle filling system using PLC

Aim

To study the control of bottle filling system using PLC

Objectives

1. Instead of achieving the desired control or automation through physical wiring of control devices, in PLC how it is achieved through a program of software.

2. To develop the programming skills for the industrial needs.

3. How to develop an interface between PLC and the bottle filling system.

Exercise

1. To develop the ladder diagram for the bottle filling system.

Equipment

1. Computer Pentium (3 or 4) - 1 No
2. PLC - 1 No
3. Bottle filling system - 1 No

5. PC based Data Acquisition

Aim

To acquire real world signals using Data Acquisition card.

Exercise

Develop a program in C – language to acquire the data and display.

Equipment

1. Data Acquisition card - 1 No
2. Computer Pentium (3 or 4) - 1 No

6. Simulation of complex control systems using MATLAB package

Aim

To study the simulation of complex control systems using MATLAB package.

Objective

To examine the advanced control strategies like cascade control, feed forward plus feedback control, ratio control.

Exercise

1. To simulate cascade control, feed forward – feedback control using MAT LAB.

2. Compare the results of cascade control with conventional control.

3. To simulate a ratio control for a process to maintain a desired ratio.

4. Compare the results of feed forward – feedback with feedback control.

Equipment

1. Computer Pentium (3 or 4) - 1 No

2. MATLAB original licensed version 6.0.

7. Operation of computer controlled liquid level system

Aim

To study the operation of computer controlled liquid level system.

Exercise

1. To study the action of "ON-OFF" control for a level process station.
2. To study the action of proportional, Proportional Integral, Proportional Derivative, Proportional + Derivative+Integral for the level process station.

Equipment

1. Compute Pentium (3 or 4)- 1 No

2. Liquid level control system

8. Operation of computer controlled thermal system

Aim

To study the operation of computer controlled thermal system.

Exercise

1. To study the controller output action over the furnace.

2. To study the action of ON / OFF, Proportional, Proportional + Integral, proportional +Derivative, Proportional + Derivative + Integral for the thermal system.

Equipment

1. Computer Pentium (3 or 4) - 1 No
2. Thermal system - 1 No

9. Study of distributed control system

Aim

To study the distributed control system

Objectives

1. To get the knowledge of communication interface between the controller and the server, server and the clients and the controller to the I/O units.
2. To know how the I/O connection with the process control station to the DCS I/O units.
3. To know how several LCU's is used to implement control strategies.
4. To know how the transmission of process data is connected to the high-level system elements (i.e. human interface and computing devices).
5. To know how the high – level element transmits information requests and control commands to the LCU's.
6. To know how the cost of plant wiring is reduced significantly by the few cables or buses used to implement the shared communication system.
7. To know how the transmission of process variables, controlled variables, alarm status information from the LCU's to the high – level interfaces and to low level human interfaces in the system.

Exercise

1. Using graphic and text features design different types of operator interaction pages, to suit different process stations available in process control lab.
2. Implement the various control actions like ON-OFF, Proportional, Proportional + Integral, Proportional +Derivative, Proportional + Derivative+Integral on different process stations available in process control lab.
3. Analyse the responses for set point and disturbance changes.

Equipment

1. Computer Pentium (3 or 4) - 1 No
2. DCS - 1 No

10. Design of dead beat / Dahlin algorithms

Aim

To design a dead beat and dahlin algorithm for a first order process.

Objective

To examine a different methodology for designing digital feedback controllers, which makes use of the computational flexibility, offered by a digital computer.

Exercise

1. Design of Deadbeat controller for a first order process and analyse the closed loop response using C language.
2. Design of Dahlin's controller for a first order process using C language.
3. Analysis of closed loop responses to step changes in set point using deadbeat and Dahlin algorithms.

Equipment

1. Computer Pentium (3 or 4) - 1 No

EC 1461 VLSI DESIGN **3**
0 0 100

AIM

To introduce the technology & concepts of VLSI.

OBJECTIVES

i. To introduce MOS theory / Manufacturing Technology.

ii. To study inverter / counter logic / stick / machine diagram / sequential circuits.

iii. To study address / memory / arithmetic circuits.

iv. To introduce FPGA architecture / principles / system design.

v. To get familiarised with VHDL programming behavioural/Structural/concurrent/ process.

1. BASIC MOS TRANSISTOR

9

Enhancement mode & Depletion mode – Fabrication (NMOS, PMOS, CMOS, BiCMOS) Technology – NMOS transistor current equation – Second order effects – MOS Transistor Model.

2. NMOS & CMOS INVERTER AND GATES

9

NMOS & CMOS inverter – Determination of pull up / pull down ratios – Stick diagram – lamda based rules – Super buffers – BiCMOS & steering logic.

3. SUB SYSTEM DESIGN & LAYOUT

9

Structured design of combinational circuits – Dynamic CMOS & clocking – Tally circuits – (NAND-NAND, NOR-NOR and AOI logic) – EXOR structure – Multiplexer structures – Barrel shifter.

4. DESIGN OF COMBINATIONAL ELEMENTS & REGULAR ARRAY

LOGIC 9

NMOS PLA – Programmable Logic Devices - Finite State Machine PLA – Introduction to FPGA.

5. VHDL PROGRAMMING

9

RTL Design – Combinational logic – Types – Operators – Packages – Sequential circuit – sub programs – Test benches. (Examples: address, counters, flipflops, FSM, Multiplexers / Demltiplexers).

L = 45 Total = 45

TEXT BOOKS

1. D.A.Pucknell, K.Eshraghian, 'Basic VLSI Design', 3rd Edition, Prentice Hall of India,
New Delhi, 2003.

2. Eugene D.Fabricius, 'Introduction to VLSI Design', Tata McGraw Hill, 1990.

REFERENCE BOOKS

1. N.H.Weste, 'Principles of CMOS VLSI Design', Pearson Education, India, 2002.

2. Charles H.Roth, 'Fundamentals of Logic Design', Jaico Publishing House, 1992.

3. Zainalatsedin Navabi, 'VHDL Analysis and Modelling of Digital Systems', 2nd Edition, Tata McGraw Hill, 1998.

4. Douglas Perry, 'VHDL Programming by example', Tata McGraw Hill, 3rd Edition, 2003.

EI 1001 FIBRE OPTICS AND LASER INSTRUMENTS 3
0 0 100

AIM

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

OBJECTIVES

i. To expose the students to the basic concepts of optical fibers and their properties.

ii. To provide adequate knowledge about the Industrial applications of optical fibres.

iii. To expose the students to the Laser fundamentals.

iv. To provide adequate knowledge about Industrial application of lasers.

v. To provide adequate knowledge about holography & Medical applications of Lasers.

1. OPTICAL FIBRES AND THEIR PROPERTIES

12

Principles of light propagation through a fibre - Different types of fibres and their properties, fibre characteristics – Absorption losses – Scattering losses – Dispersion – Connectors & splicers – Fibre termination – Optical sources – Optical detectors.

2. INDUSTRIAL APPLICATION OF OPTICAL FIBRES

9

Fibre optic sensors – Fibre optic instrumentation system – Different types of modulators – Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

3. LASER FUNDAMENTALS

9

Fundamental characteristics of lasers – Three level and four level lasers – Properties of laser – Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers – Gas lasers, solid lasers, liquid lasers, semiconductor lasers.

4. INDUSTRIAL APPLICATION OF LASERS

6

Laser for measurement of distance, length, velocity, acceleration, current, voltage and

Atmospheric effect – Material processing – Laser heating, welding, melting and trimming of material – Removal and vaporization.

5. HOLOGRAM AND MEDICAL APPLICATIONS

9

Holography – Basic principle - Methods – Helographic interferometry and application, Holography for non-destructive testing – Holographic components –

Medical applications of lasers, laser and tissue interactive – Laser instruments for surgery, removal of tumours of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.

L= 45 Total = 45

TEXT BOOKS

1. J.M. Senior, 'Optical Fibre Communication – Principles and Practice', Prentice Hall of India, 1985.
2. J. Wilson and J.F.B. Hawkes, 'Introduction to Opto Electronics', Prentice Hall of India, 2001.

REFERENCE BOOKS

1. Donald J.Sterling Jr, 'Technicians Guide to Fibre Optics', 3rd Edition, Vikas Publishing House, 2000.
2. M. Arumugam, 'Optical Fibre Communication and Sensors', Anuradha Agencies, 2002.
3. John F. Read, 'Industrial Applications of Lasers', Academic Press, 1978.
4. Monte Ross, 'Laser Applications', McGraw Hill, 1968
5. G. Keiser, 'Optical Fibre Communication', McGraw Hill, 1995.
6. Mr. Gupta, 'Fiber Optics Communication', Prentice Hall of India, 2004.

CS 1032 ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS 3

0 0 100

AIM

To present the concepts of intelligent agents, searching, knowledge and reasoning, planning, learning and expert systems.

OBJECTIVES

i. To study the idea of intelligent agents and search methods.

ii. To study about representing knowledge.

iii. To study the reasoning and decision making in uncertain world.

iv. To construct plans and methods for generating knowledge.

v. To study the concepts of expert systems.

1. INTRODUCTION

9

Introduction to AI: Intelligent agents – Perception – Natural language processing – Problem – Solving agents – Searching for solutions: Uniformed search strategies – Informed search strategies.

2. KNOWLEDGE AND REASONING

9

Adversarial search – Optimal and imperfect decisions – Alpha, Beta pruning – Logical agents: Propositional logic – First order logic – Syntax and semantics – Using first order logic – Inference in first order logic.

3. UNCERTAIN KNOWLEDGE AND REASONING

8

Uncertainty – Acting under uncertainty – Basic probability notation – Axioms of probability – Baye's rule – Probabilistic reasoning – Making simple decisions.

4. PLANNING AND LEARNING

9

Planning: Planning problem – Partial order planning – Planning and acting in non-deterministic domains – Learning: Learning decision trees – Knowledge in learning – Neural networks – Reinforcement learning – Passive and active.

5. EXPERT SYSTEMS

10

Definition – Features of an expert system – Organization – Characteristics – Prospector – Knowledge Representation in expert systems – Expert system tools – MYCIN – EMYCIN.

L=45 Total = 45

TEXT BOOKS

1. Stuart Russel and Peter Norvig, 'Artificial Intelligence - A Modern Approach', Second Edition, Pearson Education, 2003 / PHI.
2. Donald A.Waterman, 'A Guide to Expert Systems', Pearson Education.

REFERENCE BOOKS

1. George F.Luger, 'Artificial Intelligence – Structures and Strategies for Complex Problem Solving', Fourth Edition, Pearson Education, 2002.

2. Elain Rich and Kevin Knight, 'Artificial Intelligence', Second Edition Tata McGraw Hill, 1995.

3. Janakiraman, K. Sarukesi, 'Foundations of Artificial Intelligence and Expert Systems', Macmillan Series in Computer Science.

4. W. Patterson, 'Introduction to Artificial Intelligence and Expert Systems', Prentice Hall of India, 2003.

IC 1001 ROBUST CONTROL 3
0 0 100

AIM

To gain comprehensive knowledge on Robust Control theory.

OBJECTIVES

i. To study the relevant mathematical background needed for the subject robust control.

ii. To study various way of expressing uncertainties associated with physical systems.

iii. To study the methods of analysis of robust stability and robust performance analysis.

iv. To study the design of a robust optimal controller.

v. To study some practical application of robust control through case studies.

1. INTRODUCTION TO ROBUST CONTROL

9

Review of vector norms and matrix norms – Singular value analysis – Norms for systems – Singular value decomposition – Basics of real, quasi and polytopic polynomials – Need for robust control.

2. SYSTEM UNCERTAINTY

9

Sources of uncertainty – Parametric uncertainty – Non-parametric uncertainty – Additive and multiplicative type – Nominal stability, internal stability, nominal

performance, uncertain linear dynamic plants and robust control problem. Review of sensitivity and complimentary sensitivity function.

3. ROBUST STABILITY AND PERFORMANCE

9

Robust stability analysis – Kharitonov's theorem, edge theorem, mapping theorem, small gain theorem.

Robust performance analysis – Based on control sensitivity, input and output sensitivity minimization.

4. H_2 AND H_∞ OPTIMAL CONTROL

9

Standard LQR problem – Extended LQR problem – H_2 problem – Stability margin of H_2 controller - H_∞ control problem – Optimality and limiting behaviour – minimum entropy controller.

5. CASE STUDY

9

Modelling and design of robust controller for crane – Automatic steering of bus – Flight control – Comparison of conventional and robust control for the case studies.

L = 45 Total = 45

TEXT BOOKS

1. S.P. Bhattacharyya H. Chapellaf and L.H. Feel, 'Robust Control (The parametric approach)', Pearson Education, 1995.

2. J. Ackermann, 'Robust Control Systems with Uncertain Physical Parameters', Springer-Verlag, London, 1993.

REFERENCE BOOKS

1. Kemin Zhou, John C. Doyle, 'Essentials of Robust Control', Pearson Education, 1998.

2. P.C. Chandrasekharan, 'Robust Control of Linear Dynamical Systems', Academic Press, 1996.

MH 1031 MECHATRONICS 3
0 0 100

1. INTRODUCTION

7

Mechatronics – definition and key issues – evolution – elements – mechatronics approach to modern engineering design.

2. SENSORS AND TRANSDUCERS
10

Types – displacement, position, proximity and velocity sensors – signal processing – data display.

3. ACTUATION SYSTEMS

8

Mechanical types – applications – electrical types – applications – pneumatic and hydraulic systems – applications – selection of actuators

4. CONTROL SYSTEMS

12

Types of controllers – programmable logic controllers – applications – ladder diagrams – microprocessor applications in mechatronics – programming interfacing – computer applications

5. RECENT ADVANCES
8
Manufacturing mechatronics – automobile mechatronics – automobile mechatronics – medical mechatronics – office automation – case studies.

L = 45 Total = 45

TEXT BOOKS

1. Bulton, N., Mechatronics : Electronic Control system for Mechanical and Electrical Engineering, Longman, 1995.
2. Dradly, D.A. Dawson., D, Burd, N.C., and Loader, A.J., Mechatronics: Electronics in products and processes, Chapman & Hall, 1993.

REFERENCES

1. HMT Mechatronics, Tata McGraw Hill, New Delhi, 1968.

2. Galip Ulsoy, A., and Devires, W.R. microcomputer Applications in manufacturing John wiley, USA 1989.

3. James Harter, Electromechanics : Principles, concepts and devices – Prentice Hall – New Jersey 1995.

CS 1034 COMPUTER ARCHITECTURE 3 1 0 100

AIM

To Study the structure and behavior of processors, memories and input and output units and to study their interactions.

OBJECTIVES

i. To study the various representations of data, register transfer language for micro-
operations and organization and design of a digital computer.

ii. To teach the concept of micro-programmed control unit, the central processing
unit, stack and instruction formats.

iii. To Study the various arithmetic operation's algorithms and their hardware implementations and concept of pipelining and vector processing.

iv. To illustrate the techniques to communicate with input and output devices.

v. To study the organization and operation of various memories and memory management hardware.

1. DATA REPRESENTATION, MICRO-OPERATIONS AND ORGANIZATION AND DESIGN

13

Data representation: Data types, complements, fixed–point representation, floating-point representation, other binary codes, error detection codes.
Register transfer and micro operations: Register transfer language, register transfer, bus and memory transfers, arithmetic micro-operations, logic micro-operations, shift micro-operations, arithmetic logic shift unit.

Basic computer organization and design: Instruction codes, computer registers, computer instructions, timing and control, instruction cycle, memory reference instructions, input-output and interrupt. Complete computer description, design of basic computer, design of accumulator logic.

2. CONTROL AND CENTRAL PROCESSING UNIT

8

Micro programmed control: Control memory, address sequencing, micro-program example, design of control unit.

Central processing unit: General register organization, stack organization, instruction formats, addressing modes, data transfer and manipulation, program control, reduced instruction set computer.

3. COMPUTER ARITHMETIC, PIPELINE AND VECTOR PROCESSING

8

Computer arithmetic: Addition and subtraction, multiplication algorithms, division algorithms, floating-point arithmetic operations, decimal arithmetic unit, decimal arithmetic operations.

Pipeline and vector processing: Parallel processing, pipelining, arithmetic pipeline, instruction pipeline, RISC pipeline, vector processing array processors.

4. INPUT-OUTPUT ORGANIZATION

8

Input-output organization: Peripheral devices, input-output interface, asynchronous data transfer, modes of transfer, priority interrupt, direct memory access, input-output processor, serial communication.

5. MEMORY ORGANIZATION

8

Memory organization: Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory, memory management hardware.

L = 45 T=15
Total = 60

TEXT BOOK

1. Morris Mano, 'Computer System Architecture', 3rd Edition, Pearson Education, 2002 / PHI.

REFERENCE BOOKS

1. Vincent P.Heuring and Harry F.Jordan, 'Computer Systems Design and Architecture', Pearson Education Asia Publications, 2002.

2. John P.Hayes, 'Computer Architecture and Organization', Tata McGraw Hill, 1988.

3. Andrew S.Tanenbaum, 'Structured Computer Organization', 4th Edition, Prentice Hall of India/Pearson Education, 2002.

4. William Stallings, 'Computer Organization and Architecture', 6th Edition, Prentice Hall of India/Pearson Education, 2003.

ELECTIVE II

EI 1002 POWER PLANT INSTRUMENTATION 3
0 0 100

AIM

The course is designed to familiarize the student with the functions and instrumentation available in a modern power generation plant.

OBJECTIVES

i. To provide an overview of different methods of power generation with a particular stress on thermal power generation.

ii. To bring out the various measurements involved in power generation plants.

iii. To provide knowledge about the different types of devices used for analysis.

iv. To impart knowledge about the different types of controls and control loops.

v. To familiarize the student with the methods of monitoring different parameters like speed, vibration of turbines and their control.

1. OVERVIEW OF POWER GENERATION

9

Brief survey of methods of power generation – Hydro, thermal, nuclear, solar and wind power – Importance of instrumentation in power generation – Thermal power plants – Block diagram – Details of boiler processes - UP&I diagram of boiler – Cogeneration.

2. MEASUREMENTS IN POWER PLANTS

9

Electrical measurements – Current, voltage, power, frequency, power factor etc. – Non electrical parameters – Flow of feed water, fuel, air and steam with correction factor for temperature – Steam pressure and steam temperature – Drum

level measurement – Radiation detector – Smoke density measurement – Dust monitor.

3. ANALYSERS IN POWER PLANTS

9

Flue gas oxygen analyser – Analysis of impurities in feed water and steam – Dissolved oxygen analyser – Chromatography – pH meter – Fuel analyser – Pollution monitoring instruments.

4. CONTROL LOOPS IN BOILER

9

Combustion control – Air/fuel ratio control – Furnace draft control – Drum level control – Main steam and reheat steam temperature control – Super heater control – Air temperature – Deaerator control – Distributed control system in power plants – Interlocks in boiler operation.

5. TURBINE – MONITORING AND CONTROL

9

Speed, vibration, shell temperature monitoring and control – Steam pressure control – Lubricant oil temperature control – Cooling system.

L = 45 Total = 45

TEXT BOOKS

1. Sam G. Dukelow, 'The Control of Boilers', Instrument Society of America, 1991.

2. P.K. Nag, 'Power Plant Engineering', Tata McGraw Hill, 2001.

REFERENCE BOOKS

1. S.M. Elonka and A.L. Kohal, 'Standard Boiler Operations', Tata McGraw Hill, New Delhi,1994.

2. R.K.Jain, 'Mechanical and Industrial Measurements', Khanna Publishers, New Delhi, 1995.
3. E.Al. Wakil, 'Power Plant Engineering', Tata McGraw Hill, 1984.

IC 1002 ADAPTIVE CONTROL 3
0 0 100

AIM

To gain knowledge on adaptive control of systems through parameter identification and
controller retuning.

OBJECTIVES

i. To study the definition of adaptive control and methods of adaptation.

ii. To study the parameter identification of systems.

iii. To study the self-tuning of PID controllers based on parameter identification.

iv. To study the model reference adaptive control.

v. To study the practical application through case studies.

1. INTRODUCTION

9

Introduction to adaptive control - Effects of process variations – Adaptive control schemes – Adaptive control problem – Non-parametric identification – Step response method – Impulse response method – Frequency response method.

2. PARAMETRIC IDENTIFICATION

9

Linear in parameter models - ARX – ARMAX – ARIMAX – Least square estimation – Recursive least square estimation – Extended least square estimation – Maximum likelihood estimation – Introduction to non-linear systems identification - Pseudo random binary sequence.

3. SELF-TUNING REGULATOR

9

Deterministic in-direct self-tuning regulators – Deterministic direct self-tuning regulators – Introduction to stochastic self-tuning regulators – Stochastic indirect self-tuning regulator.

4. MODEL REFERENCE ADAPTIVE CONTROLLER

9

The MIT rule – Lyapunov theory – Design of model reference adaptive controller using MIT rule and Lyapunov theory – Relation between model reference adaptive controller and self-tuning regulator.

5. TUNING OF CONTROLLERS AND CASE STUDIES 9

Design of gain scheduling controller - Auto-tuning of PID regulator – Stability analysis of adaptive controllers – Application of adaptive control in chemical reactor, distillation column and variable area tank system.

L = 45 Total = 45

TEXT BOOK

1. Karl J. Astrom & Bjorn Wittenmark, 'Adaptive Control', Pearson Education (Singapore), Second Edition, 2003.

REFERENCE BOOKS

1. T. C.H.A. Hsia, 'System Identification', Lexington books, 1974.

2. Stephanopoulis G. 'Chemical Process Control', Prentice Hall of India, New Delhi, 1990.

EC1031 TELECOMMUNICATION SWITCHING AND NETWORKS

AIMS

1. To introduce fundamentals functions of a telecom switching office, namely, digital multiplexing, digital switching and digital subscriber access.

2. To introduce a mathematical model for the analysis of telecommunication traffic.

OBJECTIVES

1. To introduce the concepts of Frequency and Time division multiplexing.

2. To introduce digital multiplexing and digital hierarchy namely SONET / SDH

3. To introduce the concepts of space switching, time switching and combination switching, example of a switch namely No.4 ESS Toll switch.

4. To introduce the need for network synchronization and study synchronization issues. To outline network control and management issues.

5. To study the enhanced local loop systems in digital environment. To introduce

ISDN, DSL / ADSL, and fiber optic systems in subscriber loop.

6. To introduce statistical modeling of telephone traffic. To study blocking system characteristics and queuing system characteristics.

7. To characterize blocking probability holding service time distributions for in speech and data networks.

1. MULTIPLEXING

9

Transmission Systems, FDM Multiplexing and modulation, Time Division Multiplexing, Digital Transmission and Multiplexing : Pulse Transmission, Line Coding, Binary N-Zero Substitution, Digital Biphase, Differential Encoding, Time Division Multiplexing, Time Division Multiplex Loops and Rings.
SONET/SDH : SONET Multiplexing Overview, SONET Frame Formats, SONET Operations, Administration and Maintenance, Payload Framing and Frequency Justification, Virtual Tributaries, DS3 Payload Mapping, E4 Payload Mapping, SONET Optical Standards, SONET Networks. SONET Rings: Unidirectional Path-Switched Ring, Bidirectional Line-Switched Ring.

2. DIGITAL SWITCHING

9

Switching Functions, Space Division Switching, Time Division Switching, two-dimensional Switching: STS Switching, TST Switching, No.4 ESS Toll Switch, Digital Cross-Connect Systems, Digital Switching in an Analog Environment. Elements of SSN07 signaling.

3. NETWORK SYNCHRONIZATION CONTROL AND MANAGEMENT

9

Timing: Timing Recovery: Phase-Locked Loop, Clock Instability, Jitter Measurements, Systematic Jitter. Timing Inaccuracies: Slips, Asynchronous Multiplexing, Network Synchronization, U.S. Network Synchronization, Network Control, Network Management.

4. DIGITAL SUBSCRIBER ACCESS

9

ISDN: ISDN Basic Rate Access Architecture, ISDN U Interface, ISDN D Channel Protocol. High-Data-Rate Digital Subscriber Loops: Asymmetric Digital Subscriber Line, VDSL. Digital Loop Carrier Systems: Universal Digital Loop Carrier Systems, Integrated Digital Loop Carrier Systems, Next-Generation Digital Loop Carrier, Fiber in the Loop, Hybrid Fiber Coax Systems, Voice band

Modems: PCM Modems, Local Microwave Distribution Service, Digital Satellite Services.

5. TRAFFIC ANALYSIS

9

Traffic Characterization: Arrival Distributions, Holding Time Distributions, Loss Systems, Network Blocking Probabilities: End-to-End Blocking Probabilities, Overflow Traffic, Delay Systems: Exponential service Times, Constant Service Times, Finite Queues.

TOTAL: 45 hrs.

TEXT BOOK

1. Bellamy John, "Digital Telephony", John Wily & Sons, Inc. 3rd edn. 2000.

REFERENCES BOOKS

i. Viswanathan. T., "Telecommunication Switching System and Networks", Prentice Hall of India Ltd., 1994.

CS 1031 VISUAL LANGUAGES AND APPLICATIONS 3 1 0 100

AIM

To study the principles and techniques of windows programming using MFC, procedures, resources, controls and database programming through the visual languages, Visual C++ and Visual Basic.

OBJECTIVES

i. To study about the concepts of windows programming models, MFC applications, drawing with the GDI, getting inputs from Mouse and the Keyboard.

ii. To study the concepts of Menu basics, menu magic and classic controls of the windows programming using VC++.

iii. To study the concept of Document/View Architecture with single & multiple document interface, toolbars, status bars and File I/O Serialization.

iv. To study about the integrated development-programming event driven programming, variables, constants, procedures and basic ActiveX controls in visual basic.

v. To understand the database and the database management system, visual data manager, data bound controls and ADO controls in VB.

1. FUNDAMENTALS OF WINDOWS AND MFC

9

Messages - Windows programming - SDK style - Hungarian notation and windows data types - SDK programming in perspective. The benefits of C++ and MFC - MFC design philosophy - Document/View architecture - MFC class hierarchy - AFX functions. Application object - Frame window object - Message map.

Drawing the lines – Curves – Ellipse – Polygons and other shapes. GDI pens – Brushes - GDI fonts - Deleting GDI objects and deselecting GDI objects. Getting input from the mouse: Client & Non-client - Area mouse messages - Mouse wheel - Cursor. Getting input from the keyboard: Input focus - Keystroke messages - Virtual key codes - Character & dead key messages.

2. RESOURCES AND CONTROLS

9

Creating a menu – Loading and displaying a menu – Responding to menu commands – Command ranges - Updating the items in menu, update ranges – Keyboard accelerators. Creating menus programmatically - Modifying menus programmatically - The system menu - Owner draw menus – Cascading menus - Context menus.

The C button class – C list box class – C static class - The font view application – C edit class – C combo box class – C scrollbar class. Model dialog boxes – Modeless dialog boxes.

3. DOCUMENT / VIEW ARCHITECTURE

9

The inexistence function revisited – Document object – View object – Frame window object – Dynamic object creation. SDI document template - Command routing. Synchronizing multiple views of a document – Mid squares application – Supporting multiple document types – Alternatives to MDI. Splitter Windows: Dynamic splitter window – Static splitter windows.

Creating & initializing a toolbar - Controlling the toolbar's visibility – Creating & initializing a status bar - Creating custom status bar panes – Status bar support in appwizard. Opening, closing and creating the files - Reading & Writing – C file derivatives – Serialization basics - Writing serializable classes.

4. FUNDAMENTALS OF VISUAL BASIC

10

Menu bar – Tool bar – Project explorer – Toolbox – Properties window – Form designer – Form layout – Intermediate window. Designing the user interface: Aligning the controls – Running the application – Visual development and event driven programming.

Variables: Declaration – Types – Converting variable types – User defined data types - Lifetime of a variable. Constants - Arrays – Types of arrays. Procedures: Subroutines – Functions – Calling procedures. Text box controls – List box & Combo box controls – Scroll bar and slider controls – File controls.

5. DATABASE PROGRAMMING WITH VB

8

Record sets – Data control – Data control properties, methods. Visual data manager: Specifying indices with the visual data manager – Entering data with the visual data manager. Data bound list control – Data bound combo box – Data bound grid control. Mapping databases: Database object – Table def object, Query def object.
Programming the active database objects – ADO object model – Establishing a connection - Executing SQL statements – Cursor types and locking mechanism – Manipulating the record set object – Simple record editing and updating.

L = 45 T = 15 Total = 60

TEXT BOOKS

1. Jeff Prosise, 'Programming Windows With MFC', Second Edition, WP Publishers & Distributors [P] Ltd, Reprinted 2002.

2. Evangelos Petroutsos, 'Mastering Visual Basic 6.0', BPB Publications, 2002.

REFERENCE BOOKS

1. Herbert Schildt, 'MFC Programming from the Ground Up', Second Edition, Tata McGraw Hill, reprinted 2002.

2. John Paul Muller, 'Visual C++ 6 from the Ground Up Second Edition', Tata McGraw Hill, Reprinted 2002.

3. Curtis Smith & Micheal Amundsen, 'Teach Yourself Database Programming with Visual Basic 6 in 21 days', Techmedia Pub, 1999.

EI 1003 INSTRUMENTATION IN PETROCHEMICAL INDUSTRIES 3 0 0 100

AIM

To expose the students to the Instrumentation applied in petrochemical industries.

OBJECTIVES

i. To expose the students to the basic processing in petroleum industry.

ii. To provide adequate knowledge about the unit operations.

iii. To impart knowledge pertaining to the petroleum products and the chemicals obtained from them.

iv. To provide adequate knowledge about the measurement of various parameters in petrochemical industry.

v. To expose the students to the various control loops in Petrochemical Industry.

1. PETROLEUM PROCESSING

7

Petroleum exploration – Recovery techniques – Oil – Gas separation - Processing wet gases – Refining of crude oil.

2. OPERATIONS IN PETROLEUM INDUSTRY

10

Thermal cracking – Catalytic cracking – Catalytic reforming – Polymerisation – Alkylation – Isomerization – Production of ethylene, acetylene and propylene from petroleum.

3. CHEMICALS FROM PETROLEUM PRODUCTS

10

Chemicals from petroleum – Methane derivatives – Acetylene derivatives – Ethylene derivatives – Propylene derivatives – Other products.

4. MEASUREMENTS IN PETROCHEMICAL INDUSTRY

9

Parameters to be measured in refinery and petrochemical industry – Selection and maintenance of measuring instruments – Intrinsic safety of Instruments.

5. CONTROL LOOPS IN PETROCHEMICAL INDUSTRY

9

Process control in refinery and petrochemical industry – Control of distillation column – Control of catalytic crackers and pyrolysis unit – Automatic control of polyethylene production – Control of vinyl chloride and PVC production.

L = 45 Total = 45

TEXT BOOKS

1. A.L. Waddams, 'Chemicals from Petroleum', Butter and Janner Ltd., 1968.

2. J.G. Balchan. and K.I. Mumme, 'Process Control Structures and Applications', Van Nostrand Reinhold Company, New York, 1988.

REFERENCE BOOKS

1. Austin G.T. Shreeves, 'Chemical Process Industries', McGraw Hill International Student edition, Singapore, 1985.

2. B.G Liptak, 'Instrumentation in Process Industries', Chilton Book Company, 1994.

IC 1003 OPTIMAL CONTROL 3
0 0 100

AIM

To gain knowledge on formulation and application of optimal control problems.

OBJECTIVES

i. To study various performance measures and programming techniques.

ii. To study the computational procedure for solving optimal control problems.

iii. To study the calculus of variations.

iv. To study the variational approach to optimal control.

v. To study the applications of Pontryagin's minimum principle.

1. INTRODUCTION

9

Statement of optimal control problem – Problem formulation and forms of optimal control – Performance measures for optimal control – Selection of performance measure – Various methods of optimization – Linear programming – Non-linear programming – Dynamic programming.

2. DYNAMIC PROGRAMMING

9

Principle of optimality – Recurrent relation of dynamic programming for optimal control problem – Computational procedure for solving optimal control problems – Characteristics of dynamic programming solution – Hamilton Jacobi Bellman equation – Application to a continuous linear regulator problem.

3. CALCULUS OF VARIATIONS

9

Fundamentals concepts – Functional of a single function – Functional involving several
independent functions – Piecewise smooth extremals – Constrained extrema.

4. VARIATIONAL APPROACH TO OPTIMAL CONTROL

9

Necessary conditions for optimal control – Linear regulator problems – Pontryagin's
minimum principle and state inequality constraints.

5. APPLICATIONS OF PONTRYAGIN'S MINIMUM PRINCIPLE

9

Minimum time problem – Minimum control effort problems: minimum fuel problem, minimum energy problem – singular intervals in optimal control problems.

L = 45 Total = 45

TEXT BOOKS

1. B. Sarkar, 'Control System Design – The Optimal Approach', Wheeler Publishing, New Delhi, 1997.

2. M. Gopal, 'Modern Control System Theory', New Age International Ltd., 2002.

REFERENCE BOOKS

1. Donald E. Kirk, 'Optimal Control Theory – An introduction ', Pearson Education, 1970.

2. Kemin Zbou, J.C. Doyle, 'Robust & Optimal Control', Pearson Education, 1996.

IC 1004 INDUSTRIAL DRIVES AND CONTROL 3

0 0 100

AIM

To study and understand the operation of electric motor drives controlled from a power electronic converter and to introduce the design concepts of controllers for closed loop operation.

OBJECTIVES

1. To study and understand the different types of drives and selection of drive and power converter.

2. To study and analyze the operation of the converter / chopper fed dc drive and to solve simple problems.

3. To study and understand the operation of both classical and modern induction motor drives.

4. To study special machines stepper motor, servo motor and brushless motor drives and their control.

5. To analyze and design controllers for closed loop operation.

1. INTRODUCTION

9

Selection of drives – Factors influencing the choice of drive – Braking methods – Temperature rise and RMS rating – Power converters using IGBT and MOSFET – Open loop and closed loop control of drives – Sensors used in drives.

2. CONTROL OF DC DRIVES

9

Single phase and three phase converter fed drives – Continuous and discontinuous modes – Chopper fed drives – Four quadrant drives – Closed loop drive system.

3. CONTROL OF AC DRIVES

9

Voltage control, v/f control of induction motor – VSI and CSI fed drives – Rotor resistance control and slip power recovery scheme – Closed loop control induction motor drives – Vector control.

4. CONTROL OF SPECIAL MACHINES

9

Stepper motor – Drive circuit – Control algorithms – Digital implementation – Control of AC and DC servomotor – Brushless motor drives.

5. INTELLIGENT CONTROL OF DRIVES

9

Digital control description – Design of controllers current and speed – Digital PID implementation – PLC based control – Fuzzy and Neuro control – DSP process based
control.

L = 45 Total = 45

TEXT BOOKS

1. R. Krishnan, 'Electric Motor and Drives: Modelling Analysis and Control', Pearson Education, 2001.

2. G.K. Pubey, 'Fundamentals of Electrical Drives', Narosa Publication, 2002.

REFERENCE BOOKS

1. Bimal. K. Bose, 'Modern Power Electronics and AC Drives', Prentice Hall of India,
2003.

2. Chesmond, Wilson and Lepla, 'Advanced Control System Technology', Viva low priced student edition, 1998.

CS 1035 OPERATING SYSTEMS 3 1 0 100

AIM

To introduce the basic concepts of operating systems, process management, storage management, I/O systems and distributed systems.

OBJECTIVES

i. To study the basic concepts of operating system, computer system structures and operating system structures.
ii. To study about processes, threads, CPU scheduling, process synchronization and deadlocks.
iii. To study about memory management, virtual memory, file system interface and file system implementation.
iv. To study about I/O systems and mass-storage structure.
v. To study about distributed system structures, distributed file systems and distributed coordination.

1. OPERATING SYSTEMS – AN OVERVIEW

8

What is an OS? – Mainframe systems – Desktop systems –Multiprocessor systems – Distributed systems – Clustered systems – Real time systems – Handheld systems.

Computer system operation – I/O structure – Storage structure – Storage hierarchy – Hardware protection – Network structure.

System components – Operating system services – System calls – System programs – System structure – Virtual machines – System design and implementation – System generation.

2. PROCESS MANAGEMENT

10

Process concept – Process scheduling – Operations on processes – Cooperating processes – Inter process communication – Communication in client-server systems. Threads - Overview - Multithreading models – Threading issues.

Basic concepts – Scheduling criteria – Scheduling algorithms – Multiple-processor scheduling – Real time scheduling – Process scheduling models. The critical section problem – Synchronization hardware – Semaphores – Classic problems of synchronization – Critical regions – Monitors – Atomic transactions.

System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance – Deadlock detection – Recovery from deadlock.

3. STORAGE MANAGEMENT

10

Background **–** Swapping – Contiguous memory allocation – Paging – Segmentation – Segmentation with Paging. Background **–** Demand paging – Process creation – Page replacement – Allocation of frames – Thrashing.

File concept: Access methods – Directory structure – File system mounting – File sharing – Protection. File system structure – File system implementation – Directory implementation – Allocation methods – Free-space management – Efficiency and performance – Recovery.

4. I/O SYSTEMS

8

I/O hardware – Application I/O interface – Kernel I/O subsystem – Transforming I/O to hardware operations – Streams – Performance.

Disk structure – Disk scheduling – Disk management – Swap-space management – RAID structure – Disk attachment – Stable – Storage implementation – Tertiary storage structure.

5. DISTRIBUTED SYSTEMS

9

Background **–** Topology – Network types – Communication – Communication protocols – Robustness – Design issues. Naming and transparency – Remote file access – Stateful versus stateless service – File replication.

Event ordering – Mutual exclusion – Atomicity – Concurrency control – Deadlock handling – Election algorithms – Reaching agreement.

L = 45 T=15 Total = 60

TEXT BOOK

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, ‘Operating System Concepts’, Sixth Edition, Windows XP update, John Wiley & Sons (ASIA) Pvt. Ltd, 2002.

REFERENCE BOOKS

1. Harvey M. Deitel, 'Operating Systems', Second Edition, Pearson Education Pvt. Ltd., 2002.

2. Andrew S. Tanenbaum, 'Modern Operating Systems', 2nd Edition, Pearson Education, 2000 / PHI.

3. William Stallings, 'Operating System', Pearson Education, 4th Edition, 2003 / PHI.

ELECTIVE IV

EI 1004 VIRTUAL INSTRUMENTATION 3
0 0 100

AIM

To obtain comprehensive knowledge in virtual instrumentation and some of its applications.

OBJECTIVES

i. To review background information required for studying virtual instrumentation.

ii. To study the basic building blocks of virtual instrumentation.
iii. To study the various techniques of interfacing of external instruments of PC.

iv. To study the various graphical programming environment in virtual instrumentation.

v. To study a few applications in virtual instrumentation.

1. REVIEW OF DIGITAL INSTRUMENTATION

6

Representation of analog signals in the digital domain – Review of quantization in amplitude and time axes, sample and hold, sampling theorem, ADC and DAC.

2. FUNDAMENTALS OF VIRTUAL INSTRUMENTATION

10

Concept of virtual instrumentation – PC based data acquisition – Typical on board DAQ card – Resolution and sampling frequency - Multiplexing of analog inputs – Single-ended and differential inputs – Different strategies for sampling of multi-

channel analog inputs. Concept of universal DAQ card - Use of timer-counter and analog outputs on the universal DAQ card.

3. CLUSTER OF INSTRUMENTS IN VI SYSTEM

10

Interfacing of external instruments to a PC – RS232, RS 422, RS 485 and USB standards - IEEE 488 standard – ISO-OSI model for serial bus – Introduction to bus protocols of MOD bus and CAN bus.

4. GRAPHICAL PROGRAMMING ENVIRONMENT IN VI

10

Concepts of graphical programming – Lab-view software – Concept of VIs and sub VI - Display types – Digital – Analog – Chart – Oscilloscopic types – Loops – Case and sequence structures - Types of data – Arrays – Formulae nodes –Local and global variables – String and file I/O.

5. ANALYSIS TOOLS AND SIMPLE APPLICATIONS IN VI

9

Fourier transform - Power spectrum - Correlation – Windowing and filtering tools – Simple temperature indicator – ON/OFF controller – P-I-D controller - CRO emulation - Simulation of a simple second order system – Generation of HTML page.

L = 45 Total = 45

TEXT BOOKS

1. S. Gupta and J.P Gupta, 'PC Interfacing for Data Acquisition and Process Control',
Instrument society of America, 1994.

2. Peter W. Gofton, 'Understanding Serial Communications', Sybex International.

3. Robert H. Bishop, 'Learning with Lab-view', Prentice Hall, 2003.

REFERENCE BOOKS

1. Kevin James, 'PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control', Newness, 2000.

2. Gary W. Johnson, Richard Jennings, 'Lab-view Graphical Programming', McGraw Hill Professional Publishing, 2001.

Note: To offer this elective, multi-user licensed copy of Lab-view software should be available.

IC 1005 ROBOTICS AND AUTOMATION 3 0 0 100

AIM

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

OBJECTIVES

i. To study the various parts of robots and fields of robotics.

ii. To study the various kinematics and inverse kinematics of robots.

iii. To study the Euler, Lagrangian formulation of Robot dynamics.

iv. To study the trajectory planning for robot.

v. To study the control of robots for some specific applications.

1. INTRODUCTION TO ROBOTICS

9

History of Robots – Classifications – Various fields of Robotics – Actuators – Sensors – Manipulators – End effectors – Application areas – Robot programming languages.

2. ROBOT KINEMATICS

9

Matrix representation – Homogeneous transformation – DH representation of standard robots – Inverse kinematics.

3. ROBOT DYNAMICS

9

Velocity kinematics – Jacobian and inverse Jacobian – Lagrangian formulation – Eulers Lagrangian formulation – Robot equation of motion.

4. TRAJECTORY PLANNING

9

Introduction – Path Vs trajectory – Joint-space Vs Cartesian-space descriptions – Basics of trajectory planning – Joint-space trajectory planning – Cartesian-space trajectories.

5. CONTROL AND APPLICATION OF ROBOTICS

9

Linear control of robot manipulation – Second-order systems – trajectory following control – Modeling and control of single joint – Architecture of industrial robotic controllers – Robot applications.

L = 45 Total = 45

TEXT BOOKS

1. Saced B. Niku, ' Introduction to Robotics Analysis, Systems, Applications', Prentice Hall of India/Pearson Education, Asia, 2001.

2. Craig, 'Introduction to Robotics Mechanics and Control', Second edition, Pearson Education, Asia, 2004.

REFERENCE BOOKS

1. K.S. Fu & Co., 'Robotics Control, Sensing, Vision and Intelligence', McGraw Hill International Editions, Industrial Engineering Series, 1991.

2. Klafter R.D., Chimielewski T.A. and Negin M., 'Robotic Engineering – An integrated Approach', Prentice Hall of India, New Delhi, 1994.

8. Mikell P. Groover, Mitchell Weiss, Roger N. Nagel, Nicholas G. Odrey, 'Industrial Robotics Technology Programming and Application', McGraw Hill book company, 1986.

EC 1032 EMBEDDED SYSTEM DESIGN 3
0 0 100

AIM

To introduce to the functional building blocks of an embedded system for developing a real time system application.

OBJECTIVES

i. Introduce to features that build an embedded system.

ii. To help the understanding of the interaction that the various components within an embedded system have with each other.

iii. Techniques of inter facing between processors & peripheral device related to embedded processing.

iv. To enable writing of efficient programs on any dedicated processor.

v. To present in lucid manner the basic concepts of systems programming like operating system, assembler compliers etc and to understand the management task needed for developing embedded system.

1. INTRODUCTION TO EMBEDDED SYSTEM

9

Introduction to functional building blocks of embedded systems – Register, memory devices, ports, timer, interrupt controllers using circuit block diagram representation for each categories.

2. PROCESSOR AND MEMORY ORGANIZATION

6

Structural units in a processor; selection of processor & memory devices; shared memory; DMA; interfacing processor, memory and I/O units; memory management – Cache mapping techniques, dynamic allocation - Fragmentation.

3. DEVICES & BUSES FOR DEVICES NETWORK

9

I/O devices; timer & counting devices; serial communication using I^2C, CAN, USB buses; parallel communication using ISA, PCI, PCI/X buses, arm bus; interfacing with devices/ports, device drivers in a system – Serial port & parallel port.

4. I/O PROGRAMMING SCHEDULE MECHANISM

12

Intel I/O instruction – Transfer rate, latency; interrupt driven I/O - Non-maskable interrupts; software interrupts, writing interrupt service routine in C & assembly languages; preventing interrupt overrun; disability interrupts.

Multi threaded programming – Context switching, premature & non-premature multitasking, semaphores.

Scheduling – Thread states, pending threads, context switching, round robin scheduling, priority based scheduling, assigning priorities, deadlock, watch dog timers.

5. REAL TIME OPERATING SYSTEM (RTOS)

9

Introduction to basic concepts of RTOS, Basics of real time & embedded system operating systems, RTOS – Interrupt handling, task scheduling; embedded system design issues in system development process – Action plan, use of target system, emulator, use of software tools.

L = 45 Total = 45

TEXT BOOKS

1. Rajkamal, 'Embedded System – Architecture, Programming, Design', Tata McGraw Hill, 2003.

2. Daniel W. Lewis 'Fundamentals of Embedded Software', Prentice Hall of India, 2004.

REFERENCE BOOKS

1. David E. Simon, 'An Embedded Software Primer', Pearson Education, 2004.

2. Frank Vahid, 'Embedded System Design – A Unified hardware & Software Introduction', John Wiley, 2002.
3. Sriram V. Iyer, Pankaj Gupte, 'Embedded Real Time Systems Programming', Tata McGraw Hill, 2004.

9. Steve Heath, 'Embedded System Design', II edition, Elsevier, 2003.

CS 1033 DATA COMMUNICATION AND NETWORKS 3 0 0 100

AIM

To study the details regarding communication of voice and video, networks and its functions, data conversions, controlling of errors, switching information and its devices, internetworking device and different layers of TCP/IP.

OBJECTIVES

i. To study about the physical arrangement of networks, types and modes of networks, data conversions and transmission medium.

ii. To study the detection and correction of errors, link control and link protocols of data link layer.

iii. To study the access method, electrical specification and implementation of different networks, types of switching.

iv. To study about the standardized data interface and it's working principle.

v. To study the logic of link mechanisms used in networks and different layers of TCP/IP.

1. DATA COMMUNICATION

9

Introduction: Networks – Protocols and standards – Standards organizations – Line configurations – Topology – Transmission mode – Categories of networks – Inter networks.

OSI model: Functions of the layers.

Encoding and modulating: Digital-to-digital conversion – Analog-to-digital conversion – Digital-to-analog conversion – Analog-to-analog conversion.

Transmission media: Guided media – Unguided media – Transmission impairment – Performance.

2. ERROR CONTROL AND DATA LINK PROTOCOLS

9

Error detection and correction: Types of errors – Detection – Vertical Redundancy Check (VRC) – Longitudinal Redundancy Check (LRC) – Cyclic Redundancy Check (CRC) – Check sum – Error correction.

Data link control: Line discipline – Flow control – Error control.
Data link protocols: Asynchronous protocols – Synchronous protocols – Character oriented protocols – BIT oriented protocols – Link access procedures.

3. NETWORKS AND SWITCHING

9

LAN: Project 802 – Ethernet – Token bus – Token ring – FDDI.

MAN: IEEE 802.6 (DQDB) – SMDS.

Switching: Circuit switching – Packet switching – Message switching.

4. X.25, FRAME RELAY, ATM AND SONET/ SDH

9

X.25: X.25 Layers.

Frame relay: Introduction – Frame relay operation – Frame relay layers – Congestion control – Leaky bucket algorithm – Traffic control.

ATM: Design goals – ATM architecture – ATM layers – ATM applications.

SONET / SDH: Synchronous transport signals – Physical configuration – SONET layers – Applications.

5. NETWORKING DEVICES AND TCP / IP PROTOCOL SUITE

9

Networking and internetworking devices: Repeaters – Bridges – Gateways – Other devices – Routing algorithms – Distance vector routing – Link state routing.

TCP / IP protocol suite: Overview of TCP/IP.

Network layers: Addressing – Subnetting – Other protocols and network layers.

Application layer: Domain Name System (DNS) – Telnet – File Transfer Protocol (FTP) – Trivial File Transfer Protocol (TFTP) – Simple Mail Transfer Protocol (SMTP)– Simple Network Management Protocol (SNMP).

L = 45 Total = 45

TEXT BOOK

1. Behrouz A.Forouzan, 'Data Communication and Networking', Second Edition, Tata McGraw Hill, 2000.

REFERENCE BOOKS

1. William Stallings, 'Data and Computer Communication', 8th Edition, Prentice Hall of India/Pearson Education, 2003.

2. S. Andrew Tannenbaum, 'Computer Networks', Prentice Hall of India/Pearson Education, 4th Edition, 2003.

EE 1152 ELECTRIC CIRCUITS LABORATORY 0 0 3 100

OBJECTIVE

To impart hands on experience in verification of circuit laws and theorems, measurement of circuit parameters, study of circuit characteristics and simulation of time response.

1. Verification of Kirchoff's voltage and current laws, Thevenin's and Norton's Theorems.
2. Study of oscilloscope and measurement of sinusoidal voltage, frequency and power factor.
3. Measurement of time constant of series R-C electric circuits.
4. Frequency response of RC and RL circuits.
5. Resonant frequency and frequency response of a series RLC circuit.
6. Study of the effect of Q on frequency response and bandwidth of series and parallel resonant circuits.
7. Study of low pass and high pass filters.
8. Measurement of real power, reactive power, power factor and impedance of RC, RL and RLC circuits using voltmeters and ammeters.
9. Power measurement in a three phase circuit by two Wattmeters.
10. Study of first and second order circuit transients by digital simulation.

P = 45 Total = 45

REFERENCE BOOK

1. Paul B.Zbar, Gordon Rockmaker and David J.Bates, 'Basic Electricity', A text – Lab Manual, McGraw Hill, Seventh Edition - 2001.

Detailed Syllabus

1. Verification of Kirchoff's voltage and current laws, Thevenin's and Norton's Theorems

Aim

To verify Kirchchoff's voltage and current laws, Thevenin's and Norton's Theorems.

Exercises

1. Verify the Kirchoff's voltage and current law in a series circuit and in a circuit with series and parallel combination.

2(a) Determine the Thevenin equivalent voltage V_{TH} and resistance R_{TH} of a DC circuit with a single voltage source.

(b) Verify experimentally the values of V_{TH} and R_{TH} in solving a series – parallel circuit.

3. Determine the values of Norton's constant – current source I_N and Norton's current – source resistance R_N in a DC circuit containing one or two voltage sources.

2. Study of Oscilloscope and Measurement of sinusoidal voltage, frequency and power factor

Aim

To study the dual trace oscilloscope controls and to AC voltage values, time and frequency of A.C voltage with the oscilloscope.

Exercises

1. Learn the dual trace oscilloscope controls, safety precautions, probe compensation and the procedure to measure A.C. voltage and phase angle measurement.

2. Measure peak-to – peak A.C. voltage waveform using the oscilloscope.

3. Measure time for one cycle of an A.C signal and the corresponding frequency using the oscilloscope.

4. Measure the phase angle difference between two A.C signals using dual trace oscilloscope.

3. Measurement of time constant of series R-C electric circuits

Aim

To determine experimentally the time taken by a capacitor to charge and discharge through a resistance.

Exercises

a. Determine experimentally the time it takes a capacitor to charge through a resistor and obtain a plot between voltage across capacitor and time.

b. Determine experimentally the time it takes a capacitor discharge through a resistor and obtain a plot between voltage across capacitor and time.

c. Experimentally verify that the current and voltage in a capacitive circuit are out of phase using dual trace oscilloscope.

3. Frequency response of RC and RL circuits

Aim

1. To study the effect on impedance and current of a change in frequency in a series RL circuit.

2. To study the effect on impedance and current of a change in frequency in a series RC circuit.

Exercises

1. Conduct suitable experiment and draw the following graphs for an RL circuit.
   a. Impedance Vs frequency
   b. Current Vs frequency
   c. X_L Vs f
2. Conduct suitable experiment with a RC circuit and draw the following graphs.
   i. Xc Vs f
   ii. Z Vs f
   iii. I Vs f

4. Resonant frequency and frequency response of a series R L C circuit

Aim

1. To determine experimentally the resonant frequency f_R of a series RLC circuit.

2. To verify that the resonant frequency of a series RLC circuit is given by the formula

$$f_R = 1 / 2\pi\sqrt{LC}.$$

3. To develop experimentally the frequency – response curve of a series RLC circuit

Exercises

1. Draw the frequency response curve of a RLC circuit (V_L Vs f, V_C Vs f)
2. Experimentally show the following
   a. Resonant frequency $f_r = 1 / 2\pi\sqrt{LC}$

b. The impedance at resonance Z = R

5. Study of the effect of Q on frequency response and bandwidth of series and parallel resonant circuits

Aim

To measure the effect of circuit Q on frequency response and on bandwidth at the half – power points.

Exercises

2. Experimentally study the effect of Q on frequency response and bandwidth of RLC resonant circuit and obtain the following for three values of Q.

   i. I Vs frequency
   ii. Half power points
   iii. Bandwidth
   iv. V_e Vs f
   v. V_L Vs f

3. Experimentally determine the resonant frequency in a parallel resonant circuit. Draw current versus frequency in parallel resonant circuit.

6. Study of Low Pass and High Pass Filters

Aim

To determine experimentally the frequency response of a low and high pass filters.

Exercises

2. Determine the frequency response of passive low pass (RL) and high pass (RC) filter circuits.

3. Determine the frequency response of active low pass and high pass filter circuits.

7. Measurement of real power, reactive power, power factor and impedance of RC, RL and RLC circuits using voltmeters and ammeters.

Aim

To measure real power, reactive power, apparent power, power factor and impedance in A.C circuits using ammeters and three voltmeters.

Exercises

1. Experimentally determine the power factor, real power, reactive power, apparent power and impedance in a RL series circuit using voltmeter and ammeter. Draw the phasor diagram using the measurements.

2. Experimentally determine the power factor, real power, reactive power, apparent power and impedance in a RC circuit. Draw the phasor diagram using the measurements.

3. Experimentally determine the power factor, real power, reactive power, apparent power and impedance in a RLC series circuit using voltmeters and ammeters. Draw the phasor diagram using the measurements.

9. Power Measurement in a three phase circuit by two Wattmeters

Aim

To measure power in a three phase circuit by two wattmeter method.

Exercises

1. Measure the real and reactive power input and power factor to a three phase induction motor at different load condition using two watt- meters

10. Study of first and second order circuit transients by digital simulation

Aim

To study the first and second order circuit transients by digital simulation.

Exercises

1. Obtain the response for the following cases using MATLAB software or any other equivalent.

   a. Source free or zero input response of RL and RC circuit.

   b. D.C or step response of RL and RC circuits using available software.

   c. Obtain the source free and step response of RLC circuit using available softwares.